Programme

and

Book of Abstracts

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Welcome to ECE 2010

It is a great pleasure to welcome you, on behalf of the National Organising Committee of ECE 2010, at the 9th European Congress of Entomology.

2010 is the year to celebrate the 100th Anniversary of the Hungarian Entomological Society. This is also the International Year of Biodiversity - and we all know how divers insects are...

The series of ECE congresses, in every 4th year (alternating with ICE, the International Congress of Entomology) had already some history, with an earlier congress held also here in Hungary, together with SIEEC, at Gödöllő, in 1991. For Hungarian entomologists, to host again the congress, and offer the environment for a fruitful as well as a human gathering of fellow entomologists is a great honor.

We have altogether 855 accepted submissions, from Sunday evening till Friday noon. The credit for this rich response on our call should mainly go to our International Presidium, the National Organising Committee, and to all those symposium organisers, who made their best to invite entomologists from all over the World, reviewed their abstracts, and outlined the programme of these symposia. Plenary speakers were invited by the NOC, and we are looking forward to listen to their presentations of a broader scope. ECE 2010 features 7 plenary talks and 37 symposia, held in 3-5 parallel sessions, together with an Exhibition in the venue and a visit in the Hexapod Empire exhibition in the Hungarian Natural History Museum.

ECE is of an interdisciplinary character involving a wide range of research directions. ECE attracts taxonomists, systematists, ecologists, physiologists, toxicologists, biochemists, ethologists, experts of biocontrol, specialists and generalists alike, working in any aspect of entomology, i.e. in relation with the most wonderful group of organisms on Earth: insects. Even insects – at least mosquitos are attracted by the congress, too. Hopefully, this "ECE way" of organisation is able to build bridges between these diverse branches of research and their various masters.

ECE 2010 is held at the European Congress Center, Budapest, not far from the city. Buda has been built upon hills, and those, looking after some fresh air after the congress hours, may find it by a short walk from this relatively new facility, near the recreation zone of the capital.

Both the NOC and myself, we hope you would enjoy the congress, and also find our culture - from architecture to music and food - refreshing.

Tamás Vásárhelyi
Chairman of the National Organising Committee

General information

Venue

Europa Congress Center
(Address: H-1021 Budapest, Pálos utca 2.)

Floor "-1": meeting room "Copenhagen", exhibition, welcome reception, coffee breaks
Floor "0": meeting rooms "Brussels", "Maastricht", "Rome", "Strasbourg", speakers' ready room (room: "Zurich") with public Internet access, poster area, registration and information desk
Floor "1": lunch

Registration and information desk

Opening hours

Sunday, 22 August	14.30 – 17.30
Monday, 23 August	07.30 – 18.30
Tuesday, 24 August	08.00 – 18.30
Wednesday, 25 August	08.00 – 15.30
Thursday, 26 August	08.00 – 18.30
Friday, 27 August	08.00 – 14.00

On-site payments can be settled in cash (EUR or HUF) only. The ATM closest to the congress venue is available at Buda Gyöngye shopping center (accessible by bus from the congress venue).

Speakers' instructions

Oral presentations

The meeting rooms are equipped with PC/Laptop and data projector.

Presenters are requested to upload their presentations to the room laptop in due time before their session starts. This opportunity is open during the above opening hours. Technical assistance will be provided in the meeting rooms.

Laptops are equipped with Windows XP Professional, Powerpoint, Adobe Reader, Windows Media Player and VLC Video Player.

Speakers' Ready room: room Zurich on floor "0".

Posters

Set up: 08.00 – 10.00 on the day of the poster session in question
Removal: 16.00 (right after the session)
Room "Zurich" is provided for storing the removed posters for 24 hours.

Posters are marked in the Programme with the day of the session they are to be presented and with the number of the poster stand to be hung on. For example: "TU 24" means that the poster will be presented during Tuesday session on stand No: 24.

Exhibition

The exhibition is held in the coffee break area (floor "-1") during the congress hours.

Internet access

Free Wireless Internet access is available in the building. Public Internet access is available in the Speakers' Ready Room.

Badges

Please, make sure that you wear your badge in every event you participate, including coffee breaks, lunch and the social events.

Social events

All registered participants are cordially invited.

Welcome Reception
Sunday, 22 August, 19.00 – 21.00
Floor "-1", Congress venue

Coctail
Wednesday, 25 August, 16.00 – 18.30
departure from the Congress venue: 15.30
departure from the Museum: 18.00

The plenary lecture in the Hungarian Natural History Museum (address: Budapest VIII, Ludovika tér/square 2-6.) will be followed by a visit of the museum exhibition Hexapod Empire and a coctail party. Special buses are provided from the venue and back.

Closing session & farewell coctail
Friday, 27 August, 13.00 – 14.00
Floor "-1", room "Copenhagen"

Optional programmes

Gala Dinner on the Boat "Európa"
Thursday, 26 August, 19.30 – 22.00
a*ddress: Budapest, Buda side, the quay at Szilágyi Dezső tér (square)*

Special buses are provided for the Gala Dinner from the venue and back.

departure of buses: 18.30
boarding: 19.00
departure of the boat: 19.30
approximate arrival: 22.00 – 22.30
price: EUR 60

During the cruise on the River Danube you can enjoyed magnificent views of historical Budapest and catch a glimpse of Margaret Island, the Parliament, Hotel Gellért, the Liberty Monument, the graceful bridges and a number of stunning buildings. Besides, you may taste traditional Hungarian meals and drinks.

Tours

Budapest sight-seeing (half-day)
Monday, 23 August, afternoon
departure: 13.30 from the Congress venue
price: EUR 30

During the bus trip you may have an overall view of Budapest, one of the most exciting capitals in the world with a gorgeous geographic location, full of historical monuments and places of interest.

Danube Bend tour (full-day, lunch is included)
Tuesday, 24 August
departure: 09.00 from the Congress venue
arrival: approx. 17.00
price: EUR 80

The tour offers you visiting three small old towns crowning the picturesque Danube Bend: Szentendre – a unique artists' town, Visegrád – a former royal seat, Esztergom – the former capital of Hungary.

Eger Wine tour – City and Cellars (full-day, lunch is included)
Thursday, 26 August
departure: 09.00 from the Congress venue
arrival: approx. 17.00
price: EUR 80

With its 175 listed historical monuments, traditions of producing wine, Eger, in the north of Hungary, is one of the most popular tourist attractions of the country. After visiting the cultural and architectural sites, it is a great pleasure to venture out to the wine cellars in Szépasszony Valley.

Lake Balaton (full-day, lunch is included)
Friday, 27 August
departure: 09.00 from the Congress venue
arrival: approx. 17.00
price: EUR 80

Lake Balaton, the largest lake in Central Europe, is known as "The Hungarian Sea". Before tasting the famous Hungarian wines of the region, it is well worth visiting the historical sites, the magnificent Tihany peninsula and other places of interest.

Public transport

Public transportation (BKV) is extensive and reliable. Tickets - valid for one ride only - should be purchased in advance (e.g., at metro stations, hotels, news-stands, tobacco shops). The tickets should be validated (on board or at the entrance gates), and kept, since one must provide them if requested by the inspectors on board or at the exit gates.

You may consider buying a carnet of 10 tickets or a pass (for 1/7/14 days or for a month), or a Budapest Card, instead of single tickets. The junction of all the three metro lines is Deák tér. Service time is between 4:30 a.m. and 11.00 p.m. Most bus- and tramlines operate until 11pm.

Taxi

The most popular companies in Budapest are:

City Taxi	+36 1 211 1111, +36 20 9211 111, +36 30 9211 111, +36 70 2111 111
6x6 Taxi	+36 1 266-6666, +36-1 466 6666
Taxi 2000	+36-1 200 0000, +36 30 2000 000
Zona Taxi	+36 1 365 5555

Personal insurance

The Organizers of the Congress do not provide insurance and do not take responsibility for any loss, accident or illness that might occur during the Congress or in the course of travel to or from the meeting site.

Useful telephone numbers *(can be dialed without using a card or coins)*

Ambulance: 104 Fire Brigade: 105
Police: 107 Overall Emergency: 112

24-hour Tourinform hotline

Telephone numbers: +36 60 550 044 from abroad, +80 66 00 44 in Hungary.

Exhibitors

Brill

Brill - founded in 1683, based in Leiden, the Netherlands – publishes the journal Insect Systematics & Evolution (since 2009) as well as the International Journal of Myriapodology (with Pensoft) and Terrestrial Arthropod Reviews. Entomology books series include the famous Fauna Entomologica Scandinavica and Research on Chrysomelidae. Individual titles, like Diptera Diversity by Pape, Bickel and Meier have received international acclaim.

http://brill.nl/

Elsevier B.V.

As the world's leading publisher of science and health information, Elsevier serves more than 30 million scientists, students and health and information professionals worldwide. We help customers advance science and health by providing world-class information and innovative tools that help them make critical decisions, enhance productivity and improve outcomes.

We are a founding publisher of global programs that provide free or low-cost access to science and health information in the developing world.

Elsevier's roots are in journal and book publishing, where we have fostered the peer-review process for more than 125 years. Today we are driving innovation by delivering authoritative content with cutting-edge technology, allowing our customers to find the answers they need quickly.

http://www.elsevier.com

Noldus Information Technology

Noldus Information Technology is a leading developer of software and integrated solutions for animal behavior research. With over 5000 satisfied customers worldwide, Noldus creates products for application areas such as neuroscience, zoology, and entomology. Their solutions are designed to enhance the quality and quantity of data and to make optimal use of human and animal resources.

http://www.noldus.com

Pensoft Publishers

Pensoft is the wolrd's leading entomology publisher with more than 600 titles published. In 2008, PENSOFT launched its first open access journals named ZooKeys and BioRisk. The flagship journal of Pensoft, ZooKeys *(www.pensoftonline.net/zookeys)*, is currently considered the most technologically advanced journal in biodiversity science. It has implemented several cutting-edge innovations, such as semantic markup and publishing, data publication, etc.

http://www.pensoft.net

Wiley-Blackwell

Wiley-Blackwell, created in February 2007 by merging Blackwell Publishing with Wiley's Global Scientific, Technical, and Medical business, is now one of the world's foremost academic and professional publishers and the largest society publisher. Its extensive portfolio of entomology publications covers all areas of insect science and related fields, through partnerships with Societies, authors and researchers globally.

http://www.wiley.com/wiley-blackwell

Symposia and sessions

Symposia	Sessions	
	Oral	Poster
Aquatic insects	S3, S8, S13	MO 60-98
Biocontrol in crops and storage	S34, S39	TU 2-23
Biorational control of arthropod pests: mechanism and application	S1, S6, S11, S16	TU 24-71
Carabid ecology	S67	TH 9-11
Chemical mimicry and defence mechanisms of arthropods	S33, S38	TU 1
Chrysomelidae	S5, S10	MO 58-59
Diptera taxonomy	S74	TH 68-72
Evolution, ecology and behaviour of parasitic arthropods	S35	
Forest entomology	S2, S7, S12, S17	MO 19-35
Genetically modified plants – effects on insects	S55, S60, S65	TH 61-67
Insect behaviour (incl. Insect acoustics)	S4, S9, S14	MO 36-57
Insect biochemistry and physiology, including their hormonal regulation	S41, S46, S51, S56	WE 49-87
Invasive species	S53, S58	TH 12-25
IPM challenges and prospects in annual and perennial crops	S52, S57, S62	WE 8-38
Landscape ecology and management	S43, S48	WE 1-7
Large European and international projects and initiatives	S45	
Life history, reproduction and development of insect	S70	TH 47-60
Miscellaneous arthropod studies		WE 88-96
Non-insects entomology	S54	TH 92-96
Phylogeny of insects	S37, S42, S47	WE 48
Phytoplasma vectors	S22, S27, S32	TU 72-75
Plecoptera taxonomy	S64	TH 73-76
Quantitative ecology	S69	TH 1-4
RNA interference, a novel tool in analysing hormone function (General genetics)	S24, S29	TU 95-98
Role of biodiversity in pest management	S23, S28	MO 9-18
Science and society (incl. Communication of entomology to society and decision makers		TU 99-100
SE Asian – European Forum		MO 99-101
Semiochemicals in agroecosystems	S44, S49	WE 39-47
Sensory ecology (Pheromones)	S63, S68	TH 82-84
Social insects and apiculture	S73, S78	TH 85-91
Soil entomology – an ecosystem perspective	S72, S77	TH 5-8
Taxonomy of Lepidoptera	S21, S26, S31,	TU 76-80
Urban entomology, urban pest	S19	MO 1-8
Vector-borne diseases - biogeography and population biology (incl. Myiasis)	S30	TU 84-94
Vector-borne diseases - biology and control	S25, S30	TU 81-83
Versatile conventional entomology		TH 77-81
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Programme at a glance

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11.00 – 11.30	*Coffee break*		
11.30 – 13.00	**S6:** Biorational control of arthropod pests: mechanism and appl. II. **S7:** Forest entomology II. **S8:** Aquatic insects II. **S9:** Insect behaviour (incl. 10.2. Insect acoustics) II. **S10:** Chrysomelidae II.	Copenhagen Brussels Rome Maastricht Strasbourg	16 16 17 17 17
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Programme

Sunday, 22 August

Opening ceremony and plenary lecture 1

Room Copenhagen

17.00 – 18.30
Welcome addresses
In(sect)spiration
Marcel Dicke

Monday, 23 August

Plenary lecture 2

Room Copenhagen

08.30 – 09.15
Orchard entomology: from the field to the behavioural and molecular level
Silvia Dorn

S1: Biorational control of arthropod pests: mechanism and application I.

Room Copenhagen

Organizers: *Isaac Ishaaya, A. Rami Horowitz, András Székács*

09.30 – 09.50
Biorational control of arthropod pests: an overview
A. Rami Horowitz, P. Ellsworth, Isaac Ishaaya

09.50 – 10.10
Neuropeptide agonists and/or antagonists as potential components for controlling insect pests
Ronald J. Nachman, David Denlinger, Geoffrey M. Coast, Guy Smagghe

10.10 – 10.25
Insect signals as potential targets for controlling insect pests
Andrej Čokl, Jocelyn G. Millar

10.25 – 10.40
Genetically modified insect as a tool for biorational control
Thomas Miller

10.40 – 10.55
UV-absorbing insect exclusion screens (IES): An important tool for biorational control of sweet pepper pests
Saioa Legarrea, Alberto Fereres, Phyllis G. Weintraub

S2: Forest entomology I.

Room Brussels

Organizers: *Axel Schopf, György Csóka, Ferenc Lakatos*

09.30 – 09.45
Sweden – gales – *Ips typographus* – monitoring - management
Åke Lindelöw

09.45 – 10.00
The outbreak of *Ips typographus* in Sweden 2005 -2009 – what is the role of weather and host resistance?
Bo Långström

10.00 – 10.15
Spreading the risk of winter mortality in *Ips typographus* L. (Coleoptera, Scolytinae)
Kai Dworschak, Daniel Meyer, Axel Gruppe, Reinhard Schopf

10.15 – 10.30
Spreading of bark beetle infestations in the National Park Bavarian Forest
Markus Kautz, Axel Gruppe, Reinhard Schopf

10.30 – 10.45
Influence of seasonal changes in brood tree quality on the pubescence and the breeding success of the bark beetle *Ips typographus* (Col., Scolytinae) originating from different climatic regions
Nina Dobart, Martina Olifiers, Axel Schopf

S3: Aquatic insects I.

Room Rome

Organizers: *Arnold H. Staniczek, Zoltán Csabai*

09.30 – 09.45
Microhabitat preferences of stream macroinvertebrates
Cs. Bereczki, I. Szivák, A. Móra, Z. Csabai

09.45 – 10.00
Comparison of explanation power of environmental variables for Ephemeroptera, Plecoptera and Trichoptera larvae communities in a karst river system
Mojca Hrovat, Gorazd Urbanič, Ignac Sivec

10.00 – 10.15
Aquatic Coleoptera and Heteroptera assemblages and diversity in relation to habitat type and flood dynamic structure
Nataša Turić, Enrih Merdić, Zoltán Csabai, Branimir K. Hackenberger, Željka Jeličić

10.15 – 10.30
The relationships among Trichoptera species assemblages, biological traits and ecological requirements: a focus on lowland freshwater habitats in Flanders
Sophie Gombeer, Dries Knapen, Lieven Bervoets

10.30 – 10.45
Structural changes of macrozoobenthos in acidified streams in the Bohemian Forest (Czech Republic)
Jana Svobodová, Josef Matěna

S4: Insect behaviour (incl. Insect acoustics) I.

Room Maastricht

Organizers: *Dominique Mazzi, János Kiss, Ádám Kőrösi*

09.30 – 10.00
Resolving an evolutionary paradox? Fertility of diploid males in a parasitoid with complementary sex determination
Dominique Mazzi, Jan Elias, Silvia Dorn

10.00 – 10.15
Inbreeding avoidance in a parasitoid wasp: Choose the mate or the spot?
Daniel Ruf, Dominique Mazzi, Silvia Dorn

10.15 – 10.30
The role of experience and altered host cues in rejection by the parasitoid *Bracon hylobii* of nematode-infected pine weevil larvae
Chris Harvey, Arvin Everard, Aoife Dillon, Christine Griffin

10.30 – 10.45
Generalists and specialists in cuckoo bees: Is there just one evolutionary way?
Jakub Straka, Jana Habermannová, Petr Bogusch

10.45 – 11.00
On the life of solitary bees: nesting behaviour of *Andrena vaga* (Panzer) (Apoidea: Andrenidae)
Kateřina Rezková, Monika Žáková, Jakub Straka

S5: Chrysomelidae I.

Room Strasbourg

Organizers: *Michael Schmitt, Károly Vig*

09.30 – 09.45
Cytogenetics, cytotaxonomy and chromosomal evolution of chrysomelinae revisited (Coleoptera, Chrysomelidae)
E. Petitpierre

09.45 – 10.00
The natural history and evolution of subsociality and defensive fecal constructions in leaf beetles (Coleoptera: Chrysomelidae)
Caroline S. Chaboo

10.00 – 10.15
Reflexions on cycloalexy among Chrysomelidae (Coleoptera)
Pierre Jolivet, Krishna K. Verma

10.15 – 10.30
A Converse Bergmann Cline in an Australian eucalypt pest: *Paropsis atomaria* Olivier (Coleoptera: Chrysomelidae)
Mark K. Schutze, Anthony R. Clarke

11.00 – 11.30 Coffee break

S6: Biorational control of arthropod pests: mechanism and application II.

Room Copenhagen

Organizers: *Isaac Ishaaya, A. Rami Horowitz, András Székács*

11.30 – 11.50
Insecticides with novel modes of action: Mechanism, selectivity and importance in pest management
Isaac Ishaaya, Galina Lebedev, A. Rami Horowitz

11.50 – 12.10
Ecdysone and JH agonists and antagonists: Important agents for insect pests control
Subba Reddy Palli

12.10 – 12.25
Juvenile hormone biosynthetic enzymes as bio-rational target sites
Michel Cusson, Stephanie Sen, Tetsuro Shinoda

12.25 – 12.40
Plant lectins as tools for controlling pest insects
Guy Smagghe, Gianni Vandenborre, Shahnaz Shadidi-Noghabi, Amin Sadeghi, Mohamad Hamshou, Els J.M. Van Damme

12.40 – 12.55
Racemic female sex pheromone as a useful IPM tool for *Diabrotica* management in various parts of Europe and North America
Hans E. Hummel, K. Mori

S7: Forest entomology II.

Room Brussels

Organizers: *Axel Schopf, György Csóka, Ferenc Lakatos*

11.30 – 11.45
Phylogeography of *Pityogenes chalcographus* (Coleoptera, Scolytinae) in Europe - is *Wolbachia* involved?
Dimitrios N. Avtzis, Coralie Bertheau, Wolfgang Arthofer, Markus Riegler, Christian Stauffer

11.45 – 12.00
Alternate attractors in populations of southern pine beetle
Sharon J. Martinson, Tiina Ylioja, Brian T. Sullivan, Ronald F. Billings, Matthew P. Ayres

12.00 – 12.15
Overwintering biology of the spruce bark beetle, *Ips typographus* (Col., Scolytinae)
Peter Kritsch, Sigrid Netherer, Christa Schafellner, Axel Schopf

12.15 – 12.30
***Agrilus viridis* L. as an underestimated harmful insect of European beech**
Ralf Petercord

12.30 – 12.45
Invasive insect pests on forest trees and their parasitoid assemblages in Croatia
Dinka Matošević

12.45 – 13.00
Comparative study on the biology of gypsy moth (lymantria dispar L.) on different tree hosts in laboratory conditions
Massomeh Asadi, Mehrdad Daryaei, J. Jalali Sendi

S8: Aquatic insects II.

Room Rome

Organizers: *Arnold H. Staniczek, Zoltán Csabai*

11.30 – 11.45
Mitochondrial phylogeography of Corsican mayflies
Emilie Cavallo, Jean-Luc Gattolliat, Laurent Vuataz, Michel Sartori

11.45 – 12.00
Ephemeroptera and Plecoptera fauna of Bosnia and Herzegovina
Sadbera Trožić-Borovac, Rifat Škrijelj, Mahir Gajević, Aldijana Mušović

12.00 – 12.15
Distribution, ecology and phylogeny of the sea skater *Halobates* - Do they still avoid the Mediterranean?
Lanna Cheng, Jakob Damgaard, Romain Garrouste

12.15 – 12.30
Size dependent pore-respiration in water beetles
Bent Lauge Madsen

12.30 – 12.45
Variation in male and female secondary sexual characters in the diving beetle, *Agabus bipustulatus* (L.) (Coleoptera: Dytiscidae)
D.T. Bilton, W.J. Howe

S9: Insect behaviour (incl. Insect acoustics) II.

Room Maastricht

Organizers: *Dominique Mazzi, János Kiss, Ádám Kőrösi*

11.30 – 11.45
Sphragis-bearing and female size in the Clouded Apollo butterfly
János Kis, Adrien Fónagy

11.45 – 12.00
Male choice in a sexually cannibalistic praying mantid *(Stagmomantis limbata):* males prefer well-fed females
Michael R. Maxwell, Kevin M. Gallego

12.00 – 12.15
Male stalk-eyed flies (Diopsidae) in action: An exclusive anatomical modification to enhance fight outcome
Mihály Földvári

12.15 – 12.30
Geographic variation of male calling song and female song preference in Isophya posthumoidalis (Orthoptera) in the Eastern Carpathians
Kirill M. Orci, Gergely Szövényi, Barnabás Nagy

12.30 – 12.45
Signal recognition in chorusing environment in *Nezara viridula* (L.)
Maarten de Groot, Andrej Čokl, Meta Virant-Doberlet

12.45 – 13.00
How to explain the lack of clear oviposition preferences in a myrmecophilous butterfly?
Ádám Kőrösi, János Kis, László Peregovits

S10: Chrysomelidae II

Room Strasbourg

Organizers: *Michael Schmitt, Károly Vig*

11.30 – 11.45
Peptides of the adipokinetic hormone family in Chrysomeloidea
Gerd Gäde

11.45 – 12.00
Evolutionary origin of the elogated genitalia in the leaf beetle subfamily Criocerinae (Coleoptera, Chrsysomelidae)
Yoko Matsumura, Kazunori Yoshizawa

12.00 – 12.15
Types of geographical distribution of leaf beetles in Central Europe
Michael Schmitt

12.15 – 12.30
Károly Sajó's pioneering entomological discoveries in Hungary
Károly Vig

12.30 – 12.45
Anatomy of Mikado sp. (Coleoptera: Ptiliidae), one of the smallest free-living insects and limits to insects miniaturization
A.A. Polilov, Rolf Georg Beutel

13.00 – 14.30 Lunch

S11: Biorational control of arthropod pests: mechanism and application III.

Room Copenhagen

Organizers: *Isaac Ishaaya, A. Rami Horowitz, András Székács*

14.30 – 14.50
Molecular and proteomic investigation of bursicon's novel function beyond cuticle sclerotization and wing expansion
Qisheng Song

14.50 – 15.10
A metabolomic approach to identify secondary plant defense compounds involved in thrips resistance
K.A. Leiss, F. Maltese, Y.H. Choi, R. Verpoorte, Peter G.L. Klinkhamer

15.10 – 15.25
UV-absorbing nets interfere with the ability of whiteflies and aphids to find their host plants
Saioa Legarrea, Elisa Garzo, Maria Plaza, Alberto Fereres

15.25 – 15.40
Toxicity data on 'reduced risk insecticides' required for the development of IPM programs in North American orchards
Noubar J. Bostanian, John M. Hardman

15.40 – 15.55
Behavioural and physiological responses of *Spodoptera litura* (F.) (Lepidoptera: Noctuidae) larvae to neem kernel extracts
Anubha Das, A.K. Singh

S12: Forest entomology III.

Room Brussels

Organizers: *Axel Schopf, György Csóka, Ferenc Lakatos*

14.30 – 14.45
Forest management and pest dynamics
M.J. Lombardero, M. Alonso-Rodriguez, E.P. Roca Posada

14.45 – 15.00
Characterizing browntail moth local outbreaks in the Iberian Peninsula by combining life table data and non-linear statistics
Enric Frago, Juli Pujade-Villar, Miguel Guara, Jesús Selfa

15.00 – 15.15
Diversity of *Pemphigus* galls on the Lombardy black poplar (*Populus nigra* 'Italica')
Katalin Tuba, Ferenc Lakatos

15.15 – 15.30
Invading pine processionary moths benefit from escape from natural enemies
Charles-Edouard Imbert, Alain Roques

15.30 – 15.45
Increasing defoliator pressure on the Hungarian Forests
Gy. Csóka, A. Hirka, A. Koltay, L.G. Janik, L. Szőcs

15.45 – 16.00
Studies on tolerance resistance mechanism of poplar clones and willow species against the willow and poplar lace-bug, *Monosteira unicostata* (Mulsant & Rey) (Hemiptera: Tingidae), under natural conditions
Ali Ahadiyat, Seyed Ebrahim Sadeghi, Hadi Ostovan, Saeid Moharramipour, Gadir Nouri Ganbalani, Sattar Zeinali, Davoud Shamohammadi

S13: Aquatic insects III.

Room Rome

Organizers: *Arnold H. Staniczek, Zoltán Csabai*

14.30 – 14.45
Diel and seasonal dispersal of aquatic Coleoptera and Heteroptera species – Are the diel dispersal patterns species- or environment-dependent?
Zoltán Csabai, Pál Boda, Ildikó Szivák, Zoltán Kálmán

14.45 – 15.00
Dispersal in aquatic beetles – effects of environmental variability and species and individual traits
Jan Klečka, David Boukal

15.00 – 15.15
Comparison of aquatic weevils fauna (Coleoptera: Curculionoidea) of four artificial lakes in Central Serbia
Snežana Pešić, Svetlana Avramović

15.15 – 15.30
Ecology of the watersnipe-fly, *Atherix ibis*: Myths and facts
Bent Lauge Madsen

15.30 – 15.45
Hemocyanin in Plecoptera order: recomposing a puzzle
V. Amore, B. Gaetani, M. A. Puig, R. Fochetti

S14: Insect behaviour (incl. Insect acoustics) III.

Room Maastricht

Organizers: *Dominique Mazzi, János Kiss, Ádám Kőrösi*

14.30 – 14.45
***Erythroneura* spp. (Cicadellidae) feeding behaviour on grapevine**
Julien Saguez, Philippe Giordanengo, Charles Vincent

14.45 – 15.00
Effect of drought stress on plant resistance to specialist and generalist insect herbivores
Bettina Gutbrodt, Karsten Mody, Aline Frank, Silvia Dorn

15.00 – 15.15
Climate change alters phenology and abundance in butterflies and dragonflies
Luc De Bruyn, Dirk Maes, Geert De Knijf

16.00 – 17.00
Monday poster session and coffee

MO 1-8: Urban entomology, urban pest

MO 1
Insecticide products for houshold use as one of the way mosquitoes-control
Elena I. Bakanova

MO 2
Adult insecticides susceptibility status of *Aedes albopictus* Skuse, *Culex quinquefasciatus* Say and *Culex vishnui* Theobald collected from a pig farm in Tanjong Sepat, Selangor
Chee Dhang Chen, Han Lim Lee, Koon Weng Lau, Chong Chin Heo, Mohd Sofian-Azirun

MO 3
Temporal changes in the distribution and abundance of medically important mosquitoes in residential areas in Kuala Lumpur, Malaysia
Chee Dhang Chen, Han Lim Lee, Koon Weng Lau, Zainol Ariffin Pawanchee, Swee Beng Tan, Ibrahim Sa'diyah, Othman Wan-Norafikah, Mohd Sofian-Azirun

MO 4
Field evaluation of residue efficacy of insect growth regulators (IGRs) against *Aedes aegypti* (Linnaeus)
Koon Weng Lau, Chee Dhang Chen, Han Lim Lee, Mohd Sofian-Azirun

MO 5
A data base devoted to the insects of the Cultural Heritage
Fabien Fohrer, Michel Martinez, Franck Dorkeld

MO 6
Effects of natural compounds on stored product pests evaluated by repellency and perforation ability trials
Giacomo Vaccari, Irene Macias-Pavón, Elena Pedroni, Lara Maistrello

MO 7
Survey on flies species and density in a restricted rural area of north-eastern Italy characterised by a high breeding concentration
F. Montarsi, S. Martini, S. Ciocchetta, A. Ferro, N. De Paoli, G. Capelli

MO 8
Climate change and insect biodiversity in Pakistan: A critical review
Anjum Suhail, Muhammad Arshad

MO 9-18: Role of biodiversity in pest management

MO 9
Study on the effects extent of the cultivar variation on the injury severity of pests and diseases of date palm
M. Latifian, A.R. Ahmadi, A. Rahnama

MO 10
Defoliating and fruit boring Lepidoptera associated to Criollo Cocoa, *Theobroma cacao* L., in agroecosystems with a different plant composition in Mérida state, Venezuela
Katty Barrios, Marina Mazón, María M. Chacón, Juan Gaviria

MO 11
The effect of vegetation management on apple orchards carabid (Coleoptera: Carabidae) assemblages
Csaba Kutasi, Viktor Markó

MO 12
The population dynamics of leafhoppers in Northern Vineyards
Noubar J. Bostanian, Gaetan Bourgeois, Charles Vincent

MO 13
Monitoring of the susceptibility of codling moth (*Cydia pomonella*) populations to *Cydia pomonella granulovirus*
Tereza Zichová, Jitka Stará, Vladan Falta, František Kocourek

MO 14
Genetic polymorphism of codling moth in Croatia assessed by SSR markers
Ivana Pajač, Silvio Šimon, Ivan Pejić, Božena Barić

MO 15
Determination of whitefly biotypes in oman through molecular techniques
Farid Talukder, Jaber Al-Dahmani

MO 16
Faunestic of pistachio aphids and identification by using galls form in Kerman – Iran
M.A. Samih, R. Sadr Mohammadi

MO 17
Distributional Patterns of five heteropteran key natural enemies in Iran
Anousheh M. Zangeneh, Alimorad Sarafrazi, Mehdi Minbashi, Ali Ahadiyat

MO 18
Faunestic study on soil mites in fruit orchards in Hamedan province of Iran
Elahe Rostami, Habib Abbasipour, Alireza Askarianzadeh, Fatemeh Akbari

MO 19-35: Forest entomology

MO 19
Temporal changes in insect population form an important component of pest management
Natchiappan Senthilkumar, Shourimuthu Murugesan

MO 20
A large-scale experiment to control the spruce bark beetle *Ips typographus* using pheromone-baited and insecticide-treated trap logs in Sweden
Per-Erik Larsson, Niklas Björklund, Bo Långström, Kjell Gustafsson, Göran Örlander

MO 21
A contribution to bee fauna (Hymenoptera; Apoidea) in East Azerbayjan province- Iran
Samad Khaghaninia, Yasemin Güler, Ahmet Murat Aytekin, Fatih Dikmen, Mozhgan Mousavi

MO 22
Ecology of the Galling Aphid *Forda riccobonii* (Stefani) on *Pistacia atlantica* Desf. in Natural Habitats
Jean-Jacques Itzhak Martinez

MO 23
Crude leaf extracts from *Schinus molle* are effective against the elm leaf beetle *Xanthogaleruca luteola*
Amanda Huerta, Italo Chiffelle, Karla Puga, Fernando Azúa, Jaime E. Araya

MO 24
Toxicity and repellence of fruit extracts from *Melia azedarach* on the elm leaf beetle *Xanthogaleruca luteola*
Amanda Huerta, Italo Chiffelle, Fernando Azúa, Karla Puga, Jaime E. Araya

MO 25
Changes of infection level caused by protozoan disease *Gregarina typographi* in beetles of *Ips typographus* (Coleoptera: Curculionidae) in nuptial chambers
Karolina Lukášová[a], Jaroslav Holuša[a,b]

MO 26
Pupal parasitoids of the Pine Processionary Moth *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Thaumetopoeidae) in the Aspromonte Mountain Park (Italy)
Carmelo Peter Bonsignore, Elvira Castiglione; Francesco Manti, Vincenzo Vacante

MO 27
Ecological diversity in the population of curculionid pests of forest plantaion (Curculionidae: coleoptera)
Dalip Kumar, H.R. Pajni

MO 28
Comparison on the biodiversity of butterflies in a primary and human disturbance forests in Peninsular Malaysia
Mohd Sofian-Azirun, Mohd Zain Khaironizam, Yusoff Norma-Rashid, Ibrahim Normaisarah, Belabut Daicus, Chee Dhang Chen

MO 29
Life cycle of cedar processionary moth *Traumatocampa ispartaensis* in Turkey
Mustafa Avci, Oğuzhan Sarikaya

MO 30
Insect pests in an elevated CO_2 atmosphere: a multiyear study with gypsy moth, *Lymantria dispar* and its natural enemy *Glyptapanteles liparidis*
Christa Schafellner, Axel Schopf

MO 31
Diversity of Diptera in a deciduous forest: The role of tree and herb diversity
Elke Vockenhuber, Christoph Scherber, Teja Tscharntke

MO 32
Canopy research in the botanical garden of the University of West-Hungary, Sopron
F. Lakatos, R. Szűcs

MO 33
Recently emerged or forgotten native pests in the Hungarian Forests
A. Hirka, L.G. Janik, A. Koltay, Gy. Csóka

MO 34
Half a century of the Hungarian Forestry Light Trap Network
A. Hirka, Cs. Szabóky, L. Szőcs, Gy. Csóka

MO 35
The pest attack on *Shorea Leprosula* plants on nona mountain forest in Ambon Indonesia
Fransina Latumahina[1,2]

MO 36-57: Insect behaviour (incl. Insect acoustics)

MO 36
Life history of the earwig *Forficula auricularia* (Order: Dermaptera) in Arak city
Alireza Shayestehfar, Majid Mahdiyeh

MO 37
Aging and food source effects on mandibular stylets teeth wear of phytophagous stink bug (Hemiptera:Heteroptera: Pentatomidae)
Rogério A. Depieri, Antônio R. Panizzi

MO 38
Duration of feeding and superficial and in-depth damage to soybean seed by selected species of stink bugs (Hemiptera: Heteroptera: Pentatomidae)
Rogério A. Depieri, Antônio R. Panizzi

MO 39
Effect of photoperiod on important life traits of *Anarsia lineatella* (Lep: Gelechiidae) in the laboratory
Petros T. Damos, Matilda Savopoulou-Soultani

MO 40
Influence of cell phone radiations on foraging behaviour of honey bees
Ved Prakash Sharma, Neelima R. Kumar

MO 41
Spontaneous motor activity of *Drosophila subobscura*
Danica Dimitrijević, Branka Janać, Tatjana Savić

MO 42
Water foraging honeybees - parameters influencing load weight and drinking time
Anton Stabentheiner, Helmut Kovac

MO 43
Do non-potato aphids exhibit adapted behaviour for PVY vection?
S. Boquel, P. Giordanengo , J. Saguez, A. Ameline

MO 44
Sexual conflict in the wood cricket (*Nemobius sylvestris*): males prevent early spermatophore removal
Pavol Prokop, Michael R. Maxwell

MO 45
Involvement of odorant cues in the process of superparasitism avoidance
Sophie Vandermoten, Isabelle Frere, Véronique Genin, Thierry Hance, Éric Haubruge, François J. Verheggen

MO 46
Sexual communication and complexity of male copulatory organs in (neuropterid) insects
György Sziráki

MO 47
Are digger wasps optimal foragers? A study with *Bembix merceti* (Hymenoptera: Crabronidae)
J.D. Asís, Y. Ballesteros, L. Baños-Picón, M. Alonso, J. Tormos

MO 48
Factors influencing the spatial nesting patterns of the solitary wasp *Bembix merceti* parker (Hymenoptera: Crabronidae)
Y. Ballesteros, L. Baños-Picón, M. Alonso, J.D. Asís, J. Tormos

MO 49
External factors affecting *Trialeurodes vaporariorum* (Westwood) fly activity in zucchini squash greenhouse
Carmelo Peter Bonsignore, Francesco Barreca, Vincenzo Vacante

MO 50
Is the egg-larval parasitoid *Ascogaster reticulata* (Hymenoptera: Braconidae) answering the call of tea plants for help to defend against egg deposition by the host moth?
Sujata A. Deshpande, Yooichi Kainoh

MO 51
Voracity of *Hippodamia variegata* (Col.: Coccinellidae) fed on black bean aphid
Roya Farhadi, Samira Heydari, Hossein Allahyari

MO 52
Functional response of adult male and female *Hippodamia variegata* Goeze (Col.: Coccinellidae) to different densities of *Aphis fabae* Scopoli
Roya Farhadi, Hossein Allahyari, Samira Heydari

MO 53
Host acceptance and stylet activities of bird cherry-oat aphid, *Rhopalosiphum padi,* on intact plants and detached leaves of bird cherry, *Prunus padus*
Ki Jung Nam, Jim Hardie

MO 54
Reproductive behavior of the larval ectoparasitoid, *Goniozus legneri* Gordh (Hymenoptera: Bethylidae), on three different pyralid hosts
Fatemeh Ehteshami, Maryam Aleosfoor, Hossein Allahyari, Mahmood Alichi, Mohammad Ali Akrami, Mohsen Kiany

MO 55
Mating behaviour and its significance in reproductive performance of *Dysdercus koenigii*
K. K. Gupta

MO 56
Diurnal flight behaviour of Ichneumonidae and Braconidae (Insecta; Hymenoptera) related with environmental factors in a dry tropical forest
Alejandra González-Moreno, Santiago Bordera, Jorge Leirana, Hugo Delfín

MO 57
Simple and effective analysis of locomotor activity in insects using SwisTrack® software and Microsoft® Excel formulas
J. Francikowski, A. Kędziorski, P. Łaszczyca

MO 58-59: Chrysomelidae

MO 58
Is color of *Diabrotica virgifera virgifera* (*Chrysomelidae: Coleoptera*) adults influenced by color of silk maize?
Ioana Grozea, Ramona Stef, Alin Carabet, Ana Maria Virteiu, Swen Dinnesen

MO 59
Preference and feeding specificity of *Chrysolina fastuosa* (Coleoptera: Chrysomelidae) adults
András Bozsik

MO 60-98: Aquatic insects

MO 60
Check list of the Hydraenidae (Polyphaga: Coleoptera) species of Turkey with detailed and current distribution
Nesil Ertorun, Mustafa Tanatmiş

MO 61
Aquatic insects of the National Park «Yugyd Va» (the Komi Republic, Russia)
O. Loskutova

MO 62
Distribution of halophilous species of horse flies in Croatia (Diptera: Tabanidae)
Stjepan Krčmar, Alma Mikuška

MO 63
An annotated checklist of the Dytiscidae (Coleoptera) of Turkey
Ö. Köksal Erman

MO 64
Estimating species richness of Dytiscidae (Coleoptera) in Erzurum province in Turkey
Ö. Köksal Erman, Ö. Cevdet Bilgin

MO 65
Elemental analysis in four *Agabus* species and between elytra and alae of *Colymbetes fuscus* (Dytiscidae: Coleoptera) revealed by Energy Dispersive X-ray Fluorescence (EDXRF)
Ö. Köksal Erman, Turgay Korkut, Ö. Cevdet Bilgin, Kadir Yalçın, Esra Güdücü

MO 66
Effects of meteorological data on emergence of chironomids (Diptera: Chironomidae) in the Kisköre Reservoir
Mónika Tóth, Eduárd Csépes, Arnold Móra, György Dévai

MO 67
Trichoptera fauna of Bosnia and Herzegovina
Sadbera Trožić-Borovac, Rifat Škrijelj, Mahir Gajević, Aldijana Mušović

MO 68
The aquatic insects of a standard small plain river in North-Eastern France
Gilles Jacquemin

MO 69
Aquatic arthropod biotests for environmental surveys
András Székács, Ágnes Fejes, Gábor Fekete, Eszter Takács, Miklós Nádasy, Béla Darvas, Attila Anton

MO 70
Stream macroinvertebrates and vegetation: do they live in the same environment?
Adrienne Ortmann-Ajkai, Ildikó Szivák, Zoltán Csabai

MO 71
Effect of the extreme drought on aquatic insect community in a channelized lowland river; comparison between pool and riffle
Maja Sever, Gorazd Urbanič

MO 72
Life cycle of *Rhyacophila fasciata* and *Hydropsyche saxonica* in a Dinaric karst river system
Mojca Hrovat, Gorazd Urbanič

MO 73
Spatial distribution and diversity of chironomid (Diptera: Chironomidae) assemblages in a small hilly stream
Arnold Móra, Ildikó Szivák

MO 74
Comparative analysis of the species-group taxa in genus *Chalcolestes* based on different DNA sequences
Hajnalka Anna Gyulavári, Tamás Felföldi, Theodor Benken, László József Szabó, Margit Miskolczi, Csaba Cserháti, Valér Horvai, Károly Márialigeti, György Dévai

MO 75
Distribution of Athericidae (Diptera) in Czech part of Labe (Elbe) River basin with ecological notes
Jan Spacek, Pavel Hajek

MO 76
Check list of aquatic insects in Krkonose (Giant Mts.)
Jan Spacek, Jan Vanek

MO 77
The role of physiological tolerance in the colonization ability of two saline water beetles (Coleoptera: Hydrophilidae)
Paula Arribas, J. Velasco, Pedro Abellán, D. Sánchez-Fernández, C. Andújar, A. Millán, P. Calosi, D.T. Bilton

MO 78
Seasonal changes in water beetle assemblages in a temporary pond of Lonjsko polje Nature Park
Martina Temunović, Lucija Šerić Jelaska

MO 79
Genus *Aphelocheirus* Westwood, 1833 (Hemiptera: Aphelocheiridae) in the Iberian Peninsula
José Antonio Carbonell, Pedro Abellán, Paula Arribas, Jean François Elder, Andrés Millán

MO 80
Variation in emergence dynamics of riverine dragonflies (Odonata: Gomphidae) on the river-system Tisza (Hungary)
Anna Farkas, Tibor Jakab, Albert Tóth, György Dévai

MO 81
Diversity of aquatic insects (Heteroptera: Nepomorpha, Gerromorpha and Coleoptera: Hydradephaga, Hydrophilidae) in kras area of Gorski Kotar (Croatia)
Nataša Turić, Enrih Merdić, Zoltán Csabai, Branimir K. Hackenberger, Željka Jeličić

MO 82
Morphology and ecology of larvae and distribution of *Drusus plicatus* Radovanović, 1942 (Insecta: Trichoptera)
Mladen Kučinić, Ana Previšić, Vlatka Mičetić, Iva Mihoci, Vladimir Krpač

MO 83
Morphological features of pupae of *Drusus croaticus* Marinković-Gospodnetić, 1971 and *Drusus septentrionis* Marinković-Gospodnetić, 1976 (Insecta: Trichoptera) from Balkan Peninsula
Mladen Kučinić, Vlatka Mičetić, Marija Ivković, Lucija Šerić Jelaska

MO 84
A new electronic multiple entry key for the identification of aquatic invertebrates in Switzerland
S. Angélibert, J.-L. Gattolliat, S. Knispel, M. Lazeyras, S. Pansier, M. Sartori, P. Stucki, B. Oertli

MO 85
Diversity, distribution and ecological features of caddisfiles (Insecta: Trichoptera) in a Mediterranean karst River Cetina and its tributaries, Croatia
Ivan Vučković, Mladen Kučinić, Siniša Širac, Igor Stanković

MO 86
Effects of global change in aquatic insects of high mountain streams (Pyrenees): Stoneflies and Mayflies as indicators
Maria-Ángeles Puig, Valentina Amore, Romolo Fochetti, Nicolás Ubero-Pascal

MO 87
Macroinvertebrate drift in the lowland streams in Latvia
Agnija Skuja, Davis Ozolins

MO 88
The role of cyanotoxins on macroinvertebrate communities in Mediterranean calcareous streams
Maria-Ángeles Puig, Clara Romero, Javier García-Avilés, Nicolás Ubero-Pascal

MO 89
Are there any differences between the EPT and Coleoptera, Heteroptera assemblages in their response to environmental factors?
Ildikó Szivák, Zoltán Csabai

MO 90
The genus *Rhyacophila* Pictet, 1834 (Insecta: Trichoptera) in Kosovo
Halil Ibrahimi, Mladen Kučinić, Agim Gashi, Linda Grapci-Kotori, Ivan Vučković

MO 91
Mayflies (Ephemeroptera) and stoneflies (Plecoptera) of Pantepui biogegraphical province (Guyana highlands, Venezuela)
Tomáš Derka, José Manuel Tierno de Figueroa, Maribet Gamboa

MO 92
Assessing the conservation status of lower course of Una river using records of Adephagan Coleoptera
Lucija Šerić Jelaska, Martina Temunović

MO 93
Experimenatal research on concepts and methods of keeping and breeding *Dytiscus latissimus* Linnaeus, 1758 (Coleoptera; Dytiscidae)
Valērijs Vahruševs

MO 94
Mayflies and Stoneflies of the Wutach River in the Black Forest, Germany (Insecta: Ephemeroptera, Plecoptera)
Björn D. Frey, Arnold H. Staniczek

MO 95
Population dynamics of *Gmelinoides fasciatus* in the Volga River at Tver
Martin Schletterer, Vyacheslav V. Kuzovlev

MO 96
Habitat and diets of mayflies in an Andean stream (Colombia)
María Castro-R, Jenny Suarez, Sandra Cañon, John Donato-R, Silvia Morales, Isabel Muñoz

MO 97
Seven decades long monitoring of the aquatic bug (Heteroptera: Nepomorpha) fauna in the Lake Balaton
Tamás Vásárhelyi, Gábor Bakonyi

MO 98
Morphological features of larvae of *Drusus plicatus* Radovanović, 1942 and pupae of *Drusus croaticus* Marinković-Gospodnetić, 1971 and *Drusus septentrionis* Marinković-Gospodnetić, 1976 (Insecta: Trichoptera) with ecological and distributional notes
Mladen Kučinić, Ana Previšić, Vlatka Mičetić, Lucija Šerić Jelaska, Iva Mihoci, Marija Ivković, Vladimir Krpač

MO 99-101: SE Asian – European Forum

MO 99
Tick bite that occurs with the Isolated Facial Paralysis
M.K. Gürbüz, Nihal Doğan, M. Erdoğan, M. Birdane, Cemal Cingi, Emre Cingi

MO 100
A case reports: Entamofobia and Domestic Delusional Parasitosis
Nihal Doğan

MO 101
A review of the weevils of the genus *Cionus* Clairville & Schellenberg (Coleoptera: Curculionidae) of the Latvian fauna
M. Balalaikins, A. Bukejs

S16: Biorational control of arthropod pests: mechanism and application IV.

Room Copenhagen

Organizers: *Isaac Ishaaya, A. Rami Horowitz, András Székács*

17.00 – 17.15
Comparative aspects of Cry toxin usages in insect control
András Székács, Béla Darvas

17.15 – 17.30
Organic nanofibers as dispensers for insect pheromones: an entirely novel technical approach to mating disruption in IPM programs
Hans E. Hummel, D.F. Hein, A. Deuker, I. Lindner, G. Leithold, A. Greiner, C. Hellmann, J.H. Wendorff, M. Breuer, A. Kratt, H. Kleeberg

17.30 – 17.45
Compatibility of the very sensitive parasitoid *Psyttalia concolor* (Szèpl.) with some modern pesticides with different mode of action. Influence of the exposure route and persistence
C.S.B. da Silva, Mª M. Fernández, D. Rodríguez, I. Morales, E. Velázquez, P. Medina, E. Viñuela

17.45 – 18.00
Unexplained premature mortality in Argentine stem weevil populations: from field observation to causal mechanism
Jessica Vereijssen, Allan M. Crawford, Karen F. Armstrong, Stephen L. Goldson

18.00 – 18.15
Neem based pesticide for the management of major pests of rice, cotton, banana and vegetables
P. Sivasubramanian

S17: Forest entomology IV.

Room Brussels

Organizers: *Axel Schopf, György Csóka, Ferenc Lakatos*

17.00 – 17.15
Genetic differences among Central European Cockchafer (Melolontha spp.) species
Bálint Mészáros, Ferenc Lakatos, Christian Stauffer, Wolfgang Arthofer

17.15 – 17.30
Web-spinning sawflies of the genus *Cephalcia* Panzer (Hymenoptera, Pamphiliidae) in the *Picea abies* forests of Slovenia
Maja Jurc, David Hladnik, Gorazd Mlinšek, Danijel Borkovič, Gregor Meterc, Andreja Repe

17.30 – 17.45
ForestryImages (www.forestryimages.org): Images as tools to support forestry and natural resource education
G. Keith Douce

17.45 – 18.00
A new release mechanism of cis-verbenol, a constituent of the aggregation pheromone of the European spruce bark beetle *Ips typographus*
Lars Lehmberg, Stephanie Schaller, Axel Gruppe, Reinhard Schopf

18.00 – 18.15
Role of the European Food Safety Authority in pest risk assessment and risk communication with reference to insect species potentially harmful to trees
Sharon Cheek

S19: Urban entomology, urban pest

Room Maastricht

Organizer: *Dániel Bajomi*

17.00 – 17.15
Effect of hazelnut oil and castor oil on adults of *Callosobruchus phaseoli* F. under laboratory conditions
Nouraddin Shayesteh, Abbas Hosseinzadeh

17.15 – 17.30
A novel semi-field technique for assessing insecticide activity against bedbugs
Janos Szilagyi, Richard Naylor, Laszlo Takacs

17.30 – 17.45
Prevalence of flea infestation in dogs from Belgrade area
Ivan Pavlović, Dragana Petković, Gorica Glišić

Tuesday, 24 August

Plenary lecture 3

Room Copenhagen

08.30 – 09.15
The great carrier of an insect: the Drosophila genetic model system
István Kiss

S21: Taxonomy of lepidoptera I.

Room Brussels

Organizers: *Michael Fibiger, Zoltán Varga, László Ronkay*

09.30 – 09.45
The Noctuidae Europaeae series – a twenty-years challenge
Michael Fibiger

09.45 – 10.00
The Australian scribbly gum moths (*Ogmograptis* Meyrick, Bucculatricidae) and their unique insect/plant interaction
M. Day, C. Barlow, Y. N. Su, S. Cameron, M. Horak

10.00 – 10.15
New genetic lineages in the West Palaearctic *Hyles euphorbiae* complex (Lepidoptera: Sphingidae, Macroglossinae)
Anna K. Hundsdoerfer, Michael Mende, Ian J. Kitching

10.15 – 10.30
Morphological evolution in Lepidoptera: some potential consequences of recent molecular findings
Niels P. Kristensen

10.30 – 10.45
Butterflies of Indian Agricultural Research Institute campus (New Delhi, India) and their conservation
Rajesh Kumar, V.V. Ramamurthy

S22: Phytoplasma vectors I.

Room Strasbourg

Organizers: *Balázs Kiss, Mike Wilson*

09.30 – 09.45
Why are leafhoppers, planthoppers and psyllids vectors?
Domenico Bosco

09.45 – 10.00
Taxonomic affinities of world phytoplasma vectors
M. R. Wilson

10.00 – 10.15
A phytoplasma secreted protein that improves insect vector fitness
Heather Kingdom, Akiko Sugio, Victoria Nicholls, Saskia Hogenhout

10.15 – 10.30
Microbial symbiosis in phytoplasma vectors
Daniele Daffonchio, Noura Raddadi, Elena Crotti, Elena Gonella, Rosemarie Tedeschi, Ilaria Negri, Mauro Mandrioli, Aurora Rizzi, Alberto Alma

10.30 – 10.45
Rivalry behaviour and mating disruption in the Hemiptera Scaphoideus titanus Ball (Cicadellidae) and Hyalesthes obsoletus Signoret (Cixiidae)
Valerio Mazzoni, Meta Virant-Doberlet, Gianfranco Anfora, Andrea Lucchi

S23: Role of biodiversity in pest management I.

Room Copenhagen

Organizers: *Mark Brown, Viktor Markó*

09.30 – 10.00
Optimizing biodiversity benefits: supporting biocontrol through informed landscape management
Felix Wäckers

10.00 – 10.15
Diversity in agricultural landscapes and wild bees
Silvia Dorn, Sabine Oertli, Antonia Zurbuchen, Andreas Müller

10.15 – 10.30
Increasing orchard biodiversity for sustainable pest management
Mark W. Brown

10.30 – 10.45
Does vegetation management enhance natural enemy impact on pest populations in apple orchards?
Viktor Markó, Klára Balázs, Gábor Jenser

10.45 – 11.00
Effects of exclusion or supplementary honey feeding of the ant *Lasius niger* (L.) on aphid populations and aphidophagous predators on apple
Csaba Nagy, Viktor Markó, Jerry Cross

S24: RNA interference, a novel tool in analysing hormone function (General genetics) I.

Room Maastricht

Organizers: *Klaus Hoffmann, István Kiss*

09.30 – 09.45
Genetic variability of *Ixodes ricinus*
Algimantas Paulauskas, Jana Radzijevskaja, Olav Rosef

09.45 – 10.00
Identification of genes involved in CpGV-resistance of the codling moth, *Cydia pomonella*
Nadine A. Gund, Annette Reineke

10.00 – 10.15
Genetic variation among Iranian populations of leafhopper *Hishimonus phycitis* (Hemiptera: Cicadellidae) vector of Witches' Broom Disease of Lime Phytoplasma, based on mitochondrial DNA sequences
Mahnaz Shabani, Alimorad Sarafrazi, Mohsen Mardi, Heshmatollah Rahimian, Mohammad Salehi, Mahmoud Shojaee

10.15 – 10.30
First insights into the genetic diversity of *Otiorhynchus sulcatus* and the bacterial endosymbiontic community of divers *Otiorhynchus* species
Jacqueline Hirsch, Annette Reineke

S25: Vector-borne diseases - biology and control

Room Rome

Organizers: *Rory Post, Tamás Bakonyi*

09.30 – 10.00
Recent developments in the control of onchocerciasis
Rory Post

10.00 – 10.15
Mosquitocidal toxicity of plant *Ocimum sanctum* and Fungus toxin *Beauveria bassiana* on the malarial vector, *Anopheles stephensi*
P. Thiyagarajan, K. Murugan

10.15 – 10.30
Coexistence of Borrelia burgdorferi with Anaplasma phagocytophilum in Ixodes ricinus and Ixodes persulcatus ticks from Latvia
Valentina Capligina, Renate Ranka, Kalvis Brangulis, Antra Bormane, Viesturs Baumanis

10.30 – 10.45
Behavioural insensitivity to DEET in *Aedes aegypti*: a genetically determined trait residing in changes in sensillum function
Nina M Stanczyk, John FY Brookfield, Rickard Ignell, James G. Logan, Linda M Field

11.00 – 11.30 Coffee break

S26: Taxonomy of lepidoptera II.

Room Brussels

Organizers: *Michael Fibiger, Zoltán Varga, László Ronkay*

11.30 – 11.45
Systematic studies on Gelechiid Moth Fauna (Microlepidoptera) from North-Western Himalaya in India
P.C. Pathania

11.45 – 12.00
The Taxonomic Atlas – lessons and perspectives
László Ronkay

12.00 – 12.15
Diversity, host specificity, and community phylogenetics of New Guinean metalmark moths (Lepidoptera: Choreutidae)
Jadranka Rota, Scott E. Miller, George D. Weiblen

12.15 – 12.30
A web-based taxonomy of the Hawkmoths (Lepidoptera: Sphingidae)
Malcolm J. Scoble, Ian J. Kitching

12.30 – 12.45
Phylogeny of the Plusiinae (Lepidoptera: Noctuidae): exploring the conflict between larvae and adults
Martin Thompson, Ian J. Kitching

S27: Phytoplasma vectors II.

Room Strasbourg

Organizers: *Balázs Kiss, Mike Wilson*

11.30 – 11.45
Incidence and insect vectors of phytoplasma diseases in canola and cereal crops in Saskatchewan, Canada
Chrystel Olivier , Brian Galka, Julien Saguez

11.45 – 12.00
Phytoplasma diseases: trends in Canadian vineyards
Julien Saguez, Chrystel Olivier, Jacques Lasnier, Yves Mauffette, Charles Vincent

12.00 – 12.15
Maize redness disease – a host shift by *Reptalus panzeri*?
Jelena Jović, Tatjana Cvrković, Milana Mitrović, Andjeljko Petrović, Oliver Krstić, Slobodan Krnjajić, Margaret G. Redinbaugh, Richard C. Pratt, Ivo Toševski

12.15 – 12.30
Psyllid vectors of fruit tree phytoplasmas
Rosemarie Tedeschi[1], Barbara Jarausch, Wolfgang Jarausch, Alberto Alma

S28: Role of biodiversity in pest management II.

Room Copenhagen

Organizers: *Mark Brown, Viktor Markó*

11.30 – 11.45
Efficiency of earwigs as biocontrol agents in fruit orchards: ecology of two sibling species
Rob Moerkens, Bruno Gobin, Gertie Peusens, Herwig Leirs

11.45 – 12.00
Alien vs natives: will *Harmonia axyridis* have an impact on native aphid natural enemies?
Patricia M. Wells, Jason Baverstock, Michael E. N. Majerus, Frank M. Jiggins, Helen E. Roy, Judith K. Pell

12.00 – 12.15
Ecological relevance of test species in soil ecotoxicology – Is biodiversity protected?
Bernhard Theißen, Andreas Schäffer, Martina Roß-Nickoll

12.15 – 12.30
Chemodiversity in insect control
Lena B Brattsten

12.30 – 12.45
Variation in genetics and performance of Dutch western flower thrips populations
Mohammad Mirnezhad, Kirsten A. Leiss, Natasha Schidlo, Peter G.L. Klinkhamer

12.45 – 13.00
Host plant resistance to thrips in chrysanthemum: Appraisal of germplasm evaluation
P. Venkata Rami Reddy, T. Janakiram

S29: RNA interference, a novel tool in analysing hormone function II.

Room Maastricht

Organizers: *Klaus Hoffmann, István Kiss*

11.30 – 12.00
iBeetle – genome wide identification of gene functions in a coleopteran model organism
Ernst A. Wimmer

12.00 – 12.30
RNA interference based approaches in insect biotechnology
Andreas Vilcinskas

12.30 – 12.50
Gene silencing of neuropeptide genes in *Gryllus bimaculatus* and *Spodoptera frugiperda*
Martina Meyering-Vos

12.50 – 13.05
Silencing of corpora allata affecting neuropeptides in the pupa of *Tribolium castaneum* causes pupal-adult intermediates and reduces adult fecundity
Mohatmed Abdel-latief, Klaus H. Hoffmann

13.05 – 13.20
RNA interference in the tobacco hornworm, *Manduca sexta*
Jennie Garbutt, Stuart E. Reynolds

S30: Vector-borne diseases - biology and and population biology (incl. Myiasis)

Room Rome

Organizer: *Martin Hall*

11.30 – 11.45
Molecular genetic analysis of populations of *Wohlfahrtia magnifica* (Diptera: Sarcophagidae) in Europe and Asia
Martin Hall, Smaragda Sotiraki, April Wardhana, Zoe Adams, Paul D. Ready

11.45 – 12.00
Malaria vectors, *Anopheles* Hyrcanus Group (Culicidae, Diptera): Taxonomic status, habitats, parasitism and distribution
Pollie L. M. Rueda

12.00 – 12.15
Emergence of sandflies and leishmaniasis in Europe
Paul D. Ready

12.15 – 12.30
Impact of the global warming on species composition, distribution area and preferences of Moroccan leishmaniasis vectors (sand flies)
F. Ouanaimi, S. Boussaa, B. Pesson, A. Boumezzough

12.30 – 12.45
Malaria vectors in the Guinea savanna zone of Central Nigeria
Iliya S. Ndams, Ishaya H. Nock, Charles G. Vajime, Jan E. Conn

13.00 – 14.30 Lunch

S31: Taxonomy of lepidoptera III.

Room Brussels

Organizers: *Michael Fibiger, Zoltán Varga, László Ronkay*

14.30 – 14.45
The Asian species of the genus *Naarda* Walker, 1866: review and taxonomy (Lepidoptera: Noctuidae, Hypeninae)
Balázs Tóth

14.45 – 15.00
Revision of the genus *Xenophysa* Boursin, 1969 (Lepidoptera: Noctuidae, Noctuinae)
Zoltán Varga

15.00 – 15.15
Morphometric study on *Melitaea phoebe* species group (Lepidoptera, Nymphalidae)
János P. Tóth, Nigel Spring, Zoltán Varga

15.15 – 15.30
Dispersing the mist: molecular phylogenetics of Noctuoidea (Insecta: Lepidoptera)
Reza Zahiri, Ian J. Kitching, J. Donald Lafontaine, Marko Mutanen, Lauri Kaila, Jeremy D. Holloway, Niklas Wahlberg

S32: Phytoplasma vectors III.

Room Strasbourg

Organizers: *Balázs Kiss, Mike Wilson*

14.30 – 14.45
Sampling methods of phytoplasma vectors
Federico Lessio, Alberto Alma

14.45 – 15.00
Novel emerging plant pathogens in phytoplasma vectors
Elena Gonella, Noura Raddadi, Caterina Camerota, Rosemarie Tedeschi, Elena Crotti, Alan Pizzinat, Mauro Mandrioli, Pier Attilio Bianco, Daniele Daffonchio, Alberto Alma

15.00 – 15.15
Disseminating information on leafhopper, planthopper and psyllid vectors of phytoplasma disease
J. Turner, M. R. Wilson

15.15 – 15.30
Can phytoplasma vectors be controlled?
Phyllis G. Weintraub

S33: Chemical mimicry and defence mechanisms of arthropods I.

Room Maastricht

Organizers: *Stefan Schulz, Gábor Szőcs*

14.30 – 15.00
Diversity of chemically-based defence strategies in sawfly larvae
Jean-Luc Boevé

15.00 – 15.15
Network of transport proteins involved in sequestration of plant glucosides within leaf beetles
Anja Strauß, Antje Burse, Wilhelm Boland

15.15 – 15.30
Discovery of a novel secondary endosymbiont of the pea aphid: prevalence in natural populations, microbiological characterization, and phenotypic effect on the host insect
Tsutomu Tsuchida, Ryuichi Koga, Jean-Christophe Simon, Shogo Matsumoto, Takema Fukatsu

15.30 – 15.45
Salicyl alcohol oxidase in *Chrysomela lapponica* (Coleoptera, Chrysomelidae): a key enzyme in larval chemical defense and its functional and evolutionary dynamics in two ecological races
Roy Kirsch, Heiko Vogel, Antje Burse, Wilhelm Boland

15.45 – 16.00
Round table discussion

S34: Biocontrol in crops and storage I.

Room Copenhagen

Organizer: *Gábor Fekete*

14.30 – 14.45
Biological control of the South American tomato pinworm, *Tuta absoluta* (Lep.: Gelechiidae) with releases of *Trichogramma achaeae* (Hym.: Trichogrammatidae) on different tomato crop cycles in Spain
Enric Vila, Anabel Parra, Juan R. Gallego, Francisco J. Fernández, Tomas Cabello

14.45 – 15.00
Biological studies with an egg-larval parasitoid *Chelonus oculator*: advances, successes, and potential of use
Cem Ozkan, Hilal Tunca, Dilan Baysoyu, Seren Ceylan, Neset Kılınçer, Nilufer Akci, Ali Kürşat Şahin, Cahit Kaya, Yesim Sahin, M.M. Yassin Ali, A. Dini Pour
Biological control of mediterranean flour moth, *Ephestia kuehniella*, using egg and larval parasitoids
Ulku Canpolat, Aydin Ş. Tuncbilek

15.15 – 15.30
Aphid parasitoids in a dry lowland of Khuzestan, Iran (Hymenoptera, Braconidae, Aphidiinae)
M.S. Mossadegh, H. Salehipour, P. Stary

15.30 – 15.45
Fumigant toxicity of essential oils from two *Eucalyptus* species against stored date pests
Jouda Mediouni-Ben Jemâa, Soumaya Haouel, Enma Boushih, Mohamed Larbi Khouja

S35: Evolution, ecology and behaviour of parasitic arthropods

Room Rome

Organizers: *Boris Krasnov, Lajos Rózsa*

14.30 – 15.00
Searching for general rules in the ecology of arthropod ectoparasites
Boris R. Krasnov, Irina S. Khokhlova

15.00 – 15.15
Hytrosaviridae as a threat to the success of SIT eradication programs for tsetse flies
Adly Abd-Alla, Andrew Parker, Ma Bergoin, Marc Vreysen

15.15 – 15.30
Clever birds are lousy – comparative analysis of bird innovation and louse genera richness
Zoltán Vas, Louis Lefebvre, Lajos Rózsa

15.30 – 15.45
Application of predictive degree day model for field development of sandfly vectors of visceral leishmaniasis in northwest of Iran
Mohammad Ali Oshaghi, Naseh Maleki Ravasan, Ezatodin Javadian, Yavar Rassi, Javid Sadraei, Hassan Vatandoost, Zabiholah Zarea

15.45 – 16.00
Predatory efficiency of the tadpole of Cricket Frog *Fejervarya Limnocharis* (Anura: Dicroglossidae) on the larvae *Culex Quinquefasciatus* say mosquito (Diptera: Culicidae)
Kabirul Bashar, Nita Debnath, A. J. Howlader, K. M. Z. Rahman

16.00 – 17.00
Tuesday poster session and coffee

TU 1: Chemical mimicry and defence mechanisms of arthropods

TU 1
Fitness costs of cotton aphid's (*Aphis gossypii*) cornicle secretion, as a defense mechanism
H. R. S. Moayeri, A. Ashouri, A. R. Mohandesi

TU 2-23: Biocontrol in crops and storage

TU 2
Reproduction parameters of the dubas bug, *Ommatissus lybicus* (Homoptera: Tropiduchidae) at three constant temperatures
Arezoo Payandeh, Karim Kamali, Yaghoub Fathipour

TU 3
Preliminary observations on factors responsible for population growth of Chickpea plume moth, *Marasmarcha ehrenbergiana* Zeller in the Northern West of Iran
Nouraddin Shayesteh, Heidar Adldoost

TU 4
Demography of *Trissolcus grandis* (Hymenoptera: Scelionidae) at five constant temperatures
Zahra Nozad Bonab, Shahzad Iranipour, Reza Farshbaf Pour Abad

TU 5
Fumigant toxicity of essential oil from *Satureja hortensis* (Lamiaceae) against three Stored-Product Insect Species
Maedeh Mollai, Hamzeh Izadi, Hossein Dashti, Majeed Azizi

TU 6
Occurrence of *Wolbachia* in European weevils (Coleoptera: Curculionoidea)
Dorota Lachowska, Łukasz Kajtoch, Stanisław Knutelski

TU 7
Comparative demography of olive psyllid, *Euphyllura pakistanica* (Hemiptera: Psyllidae) and its parasitoid *Psyllaephagus zdeneki* (Hymenoptera: Encyrtidae) on yellow olive cultivar under laboratory conditions
Rahil Asadi, Ali Asghar Talebi, Jafar Khalghani, Yaghoub Fathipour, Saeid Moharramipour

TU 8
Study on the effects of some Iranian isolates of the fungus *Beauveria bassiana* (Deuteromycotina: Hyphomycetes) (Bals.-Criv.) Vuill. on the bird cherry-oat aphid, *Rhopalosiphum padi* (Hom: Aphididae), under laboratory conditions
Aida Sedighi, Mehran Ghazavi, Hana Haji Allahverdipour, Ali Ahadiyat

TU 9
Influence of temperature on functional response of *Hemiptarsenus zilahisebessi* (Hym: Eulophidae) on *Liriomyza sativae* (Diptera: Agromyzidae)
Mostafa Haghani, Yaghoub Fathipour, Ali Asghar Talebi, Valiollah Baniameri

TU 10
Temperature-dependent development of *Eupeodes corollae* (Diptera: Syrphidae) as a predator of the cabbage aphid, *Brevicoryne brassicae* (Hemiptera: Aphididae)
Naser MoeiniNaghadeh, Maryam Arabian, Abbas Ali Zamani, Farzad Jalilian

TU 11
Thermal requirements and effect of temperature on biological characteristics of Two *Spodoptera frugiperda* egg parasitoid species
Cherre Sade Bezerra Da Silva, José Roberto Postali Parra

TU 12
Effects of cold stored *Ephestia kuehniella* eggs at different periods on some biological properties of parasitoid *Trichogramma evanescens*
Ali Özpinar, Ali Kürşat Şahin, Burak Polat

TU 13
Effect of temperature on food consumption coccinellid *Hippodamia variegata* (Col.; Coccinellidae) in laboratory condition
M.A. Samih, F. Asghari, K. Mahdian, M. Basirat, H. Izadi, H. Alaei

TU 14
Synthesis of (Z)-14-methyl-8-hexadecenal – sex pheromone of khapra beetle *Trogoderma granarium* (Coleoptera: Dermestidae)
Sergey V. Zhuravlev, Vladimir Ya. Ismailov, Svetlana N. Sviridenko

TU 15
Effect of *Lecanicillium muscarium* and *L. lecanii* on the cottony camellia scale, *Pulvinaria floccifera* (Westwood) (Homoptera: Coccidae) on tea plant
Sakineh Naiemamini, Habib Abbasipour, Sirus Aghajanzadeh, Abbas Ali Zamani, Mohammad Hossein Fotokian

TU 16
An investigation on the efficacy of three egg parasitoid wasp species (*Trichogramma brassicae, T. embryophagum, T. pintoi*) on *Plutella xylostella* (L.) at 30 ºC temperature
Fatemeh Akbari, Alireza Askarianzadeh, Mohammad Reza Ataran, Abbasali Zamany

TU 17
Species diversity of parasitoids in gallwasps (Hymenoptera: Cynipidae) communities on two oak species in the west of Iran
Javad Nazemi Rafie, Ali Asghar Talebi, George Melika

TU 18
Functional response of Trichogramma brassicae to Helicoverpa armigera and Sitotroga cerealella under laboratory conditions
Nahid Vaez, Shahzad Iranipour, Mahmoud Soufbaf

TU 19
Age-dependent functional response of *Psyllaephagus zdeneki* (Hymenoptera: Encyrtidae), endoparasitoid of *Euphyllura pakistanica* (Hemiptera: Psyllidae)
Ali Asghar Talebi, Rahil Asadi, Jafar Khalghani, Yaghoub Fathipour, Saeid Moharramipour

TU 20
Predation of *Rhizoglyphus robini* Claparede (Acari:Astigmata) on alfalfa stem nematode *Ditylenchus dipsaci* Kuhun under laboratory conditions
O. Joharchi, H. Ostovan

TU 21
Biological traits and fertility life table of *Bemisia tabaci* (Genn.) and *Bemisia argentifolii* Bellows and Perring (*B. tabaci* B-biotype) (Hemiptera: Aleyrodidae) on cotton and rapeseed in laboratory
M.A. Samih, M. Zarrabi

TU 22
Morphological and behavioral characters of *Bemisia* (Hom: Aleyrodidae) eggs and nymphs on cotton
M.A. Samih

TU 23
Occurrence and composition of the *Chrysoperla carnea* species complex (Neuroptera: Chrysopidae) in Hungary
András Bozsik

TU 24-72: Biorational control of arthropod pests: mechanism and application

TU 24
Effects of UV-absorbing nets on the flying capacity of pest and beneficial insects in a tomato greenhouse
E. Velázquez; S. Legarrea; I. Morales; D. Rodríguez; A. Fereres; F. Amor; Mª M. Fernández; E. Viñuela

TU 25
Effect of *Artemisia annua* L. essential oil on mortality, development, reproduction and energy reserves of *Plodia interpunctella* (Hübner). (Lepidoptera: Pyralidae)
Jalal Jalali Sendi, Sheyvan Zamani, Mohammad Ghadamyari

TU 26
Enhancement of nucleopolyhedrovirus infectivity against *Mamestra brassicae* (Lepidoptera: Noctuidae) by proteins derived from granulovirus and a fluorescent brightener
A.A. Seraj ; M. M. Rabie, R. Talaei-Hassanloui

TU 27
Evaluation of some botanical extracts for their deterrence towards melon fruit fly under laboratory and field condition
Muhammad Dildar Gogi, Muhammad Jalal Arif, Muhammad Ashfaq

TU 28
Investigating the role of colored-egg-receptacles in the management of melon fruit fly, *Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae) in bitter gourd, *Momordica Charantia*
Muhammad Dildar Gogi, Muhammad Ashfaq, Muhammad Jalal Arif

TU 29
The effects of Pyriproxifen, Hexaflumuron, and Teflubenzuron on the sunn pest, *Eurygaster integriceps* Put. (Hemiptera: Scutelleridae) in the laboratory
Mehdi Gheibi, Mohammad Reza Ovji

TU 30
Effects of natural food additives on the protein content of adult and immature stages of the wax moth endoparasitoid, *Apanteles galleriae*.
Gadelhak G. Gadelhak, Lamya M. Z. Abo-Abdala

TU 31
Side effects of modern pesticides on the predatory bug *Orius laevigatus* (Fieber) (Hemiptera: Anthocoridae) under laboratory conditions.
F. Amor, E. Velázquez, Mª M. Fernández, E. Viñuela

TU 32
Selectivity of different acaricides to the predatory mite *Triphlodromus pyri*
Beatriz López Manzanare, Irigaray Sáenz-de-Cabezón, Javier Francisco

TU 33
Sub-lethal and lethal effects of *Datura stramonium* L. leaf extracts on European Red Mite, *Panonychus ulmi* and its predator *Stethorus gilvifrons*
Nabi Alper Kumral, Sultan Çobanoğlu, Cem Yalçın

TU 34
Screening of insecticidal activity of nine medicinal essential oils against *Brevicoryne brassica* L. (Hemiptera: Aphididae)
Najmeh Motazedian, Azadeh Davoodi, Maryam Aleosfoor, Mohammad Jamal Saharkhiz, Mohammad Sadegh Sadeghi

TU 35
Insecticidal activity of five essential oils against *Myzus persicae* (Sulzer) (Hemiptera: Aphididae)
Azadeh Davoodi, Maryam Aleosfoor, Najmeh Motazedian, Mohammad Sadegh Sadeghi, Mohammad Jamal Saharkhiz

TU 36
Effect of five essential oils against two aphids, Aphis gossypii Glover and Schizaphis graminum Rondani (Hemiptera: Aphididae) under laboratory conditions
Maryam Aleosfoor, Mohammad Jamal Saharkhiz, Najmeh Motazedian, Azadeh Davoodi, Mohammad Sadegh Sadeghi

TU 37
Evaluation of the effects some conventional and biorational insecticides on cotton bollworm, *Helicoverpa armigera* (Hubner) (Lep.; Noctuidae)
Samad Vojoudi, Moosa Saber, Mir Jalil Hejazi, Reza Talaei

TU 38
Efficacy of the novel juvenogen esters on the red firebug *(Pyrrhocoris apterus)*
Hana Ryšavá, Ondřej Jurček, Hana Svobodová, Milan Pavlík, Zdeněk Wimmer, Pavel Ryšánek

TU 39
Choice and no-choice tests to evaluate the compatibility of kaolin with *psyttalia concolor* (szèpligeti) and *anthocoris nemoralis* (f.) in laboratory
P. Bengochea, R. Saelices, A. Adán, F. Budia, P. del Estal, E. Viñuela, P. Medina

TU 40
***Diabrotica virgifera virgifera* in selected European countries and emerging options for pest management by biotechnical and cultural techniques**
Hans E. Hummel, M. Bertossa, A. Deuker, Swen Dinnesen, T. Nedelev, I. Grozea, Ch. Ulrichs

TU 41
The Comparison of Biology of Myiopardalis pardalina (Bigot) and Dacus ciliatus Loew and their mechanical control in Iran
N. Farrar, A. Shiekhi, N. Monfared, H. Pejman, S. Hosini, H. Rahimi

TU 42
Compatibility of Nuclear Polyhedrosis Virus (H-NPV) and Indoxacarb for the control of chickpea pod borer (*Helicoverpa armigera*)
Waqas Wakil, Young Jung Kwon, Muhammad Ashfaq, M. Usman Ghazanfar

TU 43
Flavonoid compounds of *Chrozophora* Neck (Euphorbiaceae) and insects
Mitra Noori, Hasan Zare Mayvan, Afshan Mazaheri , Alireza Shayestefar

TU 44
Identification of parasitoids of *Helicoverpa armigera* (Lep.: Noctuidae) in Jiroft region and assignment of effectiveness rate of postharvest deep plowing on reduction of pest damage
Moslem Basij, Mohammad Mahmoudvand, Mohammad Hossein Hosseinpour, Jalal Kolahdooz Shahroodi

TU 45
Comparative demography of olive psyllid, *Euphyllura pakistanica (*Hemiptera*:* Psyllidae*)* and its parasitoid *Psyllaephagus zdeneki* (Hymenoptera: Encyrtidae) on Yellow olive cultivar under laboratory conditions
Rahil Asadi , Ali Asghar Talebi, Jafar Khalghani, Yaghoub Fathipour, Saeid Moharramipour

TU 46
Evaluating the relationsh between the kind of plants and biochemical parameters in *Aphis gossypii* Glover (Hemiptera: Aphididae)
Shadieh Gerami, Khalil Talebi Jahromi, Vahid Hosseininaveh, Mohammad Ghadamyari

TU 47
Comparison toxicity of different dose of Tondxir against *Tetranychus urtica* Koch a pest of *Brassica napus* L
B. Amiri Besheli

TU 48
Biology of *Hippodamia variegata* (Col.: Coccinellidae) fed on *Aphis fabae*
Roya Farhadi, Hossein Allahyari, Samira Heydari

TU 49
Predation capacity of Hippodamia variegata (Col.: Coccinellidae) fed on Aphis fabae (Hem.: Aphididae)
Roya Farhadi, Hossein Allahyari, Samira Heydari

TU 50
Host plant effect on life table parameters of Silverleaf whitefly *Bemisia argentifolii* bellows and perring (Hemiptera; Aleyrodidae)
B. Pourshahid, M. Zarrabi, M. Samia, S. Movassaghi

TU 51
Study on the susceptibility of *Galleria mellonella* (L.) to *Heterorhabditis bacteriophora* (Poinar) under laboratory conditions
Nazila Saghaei, Ali Asghar Pourmirza, Majid Fallahzadeh

TU 52
Trophic interactions of parasitoid wasps (Hymenoptera: Aphidiidae) and aphids (Hemiptera: Aphididae) in Western Siberia
Anton Gavrilyuk

TU 53
Effects of methanolic extracts of *Spinacia oleracea*, a plant containing phytoecdysteroids, on development of *Ephestia kuehniella*
Bibi Zahra Sahaf, Saied Moharramipour, Farzad Kobarfard, Laurence Dinan

TU 54
Biology and demography of lesser mulberry pyralid *Glyphodes pyloalis* Walker (Lepidoptera: Pyralidae) in laboratory condition
Jalal Jalali Sendi, Roya Khosravy

TU 55
Spatial distribution and seasonal population fluctuations of *Etiella zinckenella* (Lepidoptera: Pyralidae) on ten soybean cultivars in Tehran, Iran
Roya Taghizadeh, Ali Asghar Talebi, Yaghoub Fathipour

TU 56
Synergistic interaction between sub-lethal doses of *Bacillus thuringiensis* and *Campoletis chlorideae* in managing *Helicoverpa armigera*
Shahid S. Siddique, Ram Babu, Usha Yaday, Smita Bisht

TU 57
Study on the larval parasitism of *Heliothis viriplaca* Huf in the Western Azarbaijan provience of Iran
Heidar Adldoost, Nouraddin Shayesteh

TU 58
Can nematodes control the invasive alien western corn rootworm, *Diabrotica v. virgifera*?
Stefan Toepfer, Ibolya Hatala-Zseller, Ralf-Udo Ehlers, Arne Peters, Ivan Hiltpold, Ted Turlings, Ulrich Kuhlmann

TU 59
Interaction between *Mabr*NPV and the Braconid parasitoid *Habrobracon hebetor* (Hym.: Braconidae) on larvae of beet armyworm, *Spodoptera exigua* (Lep.: Noctuidae)
M. M. Rabie, A.A. Seraj, R.Talaei-Hassanloui

TU 60
Life table parameters of green house Whitefly, *Trialeurodes vaporariorum* (Westwood), on tomato
S. Movassaghi, M. Zarrabi, M.A. Samih

TU 61
Role of *Blattisocius Keegani* Fox as a Biological Control Agent on two date mites in Egypt
Hussien A. Rezk

TU 62
Efficiency of entomopathogenic nematodes on frit fly *Oscinella frit* under laboratory and field conditions
Nabil El-Wakeil, Inga Bormann, Christa Volkmar

TU 63
Impact of three prey species and their densities on the performance of *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae) under laboratory conditions
Muhammad Ashfaq, Muhammad Dildar Gogi, Waqas Wakil, Khuram Zia, Rashid Rasool Khan

TU 64
Bottom-up effects of canola cultivars on performance of *Diadegma semiclausum* (Hymenoptera: Ichneumonidae) parasitoid of the diamondback moth
Mahmoud Soufbaf, Yaghoub Fathipour, Javad Karimzadeh, Myron P. Zalucki

TU 65
Biological Control of Beet Armyworm, *Spodoptera exigua* (Lep.: Noctuidae), by *Chelonus oculator* (Hym.: Braconidae) in Greenhouse Crops
Manuel Gámez, Alejandro Torres, Inmaculada López, József Garay, Zoltán Varga, Tomas Cabello

TU 66
Tomato varieties effects on the efficiency of natural enemies against South American Tomato Pinworm, *Tuta absoluta* (Lep.: Gelechiidae)
Tomas Cabello, José Manuel Guerra-Sanz, Juan R. Gallego, Francisco J. Fernández, Anabel Parra, Enric Vila

TU 67
Superparasitism in semi-massive rearing of *Spalangia cameroni* perkins (Hymenoptera: Pteromalidae), a parasitoid of medfly (Diptera: Tephritidae)
J. Tormos, F. Beitia, L. Baños-Picón, J.D. Asís, S.F. Gayubo

TU 68
Bioassay studies of three *Bacillus thuringiensis* Iranian strains on third larval instar of diamondback moth, *Plutella xylostella* (L.) (Lep.: Plutellidae)
Ali Deilamy, Habib Abbasipour, Masumeh Keshavarzi, Aziz Sheikhi Garjan, Hassan Askari

TU 69
Effects of some conventional and biorational insecticides on ectoparasitoid, *Habrobracon hebetor* Say (Hymenoptera: Braconidae)
Vahid Mahdavi, Moosa Saber, Ali Mehrvar , Houshang Rafiee Dastjerdi

TU 70
Causes of synergistic action between entomopathogenic fungi Metarhizium anisopliae and bacteria Bacillus thuringiensis ssp.morrisoni var. tenebrionis under the infection of Leptinotarsa decemlineata
Olga Yaroslavtseva, Vadim Kryukov, Ivan Dubovskiy, Victor Khodyrev, Victor Glupov

TU 71
Effects of selected botanical insecticides on the biology and behavior of the *Chelonus oculator* Panzer (Hymenoptera: Braconidae)
Hilal Tunca, Neset Kılınçer, Cem Ozkan

TU 72-75: Phytoplasma vectors

TU 72
An approach to the control of *Hyalesthes obsoletus*, vector of Bois Noir, using entomopathogenic agents
Nazareno Reggiani, Lara Maistrello

TU 73
Data on the Auchenorrhyncha fauna associated with vineyard agro-ecosystem in South Romania
Constantina Chireceanu, Minodora Gutue, Ionuţ Nicolae, Cătălin Stan, Cătălin Gutue

TU 74
Feeding activity of European grass-feeding leafhopper on unsuitable host plants
Balázs Kiss, Gergely Tholt

TU 75
Presence and distribution of stolbur phytoplasmas in insects captured in 'Lambrusco' vineyards in Northern Italy
Nazareno Reggiani, Nicola Mori, Mirko Bacchiavini, Samanta Paltrinieri, Assunta Bertaccini

TU 76-80: Taxonomy of Lepidoptera

TU 76
The Noctuidae *s.l.* (Lepidoptera) in sugarcane fields of Iran
Mehdi Esfandiari, Mohammad Saeed Mossadegh, Parviz Shishehbor

TU 77
Molecular investigation of *Elachista* (Lepidoptera: Elachistidae: Elachistinae) moths at the species group level
Brigita Paulavičiūtė[a], Algimantas Paulauskas[a], Virginijus Sruoga[b]

TU 78
Variability of larval pattern elements in the West Palaearctic *Hyles euphorbiae* complex (Lepidoptera: Sphingidae, Macroglossinae)
Michael Mende, Heimo Harbich, Anthony R. Pittaway, Ian J. Kitching, Anna K. Hundsdoerfer

TU 79
Sphaeroceroidea – an important member of snow active group of flies in Poland
Agnieszka Soszynska-Maj, Andrzej Woznica

TU 80
Clutch size adjustment of a leaf-mining moth (Lyonetiidae: Lepidoptera) in response to resource availability
Ali A. Seraj, Zahra Cheraqali

TU 81-83: Vector-borne diseases - biology and control

TU 81
Detoxificative system of *Aedes aegypti* laboratory strain larvae and zooplankton grazer *Daphnia magna* Straus under pyrethroid esfenvalerate treatment
Elena Boyarishcheva, Nadejda Ershova, Victor Glupov

TU 82
Bed bugs control in Russia
Elena Bogdanova

TU 83
Climate change and insect biodiversity in Pakistan: A critical review
Anjum Suhail, Muhammad Arshad

TU 84-94: Vector-borne diseases - biogeography and population biology(incl. Myiasis)

TU 84
Prevalence of head louse infestation and associated factors in elementary schools students in city of Aran and Bidgol (Esfahan Province, Iran) 2008
Abbas Doroodgar, Fakhraddin Sadr, Mansour Sayyah, Masoud Doroodgar, A. Mofarreh, Zohre Tashakkor, Moein Doroodgar

TU 85
Pediculus and Pediculosis from the past to today
Nihal Doğan

TU 86
New areas of Asian tiger mosquito (*Aedes albopictus*) invasion in North Eastern Italy
F. Montarsi, S. Martini, L. Lustro, S. Ciocchetta, M. Foroni, F. Russo, G. Capelli

TU 87
Flea-borne Anaplasma sp. in Lithuania
Indrė Kundrotaitė, Algimantas Paulauskas, Jana Radzijevskaja

TU 88
Infection of *Ixodes* ticks by *Borrelia burgdorferi* s.l. in Baltic countries
Egle Galdikaite, Algimantas Paulauskas, Jana Radzijevskaja

TU 89
New anophelines catches in Eastern Spain
R. Bueno-Marí, A. Bernués-Bañeres, F. A. Chordà-Olmos, F.J. Peris-Felipo, R. Jiménez-Peydró

TU 90
Invasion of cockroaches in Russia cities
Elena Bogdanova

TU 91
The comparison of three primers for detection of *Plasmodium vivax* parasites from *Anopheles sinensis* (Diptera : Culicidae)
Kyu-Sik Chang, E-Hyun Shin, In-Myung Park, Dong-Kyu Lee, Young-Joon Ahn, Chan Park

TU 92
Infection of *Plasmodium vivax* parasites in Anopheline mosquito (Diptera: Culicidae) from Inter-Korean transit office, 2009
Kyu-Sik Chang, E-Hyun Shin, Dong-Kyu Lee, Young-Joon Ahn, Chan Park

TU 93
Detection of flaviviruses in mosquitoes (Diptera: Culicidae) in Central Europe
Tamás Bakonyi, László Papp, Bernhard Seidel, Kata Nyárády, Attila Mórocz, Zdenek Hubálek, Norbert Nowotny

TU 94
Evaluation of the human biting ticks in Crimean-Congo Hemorrhagic Fever endemic and non-endemic areas of Turkey
Munir Aktas, Aysen Gargili, Sirri Kar, Esin Güven, Kursat Altay, Zati Vatansever

TU 95-98: RNA interference, a novel tool in analysing hormone function

TU 95
The variability of mtDNA in *Drosophila subobscura* from the Derventa River Gorge (Tara National Park, Serbia)
Mihailo Jelic, Zorana Kurbalija, Marija Savic Veselinovic, Marina Stamenkovic-Radak, Marko Andjelkovic

TU 96
Do meiotic prophase stages occur in parthenogenetic weevils (Coleoptera: Curculionidae)?
Dorota Lachowska, Maria Rożek, Milada Holecovà, Łukasz Kajtoch

TU 97
Isolation of mutants by transposon remobilization in the *Drosophila* genes coding for the FMRFamide-related neuropeptides and their specific receptors
Brigitta Kiss, Tamás Szlanka, Beáta Ramasz, Géza Ádám, Adrien Fónagy, István Kiss

TU 98
Molecular characterization of a sodium channel gene from *Spodoptera littoralis*
A. Emre Akpinar, Nurper Guz, Necva Hadim, M. Oktay Gurkan

TU 99-100: Science and society (incl. Communication of entomology to society and decision makers

TU 99
Role of the European Food Safety Authority in pest risk assessment and risk communication with reference to insect species potentially harmful to plants
Sharon Cheek

TU 100
Bugwood Image Database System: Web-accessible, taxonomically-referenced images available to support education
G. Keith Douce, Ferenc Lakatos, György Csóka, Milan Zubrik, Andrej Kunca, Petr Kapitola

S37: Phylogeny of insects I.

Room Rome

Organizers: *Nils Peder Kristensen, Zsolt Pénzes*

17.00 – 17.30
Hexapod affinities and basal evolution: lessons from neuroanatomy
Rudi Loesel

17.30 – 17.45
The "Entognatha-problem" from the molecular data perspective
Emiliano Dell'Ampio, Nikolaus U. Szucsich, Günther Pass

17.45 – 18.00
Evolution of the earliest true insects: anatomical evidence
Markus Koch

18.00 – 18.15
Grylloblattodean affinities: new light on a classic enigma
Benjamin Wipfler

S38: Chemical mimicry and defence mechanisms of arthropods II.

Room Maastricht

Organizers: *Stefan Schulz, Gábor Szőcs*

17.00 – 17.30
Chemical mimicry and the evolution of pollination systems
Florian P. Schiestl

17.30 – 17.45
Spatiotemporal variation and frequency-dependent similarity in morphology of an intra-specific mimicry system
Arne Iserbyt, Jessica Bots, Stefan Van Dongen, Janice J. Ting, Hans Van Gossum, Thomas N. Sherratt

17.45 – 18.00
Does the chemical communication system of tropical *Heliconius* butterflies related to their mimicry-rings?
Stefan Schulz, Catalina Estrada

18.00 – 18.15
Generation of reactive oxygen species and antioxidants activity in hemolymph of Galleria mellonella (L.) (Lepidoptera: Piralidae) larvae during encapsulation response
I.M. Dubovskiy, E.V. Grizanova, E.A. Chertkova, I.A. Slepneva, Y.L. Vorontsova, V.V. Glupov

18.15 – 18.30
Round table discussion

S39: Biocontrol in crops and storage II.

Room Copenhagen

Organizer: *Gábor Fekete*

17.00 – 17.15
Entomoparasitic nematodes for control of the Western Corn Rootworm, *Diabrotica virgifera virgifera*
Christina Pilz, Giselher Grabenweger

17.15 – 17.30
An abundance of mole crickets
Howard Frank

17.30 – 17.45
Susceptibility of the plum fruit moth, *Cydia funebrana* (Lepidoptera: Tortricidae) to infection by the *Cydia pomonella* granulovirus (CpGV)
Annette Reineke

17.45 – 18.00
The effects of entomopathogenic nematodes in suppressing hairy rose beetle, *Tropinota squalida* Scop., (Coleoptera: Scarabaeidae) populations on cauliflower in Egypt
A.S. Abdel-Razek, M.M.M. Abdel-Gawad

Wednesday, 25 August

Plenary Lecture 4

Room Copenhagen

08.30 – 09.15
Landscape mediation of insect biodiversity patterns and processes
Teja Tscharntke

S41: Insect biochemistry and physiology, including their hormonal regulation I.

Room Maastricht

Organizers: *Gerd Gade, Heather G. Marco, Adrien Fónagy*

09.30 – 10.00
The quest for novel adipokinetic hormone structures
Gerd Gäde

10.00 – 10.15
Characterising the adipokinetic peptide from the African water scorpion, *Laccotrephes fabricii* (Heteroptera: Nepidae)
Heather G Marco, Petr Simek, Gerd Gäde

10.15 – 10.30
Lipid, glycogen, carbohydrate and protein patterns during metamorphosis of *Anarsia lineatella* (Lepidoptera: Gelechiidae) reared on different nutritional media
Petros T. Damos, Nikos Papadopoulos, Matilda Savopoulou-Soultanii

10.30 – 10.45
Lipid metabolism in the midgut of *Rhodnius prolixus*
M. Alves-Bezerra, D. Majerowicz, L.A.M. Grillo, Katia C. Gondim

S42: Phylogeny of insects II.

Room Rome

Organizers: *Nils Peder Kristensen, Zsolt Pénzes*

09.30 – 10.00
Molecular markers and insect phylogeny: the state of the art
Bernhard Misof

10.00 – 10.15
Endopterygote interrelationships: the morphological evidence
Rolf Georg Beutel

10.15 – 10.30
The tentorium in Neuropterans – adding another piece to the evolutionary jigsaw
Dominique Zimmermann, Susanne Randolf, Brian Metscher, Ulrike Aspöck

10.30 – 10.45
The evolution of the female genital segments in mecopterid insects
Frank Hünefeld

10.45 – 11.00
Endopterygote interrelationships: evidence from thoracic morphology
Frank Friedrich

S43: Landscape ecology and management I.

Room Copenhagen

Organizers: *Teja Tscharnke, Ferenc Samu, Samantha Cook*

09.30 – 10.00
Predatory arthropods in agroecosystems relative to habitat age and landscape context
T. Frank, J.G. Zaller, D. Moser, M. Barone, I. Künzle, C. Mosimann, T. Drapela

10.00 – 10.15
Effects of agricultural management on insect populations and assemblages in Hungary
Ádám Kőrösi, András Báldi, Péter Batáry, Anikó Kovács, Noémi Örvössy, László Peregovits, István Szentirmai

10.15 – 10.30
Scale and intensity of interaction between meadow and arable field spider assemblages in a Hungarian agricultural landscape
Ferenc Samu, Dóra Neidert, Éva Szita, Kinga Fetykó, Zoltán Botta-Dukát, András Horváth

10.30 – 10.45
Effects of organic management on carabids and spiders in wheat fields and meadows
Péter Batáry, Andrea Holzschuh, Ferenc Samu, Carsten F. Dormann, Teja Tscharntke

S44: Semiochemicals in agroecosystems I.

Room Brussels

Organizer: *Silvia Dorn*

09.30 – 09.45
Are volatiles from host-plants encoding host quality for the offspring? The case of the grapevine moth, Lobesia botrana
Marco Tasin, Ilaria Pertot

09.45 – 10.00
Oriental fruit moth responses to a plant-derived synthetic mixture: from the behavioural to the neurophysiological level
Adriana Najar, Giovanni Galizia, Silvia Dorn

10.00 – 10.15
After landing: leaf surface metabolite activity on a lepidopteran pest
Sylvie Derridj, Jean-Pierre Garrec, Nadia Lombarkia, Eric Ferré, Hubert Gally

10.15 – 10.30
Cabbage root fly-induced volatiles influence behaviour of ground-dwelling predators
Anne Marie Cortesero, Antonin Ferry, Stéphane Derocles, Sébastien Dugravot

10.30 – 10.45
Olfactory response of the acarophagous ladybird beetle, *Stethorus gilvifrons* and the generalist predator *Orius laevigatus* to synthetic herbivore-induced plant volatiles
Melis Seidi, Nimet Sema Gençer

10.45 – 11.00
The role of herbivore-induced plant volailes in above- and belowground defense priming in maize
Claudia Zwahlen, Christelle Robert, Ted C.J. Turlings

S45: Large European and international projects and initiatives

Room Strasbourg

Organizers: *László Peregovits, András Gubányi*

09.30 – 09.45
The European distributed institute of taxonomy
Malcolm J. Scoble

09.45 – 10.00
SYNTHESYS: Synthesis of systematic resources
Ian J. Kitching

10.00 – 10.15
Biodiversity Heritage Library for Europe - Towards a global digital library of life
Patrick Grootaert

10.15 – 10.30
ViBRANT – A virtual infrastructure supporting the mobalisation, sharing, reuse and publication of biodiversity data
Ian J. Kitching

10.30 – 10.45
A Pan-European Species-directories Infrastructure (PESI)
Tomáš Lackner, Yde de Jong

11.00 – 11.30 Coffee break

S46: Insect biochemistry and physiology, including their hormonal regulation II.

Room Maastricht

Organizers: *Gerd Gade, Heather G. Marco, Adrien Fónagy*

11.30 – 11.45
Neuroendocrine control of diuresis in *Rhodnius prolixus* (the vector of Chagas' disease)
Ian Orchard, Jean-Paul Paluzzi, Juan Ianowski, Victoria TeBrugge

11.45 – 12.00
Characterization of the crustacean cardioactive peptide gene and its receptor in the blood-feeding bug, *Rhodnius prolixus*
Angela B. Lange, Do Hee Lee

12.00 – 12.15
Characterization of peptide hormone processing in the fruitfly brain and midgut
Christian Wegener, Wencke Reiher

12.15 – 12.30
Serotonin receptors in the American cockroach, *Periplaneta americana*
Wolfgang Blenau, Britta Troppmann, Arnd Baumann

12.30 – 12.45
Energetic optimization strategies of sucrose foraging wasps (*Vespula sp.*)
Helmut Kovac, Anton Stabentheiner, Robert Brodschneider

12.45 – 13.00
Metabolism of resting wasps (*Vespula sp.*) in dependence on ambient temperature
Helmut Käfer, Helmut Kovac, Anton Stabentheiner

S47: Phylogeny of insects III.

Room Rome

Organizers: *Nils Peder Kristensen, Zsolt Pénzes*

11.30 – 12.00
Molecular dating of some major events in insect phylogeny
Niklas Wahlberg

12.00 – 12.15
The Strepsiptera problem: a never-ending story?
Hans Pohl

12.15 – 12.30
Higher phylogeny of orthoptera using single and combined data matrices of continuous and discrete morphological data
Maryam Yasemi, Mohsen Mofidi-Neyestanak, Alimorad Sarafrazi

12.30 – 12.45
Testing diversification processes within anotalaia via character evolution in the Caucasus endemic genus *Phonochorion* (Orthoptera: Tettigoniidae: Phaneropterinae)
Ismail K. Sağlam, Selim S. Çağlar

12.45 – 13.00
Phylogeography of *Pityogenes chalcographus* (Coleoptera, Scolytinae) in Europe – Is *Wolbachia* involved?
Dimitrios N. Avtzis, Coralie Bertheau, Wolfgang Arthofer, Markus Riegler, Christian Stauffer

S48: Landscape ecology and management II.

Room Copenhagen

Organizers: *Teja Tscharnke, Ferenc Samu, Samantha Cook*

11.30 – 11.45
Agricultural management intensity at regional scale as a missing variable to explain conservation biological control at landscape scale – meta-analysis
Andrea Veres, Claire Lavigne, Sandrine Petit, Cyrille Conord, Camilla Moonen, David Bohan, Jozsef Kiss, Mark Szalai, Ferenc Toth

11.45 – 12.00
Synergistic effects of climate change and habitat fragmentation on insect biodiversity in the Alps
Oriana Pilia, Simon R. Leather, Robert M. Ewers

12.00 – 12.15
On the use of apiformes and spheciformes populations as a management tool
Ligia C. Vieira, Nuno Oliveira, Severiano F. Gayubo

12.15 – 12.30
Influence of chemical fertilizers on the life parameters of bug *Graphosoma lineatum* L.
Valentina M. Afonina, Wladimir B. Tshernyshev

12.30 – 12.45
Biodiversity threats to insects associated with rice crop in the Punjab, Pakistan
Muhammad Asghar, Anjum Suhail, Muhammad Arshad

S49: Semiochemicals in agroecosystems II.

Room Brussels

Organizer: *Silvia Dorn*

11.30 – 11.45
Chemical ecology of *Tanymecus (Episomecus) dilaticollis* Gyllenhal (Curculionidae)
Teodora B. Toshova, Mitko A. Subchev, Dimitar I. Velchev, Miklós Tóth, József Vuts, Éva Csonka, John A. Pickett, Sarah Y. Dewhirst, Christine M. Woodcock, Michael A. Birkett

11.45 – 12.00
Evaluation of different attraction traps as an alternative way of control of Scolytinae (Coleoptera: Scolytidae), an important pest of cocoa in Mérida, Venezuela
Marina Mazón, Samuel Segnini, Juan Gaviria

12.00 – 12.15
Field evaluation of the Mediterranean Fruit Fly (Diptera, Tephritidae) in Montetenegro : comparison among female attractants and trap types
Sanja Radonjić

12.15 – 12.30
Bio-activity of alfalfa (*Medicago sativa* L.) saponins towards aphid development
Sylwia Goławska, Iwona Łukasik, Agnieszka Wójcicka, Bogumił Leszczyński

12.30 – 12.45
The role of secondary plant metabolites from cowpea (*Vigna unguiculata* [L.] Walp.) floral structures in resistance to the Flower Bud Thrips, *Megalurothrips sjostedti* (Trybom)
O.Y. Alabi, J.A. Odebiyi, M. Tamò

12.45 – 13.00
Electrophysiological and behavioural responses of sweetpotato weevil, *Cylas formicarius* (Fab.) to sweetpotato semiochemicals
Rajasekhara Rao Korada, Jitendra Jena, S.K. Naskar, M. S. Palaniswami, A. Mukherjee, Kushboo Sinha, N. Bhakthavatsalam

13.00 – 14.30 Lunch

14.30 – 15.30
Wednesday poster session and coffee

WE 1-7: Landscape ecology and management

WE 1
Pollinators and predators: different functional groups benefit from agricultural landscape matrix in different ways
L. Baños-Picón, M. Alonso, Y. Ballesteros, J.D. Asís, J. Tormos

WE 2
Comparison of three models for predicting emergence patterns of the olive moth, *Prays oleae* Bern. (Lepidoptera: Yponomeutidae) in two regions of Croatia
Ivana Dminić, Sonja Kačić, Renata Bažok, Jasminka Igrc Barčić, Elda Vitanović

WE 3
Trophic variability of nestedness in beetle assemblages along pollution gradient of meadows and forest in the Copper Smelter "Głogów" environs, S-W Poland
Tomasz Skalski, Stanisław Knutelski

WE 4
Effect of field size on the abundance and species richness of bumble bees
Riin Muljar, Eneli Viik, Riho Marja, Eha Švilponis, Katrin Jõgar, Reet Karise, Marika Mänd

WE 5
Diversity of Banchinae (Hymenoptera: Ichneumonidae) from Ria Lagartos Biosphere Reserve, Yucatan, Mexico
Alejandra González-Moreno', Santiago Bordera, Hugo Delfín

WE 6
The impact of hedgerow-forest connectivity on carabid beetle and spider communities in agricultural landscapes
Christina Fischer, Hella Schlinkert, Martin Ludwig, Andrea Holzschuh, Róbert Gallé, Teja Tscharntke, Péter Batáry

WE 7
Sampling of poison hemlock (Conium maculatum) as a possible method to indicate landscape effects on arthropods (Heteroptera, Coleoptera, Araneae) in the region Jászság
Attila Kotán, Andrea Veres, Ferenc Tóth, Kinga Fetykó, Márk Szalai

WE 8-38: IPM challenges and prospects in annual and perennial

WE 8
Linking tomato phenology with antixenosis and antibiosis-based resistance to *Bemisia tabaci* Gennadius (Hemiptera: Aleyrodidae)
Clara-Isabel Rodríguez, Mariano Muñiz, Gloria Nombela

WE 9
The Ber pests (*Ziziphus* spp) in Khuzestane province
M. Latifian, A.R. Ahmadi

WE 10
Biological characteristics of *Helicoverpa armigera* (Lepidoptera: Noctuidae) on seeds of different soybean cultivars
Safieh Soleimannejad,Yaghoub Fathipour, Saeid Moharramipour

WE 11
"Efficacy of egg parasitoid, *Trichogramma chilonis* and the predator aphid lion, *Chrysoperla carnea* in present of seven selective Insecticides for Controlling the American bollworm. *Helicoverpa armigera* on Cotton."
N .K . Al-Tememi

WE 12
Monitoring of oilseed rape pests with different visual baits
Ivan Juran, Tanja Gotlin Čuljak, Dinka Grubišić

WE 13
Monitoring raspberry cane midge *(Resseliella theobald* Barnes*)* in Hungary
Kitti Sipos, Gábor Vétek, Béla Pénzes

WE 14
Comparative toxicity of some pesticides on the two-spotted spider mite *Tetranychus urticae*.
M. Lagziri, A. El Amrani, A. El Haddad, I. Sáenz-de-Cabezón, B. López Manzanare, V. Marco, I. Pérez-Moreno

WE 15
Influence of pesticides and application methods on pest and predatory arthropods associated with transgenic (Bt Cotton) and non-transgenic cotton plants
Rishi Kumar, S. Kranthi, S.L. Jat, M. Nitharwal, D. Monga

WE 16
***Anystis baccarum*: The need for correct identification in UK apple orchards**
Andrew G S Cuthbertson, Archie K Murchie

WE 17
Meteorological elements which influence the abundance of *Agriotes ustulatus* Schall.
Renata Bažok, Antonela Kozina, Maja Čačija, Tomislav Kos

WE 18
Using mating disruption technique for control of European Grapevine Moth (*Lobesia botrana*) in Bozcaada, Turkey
Ali Özpinar, Burak Polat, Ali Kürşat Şahin

WE 19
Flight patterns of peach twig borer and oriental fruit moth in Hungarian apricot and peach orchards
Katalin Hári, Béla Pénzes

WE 20
Current trends in dynamics of tea pests in Northeast India & strategies for their management
Monorama Borthakur, Anup K. Barooah

WE 21
Laboratory Investigations of *Prostephanus truncatus* (Horn) (Coleptra: Bostichidae) infestation on dried cassava chips, its effect on nutritional and anti-nutritional contents status
K.O.K. Popoola, A.V.Opayele, N.N. Nkpondion

WE 22
Evaluation of effect of chemical control of weeds in sugarcane fields on stalk borers, *Sesamia* spp. population and their egg parasitoid, *Telenomus busseola*e
Alireza Askarianzadeh, Gholamreza Abbaspour, Mahmud Shojaee

WE 23
The pest status of citrus scale insects in Khuzestan province, SW Iran (1989-2009)
Mehdi Esfandiari ,Mohammad Saeed Mossadegh

WE 24
Resistance of Czech pollen beetle to pyrethroids
Jitka Stará, František Kocourek

WE 25
Potential use of ozone for controlling of angoumois grain moth, *Sitotroga cerealella* (Lep, Gelechiidae)
Bijan Hatami, Zohreh Keshmiri, Mehdi Kadivar

WE 26
Oviposition preferences and larval parasitisation rate of *Meligethes aeneus* Fab. and *Ceutorhynchus obstrictus* Marsh. in different cruciferous plants
Riina Kaasik, Reelika Kevväi, Anne Luik, Eve Veromann

WE 27
Toxicity of five insecticides and mineral oil to white peach scale, *Pseudaulacaspis pentagona* Targioni in adult stage
B. Amiri Besheli., M. Bazrafshan

WE 28
Life table parameters of *Rhopalosiphum padi* (L.) (Homoptera: Aphididae) on different barley cultivars
L. Karami, S. Shahrokhi, M.R. Rezapanah, M. Shojaee

WE 29
Effects of the juvenoid pyriproxyfen on the pistachio green stink bug, *Brachynema germari* Kol. (Hem.: Pentatomidae): biology and energy metabolism
Faezeh Bagheri, Khalil Talebi, Vahid Hosseininaveh

WE 30
The efficacy of kaolin on damage reduction of pomegranate fruit moth, *Ectomyelois ceratoniae* (Lep.: Pyralidae), in pomegranate orchards
Hossein Farazmand, Sina Ahmadieh, Kazem Mohammadpour, Heydar Valizadeh, Taghi Sheikhali, Afshin Moshiri, Khadijeh Dashtbani

WE 31
Impact of Thrips on Cowpea
Paul McLeod

WE 32
Insecticide resistance and its management in the sweetpotato whitefly *Bemisia tabaci* (Homoptera: Aleyrodidae)
Mushtaq Ahmad

WE 33
Using of the thermal requirements knowledge of some snakeflies species (Raphidioptera, Raphidiidae) in IPM orchards
Oldrich Pultar

WE 34
Characterization of the eggs phenology of the codling moth, *Cydia pomonella* and eye-spotted bud moth, *Spilonota ocellana* (Lepidoptera, Tortricidae) and its using in the IPM orchards
Oldrich Pultar

WE 35
Some phenological observation of the garden chafer, *Phyllopertha horticola* (L.) (Coleoptera, Rutelidae)
Oldrich Pultar

WE 36
Assessing the first generation adults emergence of parasitoid *Scambus pomorum* (Ichneumonidae) by a distance method (summation of degree-days)
Oldrich Pultar

WE 37
Evaluation of cowpea cultivars for resistance to *Megalurothrips sjostedti* under insecticide applications
O.Y. Alabi, J.A. Odebiyi, M. Tamò

WE 38
Assessing the impact of site-specific spraying on control of *Eurygaster integriceps* (Hemiptera: Scutelleridae) damage and two natural enemies
R. Karimzadeh, Mir Jalil Hejazi, H. Helali, S. Iranipour, S.A. Mohammadi

WE 39-47: Semiochemicals in agroecosystems

WE 39
Deterrent of Taiwanese indigenous djulis (*Chenopodium formosanum*) on three phytophagous insect pests
Hsiang-Ting Huang, Rong-Nan Huang

WE 40
Insecticidal activity of phytohemagglutinin (PHA) towards grain aphid
Iwona Sprawka, Sylwia Goławska, Bogumił Leszczyński

WE 41
Biochemical markers of oxidative stress within tissues of pea aphid *Acyrtosiphon pisum*
Iwona Łukasik, Bogumił Leszczyński, Sylwia Goławska, Agnieszka Wójcicka

WE 42
Influence of selected plant amines on feeding behaviour of bird cherry-oat aphid (*Rhopalosiphum padi* L.)
Cezary Sempruch, Sylwia Goławska, Paweł Osiński, Bogumił Leszczyński

WE 43
Olfactometer-assessed responses of bird cherry-oat aphid *Rhopalosiphum padi* to bird cherry VOCs
Robert Krzyżanowski, Bogumił Leszczyński

WE 44
Effect of triticale surface compounds on growth and development of grain aphid
Agnieszka Wójcicka, Bogumił Leszczyński, Roman Warzecha

WE 45
Study on the synergy effect of different parts of host plant on the attraction and trapping date palm fruit stalk borer *Oryctes elegans* Prell. (Col.: Scarabaeidae) using pheromone traps
K. Mohammadpour, A. Avand-Faghih, D. Rochat

WE 46
Wheat bulb fly (*Delia coarctata*) larval response to constituents of host-plant root exudates.
Craig D. Rogers, K. Andrew Evans

WE 47
Biotechnique method attract & kill to control moth pests in Romanian orchards and vinards
Sonica Drosu, Maria Ciobanu, Mihaela Sumedrea, Silvia Cazacu, Lucia Gânscă

WE 48: Phylogeny of insects

WE 48
Morphology and the earliest splits within the hexapod lineage: Refinement of morphological concepts to chose among conflicting hypotheses
Nikolaus U. Szucsich, Alexander Böhm, Verena Jellinek, Günther Pass

WE 49-87: Insect biochemistry and physiology, including their hormonal regulation

WE 49
Physiology of Diapause in Overwintering larvae of the Pistachio twig borer, ***Kermania pistaciella*** **Amsel (Lepidoptera: Tineidae) in Rafsanjan.**
Hamzeh Izadi , Mohamad Amain, Samih , Behroozy Ehsan, Hadavi Firozeh

WE 50
Serotonin receptors in the salivary gland of *Calliphora vicina*
Claudia Röser, Otto Baumann, Bernd Walz, Wolfgang Blenau

WE 51
Effects of fungal infection by the entomopathogen fungus *Paecilomyces lilacinus* on haemolymph protein profile of the host flour moth *Ephestia kuehniella* larvae
Hülya Altuntaş , Rasime Demirel, A. Yavuz Kılıç

WE 52
Effects of 20-hydroxyecdysone and juvenile hormone on octopamine metabolism in females of *Drosophila* under normal and stress conditions
E.V. Bogomolova, N.V. Adonyeva, N.A Chentsova, I.Yu, Rauschenbach

WE 53
Determination of sugars and polyols in lab-reared and overwintering larvae of beet armyworm, *Spodoptera exigua* (Lepidoptera: Noctuidae)
Maryam Atapour, Saeid Moharramipour, Mohsen Barzegar, Saman Hosseinkhani

WE 54
Changes in the hemolymph protein profile of *Galleria mellonella* L. (Lepidoptera: Pyralidae) parasitized or envenomated by the endoparasitic wasp *Pimpla turionellae* L. (Hymenoptera: Ichneumonidae)
Fevzi Uçkan, Hülya Altuntaş, Ekrem Ergin

WE 55
Cytotoxic effects of parasitism and application of venom from the endoparasitoid *Pimpla turionellae* L. (Hymenoptera: Ichneumonidae) on hemocytes of the host *Galleria mellonella* L. (Lepidoptera: Pyralidae)
Aylin Er, Fevzi Uçkan, Olga Sak, David B. Rivers

WE 56
Developmental hormones control dopamine metabolism in *Drosophila* females under normal and heat stress conditions
E.K. Karpova, E.V. Bogomolova, N.V. Adonyeva, L.V. Shymnaya, N.E. Gruntenko

WE 57
Immune reactions of *Galleria mellonella* larvae during bacterial infection by *Bacillus thuringiensis*
Ekaterina V. Grizanova, Ivan Dubovskiy, Ekaterina Chertkova, Natalia Krukova, Victor Glupov

WE 58
Body temperature of hornets (*Vespa crabro*) and wasps (*Vespula sp.*) at the nest entrance
Helmut Kovac, Anton Stabentheiner

WE 59
Specificity and localization of lipolytic activity in males of *Bombus terrestris*
Jana Brabcová, Martina Macková, Marie Zarevúcka, Irena Valterová

WE 60
Role of stress in the evolution: opportunity of experimental evaluation.
Galina Benkovskaya

WE 61
Relationship between feeding on different plants and hibernation physiology in *Mamestra brassicae* L. pupae
Katrin Jõgar, Luule Metspalu, Külli Hiiesaar, Angela Ploomi, Irja Kivimägi, Anne Luik, Tea Tasa

WE 62
Concentration of free intracellular Ca^{2+} during the insect's cell immune response.
N.A. Krukova, E.A. Chertkova, I.M. Dubovskiy, V.V. Glupov

WE 63
***Myo*-inositol, a major cryoprotectant of the overwintering elm leaf beetle, Xanthogaleruca luteola (Coleoptera: Chrysomelidae)**
Shaghayegh Soudi, Saeid Moharramipour, Mohsen Barzegar

WE 64
Rapid cold hardiness process in *Brevicoryne brassicae* (L.)
Fatemeh Saeidi, Saeid Moharramipour, Mohsen Barzegar

WE 65
Effects of low temperature on adult longevity and fecundity of *Pimpla turionellae* L. (Hymenoptera: Ichneumonidae)
Z. Ülya Nurullahoğlu, Rahile Öztürk

WE 66
Effects of low temperature on loss weight, total lipid and total fatty acid contents and fatty acid ratios of *Achroia grisella* L. (Lepidoptera: Pyralidae) pupae
Z. Ülya Nurullahoğlu, Hacer Yenice, Rahile Öztürk

WE 67
Influence of neonicotinoid bioassay on fertility life table parameters of the cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae)
Shadieh Gerami, Khalil Talebi, Mohammad Ghadamyari, Vahid Hosseininaveh

WE 68
Impact of host plant on energy reservoirs of the cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae)
Shadieh Gerami, Khalil Talebi, Alireza Bandani, Vahid Hosseininaveh

WE 69
Distribution and different effects of a fungal lectin of *Xerocomus chrysentron* (XCL), on *Acyrthosiphon pisum* aphids: specific sugar binding activity induced changes in insect responses
Karimi Jaber, Éric Haubruge, Frédéric Francis

WE 70
Digestive polygalacturonase activity in two stored coleopteran pests: Callosobruchus maculatus (Col.: Bruchidae) and Trogoderma granarium (Col.: Dermestidae)
Mohammad Vatanparast, Vahid Hosseininaveh

WE 71
Biochemical characterization of midgut digestive carbohydrases from carob moth, *Ectomyelois ceratoniae* (Lepidoptera: Pyralidae)
Parvin Razavi Tabatabai, Vahid Hosseininaveh, Seyed Hossein Goldansaz, Khalil Talebi, Khatereh Shirafkan, Mohammad Vatanparast

WE 72
Proteinase and carbohydrase activity in the digestive system of the predatory mite, *Allothrombium pulvinum* Ewing (Acari: Trombidiidae)
Khatereh Shirafkan, Vahid Hosseininaveh, Alireza Sabouri, Parvin Razavi Tabatabai, Mohammad Vatanparast

WE 73
Cold-hardiness of the carabid beetle affected by alpha-cypermethrin
Angela Ploomi, Irja Kivimägi, Luule Metspalu, Eha Švilponis, Katrin Jõgar, Külli Hiiesaar, Ivar Sibul, Aare Kuusik

WE 74
A novel class of lepidopteran chitin-binding proteins in the peritrophic matrix
Odman Naresh Jothini, Hans Merzendorfer

WE 75
Identification of glycerolipid biosynthesis pathway in *Rhodnius prolixus*
M. Alves-Bezerra, Katia C. Gondim

WE 76
Circadian rhythm of neuroblast proliferation in the brain of moth *Spodoptera littoralis*
Agnieszka Suszczynska, Joanna Kotwica, Piotr Bebas, Marta A. Polanska

WE 77
Regulation of H^+-ATPase activity by the biological clock in male reproductive system of *Drosophila melanogaster*
Magdalena M. Majewska, Ewa Joachimiak, Piotr Bebas

WE 78
Gene expression of the Acyl-CoA-Binding protein (ACBP) gene family in *Rhodnius prolixus*
David Majerowicz, Amanda Fonseca-Santos , Katia C. Gondim

WE 79
Effects of low temperature on fatty acid composition of *Galleria mellonella* (Lepidoptera: Pyralidae)
Z. Ülya Nurullahoğlu

WE 80
Evaluating effects of essential oils from labiates family on digestive enzyme activity of *Spodoptera exigua* and *Helicoverpa armigera*
R Farshbaf Pourabad, S Zehtab Salmasi, D. Mohammadi, A.M. Vatankhah

WE 81
Chemical characterization of peptide hormones in the fruit fly midgut
Wencke Reiher, Jörg Kahnt, Stefan Baumeister, Christian Wegener

WE 82
Development, morphology, and function of the calyx cells in the endoparasitic wasp *Glyptapanteles liparidis* (Hymenoptera: Braconidae)
Martina Olifiers, Christa Schafellner, Axel Schopf

WE 83
How many neurons does the smallest winged insect *Megaphragma* (Hymenoptera: Trichogrammatidae) have?
Alexey Polilov

WE 84
The peculiarities of the structure and ultrastructure of the brain of the smallest insects (Coleoptera: Ptiliidae; Hymenoptera: Mymaridae) as a result of miniaturization
A.A. Makarova, A.A. Polilov

WE 85
Effect of temperature on population growth parameters of *Trissolcus vassilievi*, an egg parasitoid of Sunn pest, *Eurygaster integriceps*
Neda Kasraii, Abbas Ali Zamani, Naser Moeeny Naghadeh, Shahryar Asgari, Seyed Mahdi Mahjoob

WE 86
Influence of nitrogen fertilization on biology of *Aphis gossypii* (Hemiptera: Aphididae) reared on *Chrysanthemum indicum* (F: Asteraceae)
Mohammad Rostami, Mostafa Haghani, Abbas Ali Zamani, Shila Goldasteh, Reza Vafaei Shoushtari

WE 87
Potential of Sophora alopecuroides L. (Fabaceae) seed extracts for inhibiting Helicoverpa armigera Hübner (Lep., Noctuidae) midgut protease activity
Reza Farshbaf Pour Abad, Mohammad Reza Rashidi, Seyed Abolghasem Mohammadi, Davoud Mohammadi

WE 88-96: Miscellaneous arthropod studies

WE 88
Efficacy of transgenic Bt cotton containing Cry1Ac against beet armyworm larvae (Lepidoptera: Noctuidae)
Anjum Suhail, Muhammad Arshad

WE 89
Microgastrinae (Hymenoptera, Braconidae) in an heterogenous acidofilous forest in Artikutza (Navarra, Spain)
J.V. Falcó-Garí, M.T. Oltra-Moscardó, F.J. Peris-Felipo, R. Jiménez Peydró

WE 90
Alysiinae (Hymenoptera: Braconidae) community analysis from Pyrenees.
F.J. Peris-Felipo, J.V. Falcó-Garí, M.T. Oltra-Moscardó, R. Jiménez Peydró

WE 91
Cerambycidae (Coleoptera) from Natural Park of Font Roja (Alicante, Spain).
F.J. Peris-Felipo, J.V. Falcó-Garí, M.T. Oltra-Moscardó, R. Jiménez Peydró

WE 92
Ecology of Cerambycidae (Coleoptera) from Natural Park of Lagunas de la Mata-Torrevieja (Spain)
F.J. Peris-Felipo, J.V. Falcó-Garí, M.T. Oltra-Moscardó, R. Jiménez Peydró

WE 93
Entomological inventory of Atlantic Islands National Park (Galicia, Spain): Main findings, its value as early warning system for biodiversity and climate change
Pablo Cobos, Isabel Angulo, Oscar Rodríguez de Rivera, Ignacio Arizmendi, Eudaldo González, Elena García, Elena Gordillo, Gerardo Sánchez

WE 94
Is harlekinkatica (Harlequin ladybird) a proper Hungarian common name for *Harmonia axyridis*?
András Bozsik

WE 95
Saprininae of the Australopacific region-victims of isolation or victims of man?
Tomáš Lackner

WE 96
New records of Ophioninae genera (Hymenoptera, Ichneumonidae) from Peru
Alexander Rodríguez-Berrio, Mabel Alvarado, Santiago Bordera, Alejandra González-Moreno

Celebration of the 100. Anniversary of the Hungarian Entomological Society

Plenary lecture 5

Hungarian Nature History Museum

16.00 – 18.00
Why lice are nice
Lajos Rózsa

Greetings
Coctail in the exhibition: Hexapod Empire

Thursday, 26 August

Plenary lecture 6

Room Copenhagen

08.30 – 09.15
Root feeding insects – an ecosystem perspective
Scott Johnson

S51: Insect biochemistry and physiology, including their hormonal regulation III.

Room Maastricht

Organizers: *Gerd Gade, Heather G. Marco, Adrien Fónagy*

09.30 – 10.00
The PK/PBAN family of insect neuropeptides
Ada Rafaeli

10.00 – 10.15
Molecular analysis of sex pheromone production-related gene in the silkmoth, *Bombyx mori.*
Ken'ichi Moto, Shogo Matsumoto

10.15 – 10.30
The PK/PBAN family of insect neuropeptides: Progress toward the design of novel insect control agents
M. Altstein, M. Davidovitch, O. Ben-Aziz, A. Hariton

10.30 – 10.45
Bacterial flagellin as an elicitor of the immune response in the insect *Manduca sexta*
Christophe Fleury, Stuart E. Reynolds

S52: IPM challenges and prospects in annual and perennial crops I.

Room Brussels

Organizers: *József Fail, Stefan Toepfer*

09.30 – 10.00
Framework for the sustainable use of pesticides across the EU Member States: challenges and opportunities for implementing IPM
Dirk Babendreier, W. Jenner, E. Hunt, M. Grossrieder, F. Zhang, K. Holmes, U. Kuhlmann

10.00 – 10.15
Transition to sustainable pest management in Bulgaria by example of the key pest in apple – the codling moth, *Cydia pomonella*
Jörg Samietz, Hristina Kutinkova, Vasiliy Dzhuvinov, Patrik Kehrli, Denis Pasquier, Heinrich Höhn, Penka Peeva, Pierre-Joseph Charmillot

10.15 – 10.30
Biology and ecology of false codling moth *Thaumatotibia leucotreta*, (Meyrick) (Lepidoptera: Totricidae), in deciduous fruit orchards of the Western Cape Province, South Africa
Nyembezi Mgocheki, Pia Addison

10.30 – 10.45
Developing IPM tactics for pollen beetles in oilseed rape
Sam M. Cook, Andrew W. Ferguson, Janet A. Martin, Matthew P. Skellern, Lesley E. Smart, Nigel P. Watts, John A. Pickett

S53: Invasive species I.

Room Copenhagen

Organizers: *Wolfgang Rabitsch, Gábor Vétek*

09.30 – 09.45
Longhorn beetles in The Netherlands: evaluation of eradication of *Anoplophora chinensis* (Forster)
Antoon JM Loomans, Brigitta F Wessels-Berk, Dirk-Jan van der Gaag

09.45 – 10.00
The Yellow-Legged Hornet *Vespa velutina* (Hymenoptera: Vespidae): a new invader in France
Adrien Perrard, Quentin Rome, Franck Muller, Mariangela Arca, Gérard Arnold, Jean-François Silvain, Claire Villemant

10.00 – 10.15
Differences between independently invading and crossed populations of the alien maize pest *Diabrotica virgifera virgifera* in Europe
Stefan Toepfer, Hongmei Li Thomas Guillemaud, Ulrich Kuhlmann

10.15 – 10.30
Is the Alpine divide becoming more permeable to biological invasions? - Insights on the invasion and establishment of the walnut husk fly (*Rhagoletis completa*) in Switzerland
Jörg Samietz, Martín Aluja, Larissa Guillén, Juan Rull, Heinrich Höhn, Jürg Frey

10.30 – 10.45
Investigating global invasion routes of the harlequin ladybird (*Harmonia axyridis*)
Cathleen E. Thomas, Renate Zindel, Eric Lombaert, Remy Ware, Alexandre Aebi, Arnaud Estoup, Lori Lawson Handley

10.45 – 11.00
***Aproceros leucopoda* (Hymenoptera: Argidae): a new invasive pest of elm (*Ulmus* spp.) in Europe**
Gábor Vétek, György Csóka, József Mikulás, Hideho Hara, Constantin Ciornei, Raoul Constantineanu, Irinel Constantineanu, Ladislav Roller, Ewald Altenhofer, Tomasz Huflejt, Stephan M. Blank

S54: Non-insects entomology

Room Strasbourg

Organizer: *Zoltán Korsós*

09.30 – 09.45
Life history of *Typhlodromus bagdasarjani* (Acari: Phytoseiidae) on immature stages of two-spotted spider mite at different temperatures
Fatemeh Ganjisaffar, Yaghoub Fathipour, Karim Kamali

09.45 – 10.00
Biodiversity and biogeography of millipedes in the Ryukyu Archipelago, Japan
Zoltán Korsós

10.00 – 10.15
Oribatid mites (Oribatei) of the European North of Russia: taxonomic diversity, area of distribution
Elena N. Melekhina

10.15 – 10.30
Temporal patterns of sex ratio in terrestrial isopods (Crustacea, Oniscidea)
Elisabeth Hornung, Attila Végh, Ferenc Vilisics

10.30 – 10.45
Evaluation of germination losses caused by mites in seeds of maize and mung from farmer's holdings in Tehsil Toba Tek Singh Punjab, Pakistan
Syed Usman Mahmood, Muhammad Hamid Bashir

10.45 – 11.00
Effects of thinning on spider diversity of a subtropical plantation forest in Taiwan
Pao-Shen Huang

S55: Genetically modified plants – Effects on insects I.

Room Rome

Organizers: *Andreas Lang, Béla Darvas*

09.30 – 09.50
A review of laboratory data on the impact of transgenic plants on natural enemies indicates non-random effects
Gábor L. Lövei, David A. Andow, Salvatore Arpaia

09.50 – 10.10
An overview about the effects of transgenic *Bacillus thuringiensis* maize on non-target Lepidoptera
Andreas Lang, Mathias Otto

10.10 – 10.30
Determination of Cry1Ab toxin content of *MON 810* maize pollen by enzyme-immunoassay
András Székács, Eszter Takács, Judit Juracsek, Éva Lauber, Béla Darvas

10.30 – 10.50
Relationships of Helicoverpa armigera, Ostrinia nubilalis and Fusarium verticillioides on MON 810 maize
Béla Darvas, Hajnalka Bánáti, Árpád Szécsi, Éva Lauber, András Székács

11.00 – 11.30 Coffee break

S56: Insect biochemistry and physiology, including their hormonal regulation IV.

Room Maastricht

Organizers: *Gerd Gade, Heather G. Marco, Adrien Fónagy*

11.30 – 11.45
A process of uptake of Vitellogenin through receptor by the ovary
C. Bharathiraja, M. Krishnan

11.45 – 12.00
Circadian and non-circadian expression of clock genes in the male reproductive system of *Spodoptera littoralis*
Joanna Kotwica, Justyna Kaźmierczak, Ewa Joachimiak, Piotr Bebas

12.00 – 12.15
Role and identification of gut symbiotic bacteria of the red firebug *Pyrrhocoris apterus*
Hana Ryšavá, Petr Štursa, Veronika Kurzawová, Milan Pavlík, Zdeněk Wimmer, Martina Macková, Pavel Ryšánek

12.15 – 12.30
Permissive and non-permissive hosts: polyDNAvirus as key factor for parasitoid success?
Christa Schafellner, Axel Schopf

12.30 – 12.45
New insights into aphid isoprenoid pathway
Sophie Vandermoten, Michel Cusson, Éric Haubruge, Frédéric Francis

12.45 – 13.00
The monoterpenoid deterrent production in leaf beetle larvae: regulation and evolution
Antje Burse, Sindy Frick, Gerhard Pauls, Axel Schmidt, Jonathan Gershenzon, Wilhelm Boland

S57: IPM challenges and prospects in annual and perennial crops II.

Room Brussels

Organizers: *József Fail, Stefan Toepfer*

11.30 – 11.45
New prospects of exploiting tritrophic interactions for biological crop protection
Ivan Hiltpold, Ted Turlings

11.45 – 12.00
A discrete spatiotemporal population model for management of western corn rootworm (Diabrotica virgifera virgifera LeConte; Coleoptera: Chrysomelidae) at landscape level
Márk Szalai, Judit Papp Komáromi, József Kiss, Stefan Toepfer

12.00 – 12.15
***Sorghum, Miscanthus* & Co: Energy crops are potential host plants of the western corn rootworm larvae**
Kai Gloyna, Thomas Thieme, Michael Zellner

12.15 – 12.30
The delivery of a virus risk assessment to decision makers in the seed potato industry via rapid result provision of aphid trap catches and the incorporation of new data on *Potato Virus A* transmission
Phil Northing, Larissa E Collins, John Magson, Adrian Fox

12.30 – 12.45
Control of European corn borer in bell peppers with chlorantaniliprole applied through a drip irrigation system
Gerald M. Ghidiu, Daniel L. Ward

S58: Invasive species II.

Room Copenhagen

Organizers: *Wolfgang Rabitsch, Gábor Vétek*

11.30 – 11.45
Ongoing biological control studies of *Laricobius osakensis* (proposed) Montgomery & Shiyake (Coleoptera: Derodontidae), a predator of *Adelges tsugae* Annand (Hemiptera: Adelgidae)
L. Cota-Vieira, S.M. Salom, L.T. Kok

11.45 – 12.00
More than twenty years successful prevention of establishment in Europe of the EU quarantine pest *Thrips palmi*
Gijsbertus Vierbergen, Antoon JM Loomans

12.00 – 12.15
***Tapinoma nigerrimum* (Hymenoptera: Formicidae): last shield against the spread of the Argentine ant**
Laurence Berville, Olivier Blight, Marielle Renucci, Alain Tirard, Erick Provost

12.15 – 12.30
***Aedes albopictus* (Skuse, 1894): monitoring and current status of an important invasive mosquito species in Spain**
R. Bueno-Marí, F. A. Chordà-Olmos, A. Bernués-Bañeres, F.J. Peris-Felipo, R. Jiménez-Peydró

12.30 – 12.45
Revision of the genus *Epiphyas* – the light-brown apple moth in context
Bobbie Hitchcock

12.45 – 13.00
Web systems and tools to support invasive species education programs in multiple languages across national and institutional boundaries
G. Keith Douce, Ferenc Lakatos

S60: Genetically modified plants – Effects on insects II.

Room Rome

Organizers: *Andreas Lang, Béla Darvas*

11.30 – 11.50
A new method for *in-situ* measurement of *Bt*-maize pollen deposition on host-plant leaves
Frieder Hofmann, Ulrike Kuhn, Mathias Otto

11.50 – 12.10
Protected lepidopteran larvae and Cry1Ab toxin exposure by Bt maize pollen in the Pannonian Region
Éva Lauber, László Peregovits, László Ronkay, Attila Csóti, András Székács, Béla Darvas

12.10 – 12.30
Potential effects of pollen from stacked *Bt*-maize to non-target Lepidoptera in agrarian systems
Mechthild Schuppener, Alan J. Slusarenko, Stefan Rauschen

12.30 – 12.50
***Bt*-maize (*MON 810*) effect on the collembolan *Folsomia candida* – some new aspects**
Gábor Bakonyi, Anna Dolezsai, András Székács

13.00 – 14.30 Lunch

S61: Xenobiotic effects and side-effects on arthropods

Room Strasbourg

Organizer: *András Bozsik*

14.30 – 14.45
Baseline susceptibility and stability for insecticides in a field population of beet armyworm, *Spodoptera exigua* (Noctuidae: Lepidoptera)
Mushtaq A. Saleem, Muhammad Ishtiaq, Munir Ahmad

14.45 – 15.00
Control of *Culex pipiens molestus* in septic tank by using deltamethrin-sucrose solution
Kyu-Sik Chang, E-Hyun Shin, Dong-Kyu Lee, Young-Joon Ahn, Chan Park

15.00 – 15.15
The effect of sulphur and chlorpyriphos on two spotted spider mite, *Tetranychus urticae* (Acari: Tetranychidae) and an introduction to natural enemies in grape
Nouraddin Shayesteh, Seyed Adel Hashemi, Abbas Hosseinzadeh

15.15 – 15.30
Evaluation of Sublethal doses of chlorpyrifos and fenpropathrin pesticides on stable growth parameters in adult stage treatment of *Habrobracon hebetor* Say. (Hym.: Braconidae)
Mohammad Ali Hajar Faal , A.A. Seraj, K. Talebi-Jahromi

15.30 – 15.45
The effect of some chemical additives as formulation on the *Bacillus thuringiensis* enhancement against the potato tuber moth *Phthorimaea operculella* (Lepidoptera: Gelechiidae)
M.M. Sabbour, M.A Ragae, Samy Rasha

15.45 – 16.00
Evaluation of spray technology with minimum requirements for the control of desert locust *Schistocerca gregaria* (Orthoptera: Acrididae)
Muhammad Ashfaq, Muhammad Ishfaque, Waqas Wakil M. Didar Goggi

16.00 – 16.15
Comparison of insecticidal activity of essential oils against red flour beetle *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae)
Muhammad Tayyib Naseem, Khuram Zia, Rashid Rasool Khan, Faisal Nazir

S62: IPM challenges and prospects in annual and perennial crops III.

Room Brussels

Organizers: *József Fail, Stefan Toepfer*

14.30 – 14.45
Pesticide free control of Flea beetles (*Phyllotreta* spp.) in Rocket (*Eruca sativa*)
A. Pintér, F. Tóth

14.45 – 15.00
Determination of the optimum dose for sterilizing Greenhouse Whiteflies, *Trialeurodes vaporariorum* (Westwood) (Hem.: Aleyrodidae) by gamma radiation
Maryam Moradi, Mehdi Zarrabi

15.00 – 15.15
Predatory mites to control *Thrips palmi* Karny (Thysanoptera:Thripidae): Prey consumption rates and compatibility with chemical insecticides
Andrew G S Cuthbertson, James J Mathers, Pat Croft, Lisa F Blackburn, Weiqi Luo, Phil Northing, Tamotsu Muari, Robert J. Jacobson, Keith F.A. Walters

15.15 – 15.30
Investigation of life history parameters for the development and validation of a simulation model describing the population development of the currant-lettuce aphid, *Nasonovia ribisnigri* in glasshouse lettuce
Phil Northing, Andrew G S Cuthbertson, Anne Ainsley, Pat Croft, Lisa F Blackburn, Philip A S S Mason, Keith F.A. Walters

15.30 – 15.45
The effects of cultural control methods on the Lesser date moth (*Batrachedra amydraula* myer) infestations
M. Latifian, H. Pejman, A.R. Ahmadi

S63: Sensory ecology (Pheromones) I.

Room Copenhagen

Organizers: *Bill S. Hansson, Gábor Szőcs*

14.30 – 15.00
The importance of background odor for insect olfactory orientation to a resource
Monika Hilker

15.00 – 15.15
Mate choice is a matter of "taste": Host plant shift induced changes of contact pheromones affect mate and species recognition in herbivorous insects
Tobias Otte, Sven Geiselhardt, Monika Hilker

15.15 – 15.30
The Search for Bed Bug Pheromones: A behavioural and electrophysiological study of the common bed bug
E. Weeks, Michael A. Birkett, M. M. Cameron, J. G. Logan, J. A. Pickett

15.30 – 15.45
Half a century of pheromone science
Hans E. Hummel, E. Hecker, K.-E. Kaissling

15.45 – 16.00
Round table discussion

S64: Plecoptera taxonomy

Room Maastricht

Organizers: *Ignac Sivec, Dávid Murányi*

14.30 – 14.45
Systematics, biogeography and genetic structure of the genus *Besdolus* Ricker, 1952
R Fochetti , B. Gaetani, S. Fenoglio, T. Bo, T. Kovács, M.J. López-Rodríguez, J.M. Tierno de Figueroa

14.45 – 15.00
Molecular genetics of four morphological species of *Anacronueria* genues (Plecoptera:Perlidae) in sympatric speciation. Its Implications on taxonomical, phylogenetical, speciation
Maribet Gamboa, Jazzmin Arrivillaga

15.00 – 15.15
On the identity of *Isoperla curtata* Navás, 1924: a behavioural and molecular approach
J.M. Tierno de Figueroa, B. Gaetani, J.M. Luzón-Ortega, M.J. López-Rodríguez, R. Fochetti

15.15 – 15.30
Plecoptera of the Balkans: history of investigations, and the present knowledge on distributional patterns
Dávid Murányi, Ignac Sivec

15.30 – 15.45
The stonefly-fauna (insects: Plecoptera) of Austria: Diversity, ecology and zoogeography
Wolfram Graf

15.45 – 16.00
Recent findings of rare and endangered stoneflies (Insecta: Plecoptera) in Croatia
Aleksandar Popijač, Ignac Sivec

16.00 – 16.15
Are they any future of classical taxonomy?
Ignac Sivec

S65: Genetically modified plants – Effects on insects III.

Room Rome

Organizers: *Andreas Lang, Béla Darvas*

14.30 – 14.50
Grasshoppers and butterflies as biodiversity indicators in a GM-plant monitoring program – An Austrian case study
Kathrin Pascher, Dietmar Moser, Stefan Dullinger, Leopold Sachslehner, Patrick Gros, Norbert Sauberer, Andreas Traxler, Georg Grabherr, Thomas Frank

14.50 – 15.10
Metabolomic responses to herbivory in genetically modified potato
Maaike Bruinsma, Andreas Plischke, Paul M. Brakefield, Peter G.L. Klinkhamer

15.10 – 15.30
Can transgenic Bt maize and biological control be combined to reduce pest populations of Western corn rootworm in maize?
Claudia Zwahlen, Géraldine S. Léchot, Bruce E. Hibbard, Ted C.J. Turlings

15.30 – 15.50
Occurrence of Diptera and secondary pests in *Diabrotica*-resistant Bt-maize
Wolfgang Büchs, Sabine Prescher, Oliver Schlein

16.00 – 17.00
Thursday poster session and coffee

TH 1-4: Quantitative ecology

TH 1
Population dynamics of white peach scale, *Pseudaulacaspis pentagona* Targioni and its main natural enemies, in Sari County, Iran
M. Bazrafshan, B. Amiri Besheli

TH 2
Spatial distribution and seasonal activity of *Zetzellia pourmirzai* (Acari: Stigmaeidae) and its two prey species, *Cenopalpus irani* and *Bryobia rubrioculus* (Acari: Tetranychidae) in a sprayed apple orchard of Kermanshah (Iran)
Maryam Darbemamieh, Yaghoub Fathipour, Karim Kamali

TH 3
Optimising the sample size for *Pronematus ubiquitus* (Acari: Iolinidae) and its spatial distribution and seasonal activity in natural and sprayed apple orchards in Kermanshah, Iran
Maryam Darbemamieh, Yaghoub Fathipour, Karim Kamali

TH 4
Mathematical Model for Biological Control of the South American Tomato Pinworm, *Tuta absoluta* (Lep.: Gelechiidae), with Releases of *Trichogramma achaeae* (Hym.: Trichogrammatidae) and *Nesidiocoris tenuis* (Hem.: Miridae), in Tomato Greenhouses of Spain
Manuel Gámez, Zoltán Varga, József Garay, Enric Vila, Tomas Cabello

TH 5-8: Soil entomology – an ecosystem perspective

TH 5
Structure and dynamic of rove beetles (Coleoptera: Staphylinidae) communities in the floodplain forests of the European North-East of Russia
Alla Kolesnikova

TH 6
Collembolan morphospecies (Hexapoda: Collembola) in serpentine soils: a case study in a natural ecosystem in northeastern Portugal
M. Alice Pinto, Margaux Rosenzweig, Marisa Monteiro, Felícia Fonseca, José Paulo Sousa, Sónia A.P. Santos

TH 7
Collembolan communities in a sustainable system for production of woody biomass for energy: abundance and diversity of morphospecies
Sónia A.P. Santos, Margaux Rosenzweig, Marisa Monteiro, M. Alice Pinto, Felícia Fonseca, José Paulo Sousa, João C. Azevedo

TH 8
Diversity and abundance of soil arthropods on maize fields with different farm practices in Northern Portugal
Fátima Simão, Miguel A. Carretero, Maria José Amaral, Amadeu M.V.M. Soares, Eduardo Mateos

TH 9-11: Carabid ecology

TH 9
Method for ecological monitoring based on research of ground beetle fauna (Coleoptera, Carabidae)
Kitaev A. Konstantin

TH 10
Ground beetles (Coleoptera: Carabidae) as object of bioindicator researches in area of emissions of a timber industry complex
Tatyana Konakova

TH 11
High temperature induced spike bursts generated by antennal thermo- and hygroneurons in ground beetles
Anne Must, Enno Merivee Anne Luik

TH 12-25: Invasive species

TH 12
Tarachidia candefacta Hübn. (Noctuidae, Lepidoptera) against ragweed Ambrosia artemisiifolia L (Ambrosieae. Asteraceae): the novel approach in the biological suppression of the adventive weed vegetation
L.P. Esipenko

TH 13
Adaptive processes in the populations of invasive species *Zygogramma suturalis* (F.) (Coleoptera, Chrysomelidae) and *Ambrosia artemisiifolia L*. (Asteraceae)
L.P.Esipenko

TH 14
Colonization of *Glycaspis brimblecombei* (Hemiptera: Psyllidae), eucalyptus pest, in Spain
F.J. Peris-Felipo, A. Bernués-Bañeres, J.V. Falcó-Garí, R. Jiménez-Peydró

TH 15
Two subspecies of Colorado potato beetles are forming?
Maxim Udalov, Galina Benkovskaya

TH 16
Genetic structure, gene flow and dispersal patterns of western corn rootworm *Diabrotica virgifera virgifera* LeConte(Coleoptera: Chrysomelidae) populations from Croatia
Darija Lemić, Katarina Mikac, Renata Bažok, Maja Čačija

TH 17
Persistent spread of *Lycorma delicatula* in Korea
Jong Min Kim, Do Hun Lee, Chang Wu Lee, Hyun Chul Shin, Young Ha Kim, Jae Hun Kim

TH 18
An invasive non-pest fungivore: Cis bilamellatus Wood (Coleoptera: Ciidae) in northern Europe
Glenda M. Orledge, Paul A. Smith, Stuart E. Reynolds

TH 19
Pest Risk Assesment of Liriomyza species in Estonia
Eha Švilponis, Külli Hiiesaar, Luule Metspalu, Angela Ploomi, Katrin Jõgar, Marika Mänd

TH 20
What will stop the invader? Dispersal barriers of the harlequin ladybird (*Harmonia axyridis)*
Cathleen E. Thomas, Eric Lombaert, Remy Ware, Arnaud Estoup, Lori Lawson Handley

TH 21
Characteristics of ladybird *Harmonia axyridis* during autumn migration
Oldřich Nedvěd, Tereza Nedvědová

TH 22
Collembola assemblages under the invasive *Senecio inaequidens* and the native *S. jacobaea*
Luc De Bruyn Luc, Frans Janssens , Valérie Vanparys

TH 23
The currently known distribution of *Acizzia jamatonica* (Hemiptera: Psyllidae), a major pest of silk tree, in Europe
Gábor Vétek, Dávid Rédei, Bettina Pásztor, Andrea Babić, Hajnalka Bognar Pastor, Attila Haltrich, Béla Pénzes

TH 24
Occurrence of the multicoloured Asian ladybird beetle, *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) in Hungarian habitats
András Bozsik

TH 25
Attack intensity of *Corythucha ciliata* (Hemiptera, Tingidae) on *Platanus spp*. in an urban area in Portugal: a comparison between pruned and unpruned trees
Ana Gonçalves, Sónia A.P. Santos, Maria Alice Pinto

TH 26-46: Xenobiotic effects and side-effects on arthropods

TH 26
Fumigant toxicity of Essential oil from Thymus kotschyanus on Callosobruchus maculatus and Ephestia kuehniella
H. Akrami, S. Moharramipour, S.Imani

TH 27
The lethal effects of Spinosad on *Chrsoperla carnea* larvae (Neu: Chrisopidae) via ingestion technique under laboratory conditions
Mostafa Maroufpoor, Mohhammad Hasan Safaralizadeh, Ali Asghar Pourmirza, Nouraddin Shayesteh

TH 28
Bioactivity of *Satureja hortensis* (Lamiaceae) and *Zingiber officinale* (Zingiberaceae) against the Mediterranean flour moth, *Ephestia kuehniella* (Lepidoptera: Pyralidae)
Maedeh Mollai, Hamzeh Izadi, Majeed Azizii

TH 29
Fumigant toxicity of essential oil from *Zingiber officinale* (Zingiberaceae) against *Tribolium castaneum* (Col.: Tenebrionidae) and *Ephestia kuehniella* (Lep.: Pyralidae)
Maedeh Mollai, Hamzeh Izadi, Majeed Azizi, Hasan Rahimi

TH 30
Efficacy of Spinosad Against *Tribolium castaneum* (Coleoptera: Tenebrionidae) and *Plodia interpunctella* (Lepidoptera: Pyralidae)
Maedeh Mollai, Hamzeh Izadi, Hossein Dashti, Hasan Rahimi

TH 31
Fumigant toxicity of essential oil from *Satureja hortensis* (Lamiaceae) against three Stored-Product Insect Species
Maedeh Mollai, Hamzeh Izadi, Hossein Dashti, Majeed Azizi

TH 32
Efficacy of garlic powder, *Allium sativum* L. against *Tribolium confusum* Jacquelin du Val.
Hasan Rahmani, Mostafa Karimi, Morteza Movahedi Fazel

TH 33
Impact of alpha-cypermethrin on body mass of the carabid beetle Platynus assimilis
Irja Kivimägi, Angela Ploomi, Luule Metspalu, Eha Švilponis, Katrin Jõgar, Külli Hiiesaar, Aare Kuusik

TH 34
A New Simple Methodology to Evaluate the Insecticide Side-Effects on *Trichogramma* Species (Hym.: Trichogrammatidae) in Greenhouse Crops
Tomas Cabello, Juan R. Gallego, Francisco J. Fernández, David de Scals, Adolfo Rubio, Salvador Salvatierra, Anabel Parra

TH 35
Side effect of four insecticides on demographic parameters of the aphid parasitoid, *Diaeretiella rapae* (McIntosh) (Hym., Braconidae)
M. Khosravian, K. Kheradmand, S. Shahrokhi, M.R. Rezapanah

TH 36
Effects of *Peganum harmala* L. seed extract on the diamondback moth, *Plutella xylostella* (L.) (lep.: Plutellidae)
Habib Abbasipour, Mohammad Mahmoudvand, Fahimeh Rastegar Moslem Basij

TH 37
Sublethal effects of indoxacarb doses on fecundity, developmental time and adult longevity of diamondback moth, *Plutella xylostella* (L.) (Lep.: Plutellidae)
Mohammad Mahmoudvand, Habib Abbasipour, Aziz Sheikhi Garjan, Alireza Bandani

TH 38
Efficacy of essential oil from *Ferula gummosa* Boiss (Apiaceae) on larvae and adult of *Ephestia kuehniella* Zeller (Lep.: Pyralidae)
Alireza Seyedi, Habib Abbasipour, Saeid Moharramipour, Mohammad Kamalinejad

TH 39
Effect of two neonicotinoid pesticides on some population growth parameters of the cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae)
Shadieh Gerami, Khalil Talebi Jahromi, Vahid Hosseeini Nave

TH 40
Toxicity Evaluation of Nissorun, Palizin, Sirinol and Tondexir on *Tetranychus urtica* Koch a pest of *Brassica napus* L
B. Amiri Besheli

TH 41
An investigation on efficacy of garlic extraction on adults of potato Colorado beetle, *Leptinotarsa decemlineata* Say., in Lab. Conditions
Z. Mamduh, M. Movahedi Fazel

TH 42
An investigation on efficacy of garlic extraction on larvae of potato Colorado beetle, *Leptinotarsa decemlineata* Say., in Lab. Conditions
Z. Mamduh , M. Movahedi Fazel

TH 43
Comparison toxicity of different dose of Tondxir, Sirinol and Palizin against *Tetranychus urtica* Koch a pest of *Brassica napus* L
B. Amiri Besheli

TH 44
Ovicidal activity of essential oil of *Ruta graveolens* L. against the eggs of *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae)
Mohammad Hossein Hosseinpour, Alireza Askarianzadeh, Saeid Moharramipour, Jalal Jalali Sendi

TH 45
Insecticide resistance status of *Myzus persicae* populations from Turkey
Selcan Alptekin, Nurper Guz, Sibel Velioglu, Cem Erdoğan , M. Oktay Gurkan

TH 46
Susceptibility of the *Agonoscena pistaciae* (Hemiptera: Psyllidae) to amitraz and phosalone in Kerman, Iran
Ali Alizadeh , Khalil Talebi-Jahromi Vahid Hosseininaveh

TH 47-60: Life history, reproduction and development of insect

TH 47
Study on the conidial dispersion of *Beauveria bassiana* (Balsamo) Vuillemin (Deut., Moniliaceae) in Date by larval and adult stages of Saw-toothed Beetle, *Oryzaephilus surinamensis* L. (Col., Silvanidae)
M. Latifian, E. Solimannejadian, M. Gazavi, M. A. Makvandi

TH 48
Effect of different commercial Date palm cultivars on the growth of *Beauveria bassiana* on the larval and adult stages of Saw-toothed Beetle, *Oryzaephilus surinamensis* (Coleoptera: Silvanidae), using Fungal development index (FDI)
M. Latifian, E. Solimannejadian, M. Gazavi, M. A. Makvandi

TH 49
Biology of *Ommatissus lybicus* (Homoptera: Tropiduchidae) on date palm in natural condition of Bam region
Mehdi Sepanji, Arezoo Payandeh, Karim Kamali, Yaghoub Fathipour

TH 50
Laboratory rearing of *Helicoverpa armigera* (Lep.: Noctuidae) on artificial medium and investigation on effect of nutriment types and different surfaces on oviposition rate of female moths
Moslem Basij, Mohammad Mahmoudvand, Mohammad Hossein Hosseinpour, Jalal Kolahdooz Shahroodi

TH 51
***Dorcadion pseudopreissi*, a new turf pest in Turkey, the biology and damage on different Turf species**
Nabi Alper Kumral, Uğur Bilgili, Esvet Açıkgöz

TH 52
Study of longevity of different life stages of Silverleaf Whitefly, *Bemisia argentifolii* (Hemiptera: Aleyrodidae) on different hosts
B. Pourshahid, M. Zarrabi, M. Samia, M. Mohseni

TH 53
Study on the biology of the greater wax-moth under laboratory conditions and determination of larval instar by measuring body weight
Nazila Saghaei, Ali Asghar Pourmirza, Majid Fallahzadeh

TH 54
Seasonal abundance of *Planococcus ficus* (Signoret) (Hemiptera, Pseudococcidae) in Jahrom vineyards, Fars Province-Iran
Majid Fallahzadeh, Nazila Saghaei, Hadi Ostovan

TH 55
Annual dynamics of *Hypera postica* (Coleoptera: Curculionidae) population in Hamedan: Alternatives key factor analyses
Babak Zahiri, Yaghoub Fathipour, Mohammad Khanjani, Saeid Moharramipour

TH 56
Long standing dynamics of termite population and its global ecological and meteorological significance
Valentin B. Sapunov, Lev N. Karlin

TH 57
Rose gall wasp, *Diplolepis rosae* (Hym., Cynipidae) and its associated wasps in Iran
Shahram Hesami, Mehdi Gheibi, Mohammad Reza Behzadi, Selmi Seyedebrahimi

TH 58
Study on Greenhouse Whitefly *Trialeurodes vaporariorum* (Westwood) longevity and female fecundity on cherry tomato
S. Movassaghi, M. Zarrabi

TH 59
An investigation on efficacy of potato Colorado beetle, *Leptinotarsa decemlineata* Say, larvae feedings of garlic extraction on some adult life parameters in lab. conditions
Z. Mamduh , M. Movahedi Fazel

TH 60
Response of the larval ectoparasitoid, Goniozus legneri Gordh (Hymenoptera: Bethylidae), to carob moth Apomyelois ceratoniae (Zeller) odors and pomegranate fruit Punica granatum L. volatiles in an olfactometer
Fatemeh Ehteshami, Maryam Aleosfoor

TH 61-67: Genetically modified plants – Effects on insects

TH 61
Important aspects to be considered when assessing the impact of *Bt*-maize on herbivorous insects in the field
Eva Schultheis, Alan J. Slusarenko , Stefan Rauschen

TH 62
Assessing the effects of Cry toxins on ladybird beetles: a case study with *Adalia bipunctata*
Fernando Álvarez-Alfageme, Franz Bigler, Jörg Romeis

TH 63
Efficacy of transgenic *Bt*-cotton containing Cry1Ac-toxin against *Spodoptera exigua*
Anjum Suhail, Muhammad Arshad

TH 64
Efficacy Of Transgenic Bt Cotton Containing Cry1Ac Against Beet Armyworm Larvae (Lepidoptera: Noctuidae)
Anjum Suhail, Muhammad Arshad

TH 65
A full life cycle test as tool for the evaluation of potential effects of genetically modified plants on the ground beetle *Poecilus cupreus*
Kai U. Priesnitz, Thomas Thieme , Ullrich Benker

TH 66
The potential of transgenic legumes in storage pest management: assessing the impact on bruchid parasitoids
Fernando Álvarez-Alfageme, Christoph Lüthi, Jörg Romeis

TH 67
A Round Robin interlaboratory comparison of Cry1Ab toxin determination in *MON 810* maize and biological samples by enzyme-immunoassay
András Székács, Gabriele Weiss, David Quist, Eszter Takács, Béla Darvas, Angelika Hilbeck

TH 68-72: Diptera taxonomy

TH 68
First record of the genus *Alliocera* with one species and *Beris chalybata* (Forster, 1770) from Turkey (Diptera: stratiomyidae)
Turgay Üstüner, Abdullah Hasbenli

TH 69
New contribution to information about Tabanidae (Diptera) adult and larvae from West Anatolia
A. Yavuz Kılıç, Ferhat Altunsoy

TH 70
New Systematic Knowledge about *Tabanus karaosus* Timmer 1984 (Tabanidae: Diptera) from Turkey
Ferhat Altunsoy, A. Yavuz Kılıç

TH 71
Four genera and seven species as new records for Iran hover flies fauna (Diptera; Syrphidae) from East Azerbayjan province
Samad Khaghaninia, Reza Farshbaf Pour Abad , Suleyman Saribiyik

TH 72
A geometric morphometric variation study in five geographical populations of *Shaerophoria scripta (Diptera: Syrphidae)* in Iran
A. Sarafrazi, N.S. Seyed Hashemi, E. Gilasian

TH 73-76: Plecoptera taxonomy

TH 73
Review of the status of two threatened stonefly species (Plecoptera) in southern Iberian Peninsula
J.M. Tierno de Figueroa, M.J. López-Rodríguez

TH 74
Nymphal trophic behaviour of two Nemouridae species (Insecta, Plecoptera) in the Curone creek (northern Apennines, Italy)
M.J. López-Rodríguez, T. Bo, J.M. Tierno de Figueroa, S. Fenoglio

TH 75
Study of flight period and adult size variations in an altitude gradient in Río Trevélez (southern Iberian Peninsula)
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Do aphids and their predators use the same OBP to transport a same odour?
Sophie Vandermoten, Jia Fan, Yong Liu, Julian Chen, Eric Haubruge, Frédéric Francis

TH 83
New faunistic records of the honey locust gall midge, by newly developed pheromone traps
Béla Molnár, Tina Boddum, Gábor Szőcs, Ylva Hillbur

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A. A. Pachkin, V.Y. Ismailov, S.V. Zhuravlev

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TH 85
***Volucella bombylans* (Syrphidae, Diptera) Recorded from a Colony of *Bombus mesomelas* (Apidae, Hymenoptera) in Iran**
Alireza Monfared, Shahrzad Azhari

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Mohammad Yahyavinezhad, Gholamhosein Tahmasbi, Alireza Saboori, Alireza Monfared, Pavel Klimov

TH 87
***Mutilla saltensis* (Mutillidae, Hymenoptera) a parasite of *Bombus armeniacus* colony in Iran**
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A Nest Restoration Case by *Bombus* (*Megabombus*) *argillaceus* (Scopoli, 1763) (Hymenoptera: Apidae) from Turkey
Çiğdem Özenirler, Kürşat Koyuncu, Demet Töre, Fatih Dikmen, Ahmet Murat Aytekin

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Yasemin Güler, Fatih Dikmen, Demet Töre, Ahmet Murat Aytekin

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Neelima R. Kumar, R. Kumar

TH 92-96: Non-insects entomology

TH 92
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Elisabeth Hornung, Ferenc Vilisics

TH 93
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Vahid Rahiminejad, Hamidreza Hajiqanbar, Yaghoub Fathipour

TH 94
First record of the *Caraboacarus krczali* Eidelberg, 1994 (Acari: Caraboacaridae) associated with *Calosoma* sp. (Col.: Carabidae) from Iran
Abdolazim Mortazavi, Hamidreza Hajiqanbar, Alireza Saboori

TH 95
Effect of temperature on prey consumption of *Typhlodromus bagdasarjani* (Acari: Phytoseiidae) feeding on nymphs of *Tetranychus urticae* (Acari: Tetranychidae)
Fatemeh Ganjisaffar, Yaghoub Fathipour, Karim Kamali

TH 96
Some scutacarid mites (Acari: Scutacaridae) associated with ants (Hym.: Formicoidea) and their nests from Iran
Hamidreza Hajiqanbar

S67: Carabid ecology

Room Brussels

Organizers: *Gábor Lövei, Béla Tóthmérész*

17.00 – 17.15
Enhanced carabid diversity and abundance in Hungarian set-aside fields
Anikó Kovács, András Báldi

17.15 – 17.30
Spatial pattern and edge effect of carabids along oak-hornbeam forest-grassland transects
Béla Tóthmérész, Tibor Magura

17.30 – 17.45
Seasonal dynamics of beetle (Insecta, Coleoptera) assemblages in different dune habitats of the Curonian Spit (Lithuania)
Povilas Ivinskis, Christa Maria Heidger, Jolanta Rimšaitė

17.45 – 18.00
Comparing seasonal dynamics by a graphical method to assess the reactions of ground beetles (Coleoptera, Carabidae) to urbanisation
Gábor L. Lövei, Zoltán Elek, Andy Howe, Matthias Engaard

18.00 – 18.15
Phenological changes in ground beetle (Coleoptera: Carabidae) communities at two Environmental Change Network sites in Scotland
Gabor Pozsgai

18.15 – 18.30
Possibility of contacts between arthropods active on the soil surface and on vegetation
Wladimir B. Tshernyshev, Valentina M. Afonina, Andrey N. Semenov, Yaroslav A. Terehov

S68: Sensory ecology (Pheromones) II.

Room Copenhagen

Organizers: *Bill S. Hansson, Gábor Szőcs*

17.00 – 17.30
How can pheromone studies complement taxonomy: A click beetle example (Coleoptera: Elateridae)
Miklós Tóth, József Vuts, Lorenzo Furlan, Till Tolasch, Amália Xavier, Teodora B. Toshova, Mitko A. Subchev, István Szarukán, Venyamin Yatsynin

17.30 – 17.45
Host odor-related neuroethology in *Drosophila*
Bill S Hansson

17.45 – 18.00
Isolation and cloning of olfactory receptor gene from *Bombyx mori*
P. Britto Cathrin, M. Krishnan, K. Touhara

18.00 – 18.15
Plan ORSA: Design and synthesis of anti-insect Odorant-Reception Suppressing Agents
Jean-François Picimbon

18.15 – 18.30
Round table discussion

S69: Quantitative ecology

Room Strasbourg

Organizers: *László Papp, Béla Tóthmérész*

17.00 – 17.15
Investigation on spatial distribution of sugarcane pink stem borers Sesamia spp. (Lep.: Noctuidae) by using classical statistics in sugarcane fields in the south of Khuzestan province
Hossein Parian, Ali Asghar Seraj, Alireza Askarianzadeh, Abdolamir Mohiseni

17.15 – 17.30
Pollen flow mediated by different groups of generalist pollinators
Sergey Lysenkov

17.30 – 17.45
Leaf beetle diversity (Coleoptera, Chrysomelidae) of Kýzýldað National Park, Ýsparta (Turkey)
İsmail Şen, Ali Gök

17.45 – 18.00
Insect biodiversity improves ecosystem services in Moscow
Ludmila Volkova, Nikolay Sobolev

S70: Life history, reproduction and development of insect

Room Maastricht

Organizer: *Géza Ripka*

17.00 – 17.15
Red palm weevil and date palm fruit stalk borer in UAE: serious pests and hosts of phoretic mites
Mohammad Ali Al-Deeb

17.15 – 17.30
Overwintering of *Thrips tabaci* population under continental climatic conditions
Szilvia Orosz, Emese Balog

17.30 – 17.45
Living in a plant trap: specialisation in mirid bugs *Pameridea roridulae* to the sticky glandular surface of their host plant *Roridula gorgonias*
Dagmar Voigt, Stanislav Gorb

17.45 – 18.00
How can *Phytomyza orobanchia* (Diptera: Agromyzidae) and pollinators understand the different languages of the broomrapes (Orobanchaceae)?
Peter Tóth, Jozef Lukáš, Harro Bouwmeester

18.00 – 18.15
Biological traits and fertility life table of *Bemisia tabaci* (Genn.) and *Bemisia argentifolii* Bellows and Perring (*B. tabaci* B-biotype) (Hemiptera: Aleyrodidae) on cotton and rapeseed in laboratory
M.A. Samih, M. Zarrabi

18.15 – 18.30
Geometric morphometric studies in color morphs of *Cicadatra alhageos* (Kolenati 1857) populations in Iran
T. Tavanpour, F. Mozaffarian, A. Sarafrazi

18.30 – 18.45
Population dynamic of Western Corn Rootworm (*Diabrotica virgifera virgifera* Le Conte) in Bosnia and Herzegovina
N. Karic

18.45 – 19.00
Effect of soil moisture level on pupation depth and survival of Oriental Fruit Fly, *Bactrocera dorsalis* Hendel (Diptera: Tephritidae) on mango (*Mangifera indica* L.) in Myanmar
Nwe Nwe Yin, Thi Tar Oo, Kyaw Kyaw Win, Thil Bahadur

Friday, 27 August

Plenary lecture 7

Room Copenhagen

08.30 – 09.15
Gall midge sex pheromones
Ylva Hillbur

S72: Soil entomology – an ecosystem perspective I.

Room Maastricht

Organizers: *Scott Johnson, Gábor Bakonyi*

09.30 – 10.00
Completing the view of ecosystems: Including the belowground food web
Stefan Scheu

10.00 – 10.15
Root herbivore mediated changes in N status of plants and N-transfer between clover and associated grasses
Philip Murray

10.15 – 10.30
Spatial distribution of phytophagous soil insects in grassland
Rod P. Blackshaw

10.30 – 10.45
Elucidation of the C and N flow through the soil invertebrate food web, comparison of a grassland and woodland soil
Felicity Crotty, Christopher Clegg, Rod P. Blackshaw, Philip Murray

10.45 – 11.00
Soil arthropod communities – A spatial explicit perspective
Matty P. Berg, Pedro Martins, Paulo Sousa

S73: Social insects and apiculture I.

Room Rome

Organizers: *Bálint Markó, László Gallé*

09.30 – 09.45
Cooperation among worker of *Bombus terrestris* and queens of several bumble bee (Hymenoptera, Apoidea) species in starting colonies
Alena Bučánková, Vladimír Ptáček

09.45 – 10.00
Closely related pollen generalist bee species differ in their ability to develop on the same pollen: evidence for the need of physiological adaptations for pollen digestion
Claudio Sedivy, Andreas Müller, Silvia Dorn

10.00 – 10.15
Enemy specification in red wood ants
Zhanna Reznikova, Elena Dorosheva, Ivan Iakovlev

10.15 – 10.30
Myrmecofauna on trees in Mediterranean Maquis
Jean-Jacques Itzhak Martinez, Moshe Inbar

10.30 – 10.45
Possible complex relationships between red wood ants and small rodents
Sofia Panteleeva, Olga Vygonyailova

S74: Diptera taxonomy I.

Room Brussels

Organizers: *Milan Chvála, László Papp*

09.30 – 09.45
The potential of wing-shape data to resolve morphologically cryptic species within the *Bactrocera dorsalis* fruit fly species-complex (Diptera: Tephritidae)
M.K. Schutze

09.45 – 10.00
Taxonomic approach to the *Dinera carinifrons* species-group (Tachinidae) using different identification methods
Erikas Lutovinovas, Jaromír Vaňhara, Andrea Tóthová, Joachim Ziegler

10.00 – 10.15
Cloning and bioinformatic characterization of a 18S ribosomal RNA gene from *Tabanus bromius* (Diptera: Tabanidae)
Beste Yeşilli, Cem Öziç, A. Yavuz Kılıç

10.15 – 10.30
Ulidiidae (Diptera) of Russia
Tatiana Galinskaya

10.30 – 10.45
Oriental Teratomyzidae (Diptera)
László Papp

10.45 – 11.00
Taxonomic problems in the genus *Phalacrotophora* (Diptera: Phoridae)
Gábor Dániel Lengyel

11.00 – 11.15
Floral host plant range of syrphid flies (Syrphidae: Diptera) under natural conditions in Southern Punjab, Pakistan
Shafqat Saeed, Asif Sajjad

11.00 – 11.30 Coffee break

S77: Soil entomology – an ecosystem perspective II.

Room Maastricht

Organizers: *Scott Johnson, Gábor Bakonyi*

11.30 – 11.45
Click beetle dispersal in agricultural land: A study using molecular markers
Carly Benefer, Rod P. Blackshaw, Mairi Knight, Jon Ellis

11.45 – 12.00
Comparison of soil weevils' faunas (Coleoptera: Curculionoidea) in Serbia
Snežana Pešić, Svetlana Avramović

12.00 – 12.15
Collembola population of pine forests in a gradient of industrial pollution
Anastasia Taskaeva

12.15 – 12.45
Frog-biting midges – A return to biosystematics
Art Borkent
Winner of the J.O. WESTWOOD MEDAL FOR EXCELLENCE IN INSECT TAXONOMY

S78: Social insects and apiculture II.

Room Rome

Organizers: *Bálint Markó, László Gallé*

11.30 – 11.45
The specialization in groups of ants tending aphid colonies
Tatiana Novgorodova

11.45 – 12.00
The protection of aphids from aphidophagous by different ants
Tatiana Novgorodova, Anton Gavrilyuk

12.00 – 12.15
How ants of the genus *Formica s.str.* influence on spatial distribution of carabid beetles and spiders
Elena Dorosheva

12.15 – 12.30
Control of wax moth, *Galleria mellonella* L. (Lep.: Pyralidae) with male sterile technique
Reza Jafari

Closing session & farewell coctail

Room Copenhagen

List of abstracts

Sunday, 22 August

Opening ceremony and plenary lecture 1

Room Copenhagen

Welcome addresses
In(sect)spiration

Marcel Dicke
Laboratory of Entomology, Wageningen University, PO Box 8031, 6700 EH Wageningen, The Netherlands, www.insect-wur.nl

Insects dominate the world, not only life in nature but they have invaded our culture as well. They contribute to many aspects of our daily lives, including our economy, our food, our medical care etc. Moreover, insects have inspired artists throughout the centuries. From the 13th century until present, artists have depicted insects in two-dimensional and three-dimensional works. Insects have often been used as symbols for the brevity of life, for the transcendence of the soul, but also because of the beauty of their forms and colours. Some artists paint or sculpt with insects themselves, either dead or still alive.

Over the past years I have visited more than 200 art museums and recorded the representation of insects in the works on display. As a result I have gained an entomological view of the history of art. This has provided insight both in the history of art itself as well as in the role of insects in its development.

At present I have seen ca 4,000 works of art in which insects are represented. Some artists have depicted only a single insect while others have represented over 100 insects in a single work of art. Of some artists I know only a single work with insects, while of others more than 100 works are known. In this presentation I will emphasize the role of insects in our culture with an emphasis on their appearance in the visual arts.

Monday, 23 August

Plenary lecture 2

Room Copenhagen

Orchard entomology: from the field to the behavioural and molecular level

Silvia Dorn
ETH Zurich, Applied Entomology, 8092 Zurich, Switzerland

Hungarian studies document that fruit orchards belong to the agricultural systems with the highest richness in insect species. Some of these insects are highly adapted to their specific host habitat or even microhabitat, as will be discussed for two key herbivore fruit moth species, the codling moth *Cydia pomonella* and the oriental fruit moth *Grapholita molesta* and their common parasitoid *Hyssopus pallidus*. Host plants of the codling moth that are phenologically or phylogenetically distant shape the herbivore's population structure. Microhabitat selection and progeny performance at elevated temperatures differ markedly between the codling moth and the oriental fruit moth, a species confined to more southern regions in Europe. Considering tritrophic interactions, the mentioned larval ecto-parasitoid of these herbivores shows a host niche selection behaviour that most likely co-evolved with the codling moth on apple. Apple odours are learned by the parasitoid during its early development, and this unusual preimaginal olfactory learning strongly improves parasitoid searching behaviour in the adult stage. Adult parasitoids utilize fruit components from the feeding galleries of the caterpillar as a nutrient source to increase longevity and fertility. These intriguing biotic and abiotic relationships indicate mechanisms underlying these insects' success. Ecological consequences and implications for integrated pest management will be discussed.

S1: Biorational control of arthropod pests: mechanism and application I.

Room Copenhagen

Biorational control of arthropod pests: an overview

A. Rami Horowitz[1], P. Ellsworth[2], Isaac Ishaaya[1]
[1] Department of Entomology, Agricultural Research Organization, Israel, Email: hrami@volcani.agri.gov.il; vpisha@volcani.agri.gov.il
[2] Department of Entomology, University of Arizona, USA,

Since the 1950's, pest control has been mostly based on broad-spectrum conventional-insecticides. However, the severe adverse effects of pesticides on the environment, problems of resistance reaching crisis proportions and public protests led to strict regulations and legislation aimed at reducing their use. Here, we are briefly summarizing various new environmentally friendly approaches for pest management. One such approach is based on disrupting the activity of specific biochemical sites such as neuropeptides, ecdysone and juvenile hormones and others acting on specific insect receptors. Another approach is the potential use of natural products obtained from tropical plants for pest control. Some new ideas for utilization of semiochemicals and of insect signaling are described too. Novel biotechnology control strategies ("the genetic approach") exploit genetically modified- plants, -insects, and -symbionts in the combat against insect pests and disease-borne vectors are discussed.

Neuropeptide agonists and/or antagonists as potential components for controlling insect pests

Ronald J. Nachman[1], David Denlinger, Geoffrey M. Coast, Guy Smagghe
[1] Areawide Pest Management Research Unit, Southern Plains Agricultural Research Center, U.S. Department of Agriculture, 2881 F/B Rd., College Station, TX 77845 USA

Insect neuropeptides regulate critical processes and behaviors in insects, though they are unsuitable as pest management agents due to unsuitable biostability and/or bioavailability characteristics. Peptidomimetic analogs can overcome these limitations and either over-activate or block critical neuropeptide-regulated functions. Stereochemical aspects critical for the successful interaction of three classes of insect neuropeptides were exploited to design/discover mimetic analogs with enhanced biostability and selectivity. Based on a structure-activity profile, biostable agonists of a diuretic, insect kinin expressed receptor were developed that match or exceed the potency of native peptides. While an unmodified insect kinin is inactive, these biostable agonists demonstrate potent induction of high mortality when fed to pea aphids in a sugar water solution. The mechanism is as yet unknown, but the activity may result from disruption of insect kinin-regulated systems. Biostable analogs of the diuretic insectatachykinin class also show aphicidal activity. The analogs provide important leads for alternative aphicides. Diapause hormone has been shown to terminate

pupal diapause of heliothine species. Several potent analogs have provided clues as to the active conformation and other critical structural requirements for interaction with the putative diapause-termination receptor. One potent analog can prevent the onset of pupal diapause when injected into the larval stage of a heliothine insect. The observed activity is dependent on the presence of a DH core sequence. This mimetic agonist analog provides a lead for the generation of an agent capable of disrupting diapause in economically important lepidopteran pests.

Insect signals as potential targets for controlling insect pests

Andrej Čokl[1], Jocelyn G. Millar[2]
[1] *Department of Entomology, National Institute of Biology, Vecna pot 111, SI-1000 Ljubljana, Slovenia*
[2]*Department of Entomology, University of California, Riverside, CA 92521, USA*

Communication plays a vital role in insect life. Signals that convey information about species, sex, location, and physiological state are transmitted through different media. The physical and chemical properties of signals are adapted to the transmission characteristics of the media to provide efficient and accurate information exchange. Insects use the largest variety of signals during mating behaviour, where signals are used for mate location, recognition, and other functions. Information is exchanged by chemical, acoustic, and visual signals transmitted through air, and vibrational signals transmitted through substrates. Volatile molecules are used for long distance communication whereas low-volatility signals convey information over shorter distances. Pheromones are widely used to detect and sample insect populations, or for control by mating disruption, mass trapping, or attract and kill methods. Mechanical signaling through different media also has been described in most insect groups. Such communication may be the most ancient signaling mode among insects, and recently developed technology has enabled intensive investigation of these signals under natural conditions. However, practical applications of vibrational communication have not yet been developed for insect management. We will discuss substrate-borne communication in the economically important insect family Pentatomidae together with ideas about potential methods of controlling insect pests by attraction of parasitoids and predators, interruption of communication, or by combined chemical and vibratory signals.

Genetically modified insect as a tool for biorational control

Thomas Miller
Department of Entomology, University of California, Riverside, CA 92521, USA.

Use of transgenic insects was thought to be an ideal way to improve the Sterile Insect Technique either by modifying or replacing sterilization by radiation with conditional lethal genes, genetic sexing strains producing all males, genes that confer vector incompetence or by using fail-safe genetic markers that could unequivocally distinguish released insects from wild types. The latter would eliminate the need for imposing expensive quarantine restrictions that sometimes interfere with commerce. Non-PCR methods of identification incur a 6% - 17% error rate in the pink bollworm project. The main SIT projects around the world are each in various stages of development. Progress will be summarized. Regulatory delay is caused mostly by reluctance on the part of scientists, not public perceptions of the technology.

UV-absorbing insect exclusion screens (IES): An important tool for biorational control of sweet pepper pests

Saioa Legarrea, Alberto Fereres, Phyllis G. Weintraub
Agricultural Research Organization, Gilat Research Center, Israel

The integration of different tactics in pest control is essential to gain sustainable agricultural practices and a biorational use of pesticides. Photoselective covers in protected crops are known to modulate plant physiology and influence pest infestation rates.

In this work, UV- and non-UV-absorbing IES were used to cover sweet peppers; pest dynamics, plant physiology and yield were evaluated. Half of the plots were managed using biological control to test the ability of joining both techniques in a successful management program. Among the harmful organisms monitored, *Scirtothrips dorsalis, Polyphagotarsonemus latus, Frankliniella occidentalis* and *Bemisia tabaci* were found. The number of *B. tabaci* entering the protected structure was 10 times lower in the UV absorbing screens. Furthermore, due to physical exclusion properties of all nets, densities never reached the pesticide action threshold. UV-absorbing screens combined with biological control was the best strategy to reduce infestation by *S. dorsalis* and *P. latus* in the young tissues of the plants, causing damage in less than 40% of the plants. Alternatively, pest infestation in the control nets resulted 100% apical plant damage by the end of the experiment, causing a reduction in plant height, dry matter production and yield. The opposite was observed for *F. occidentalis* that reached higher population in the UV-absorbing screens and was over the action threshold in all plots once flowers were produced.

In this experiment, the combination of both strategies studied, UV-absorbing screens and biological control resulted in a better crop development, reducing the need for chemical control of some important pests.

S2: Forest entomology I.

Room Brussels

Sweden – gales – *Ips typographus* – monitoring - management

Åke Lindelöw
Department of Ecology, Swedish University of Agricultural Sciences (SLU), P.O. Box 7044, SE-75007 Uppsala, Sweden; e-mail: ake.lindelow@ekol.slu.se

In 1995 monitoring of *Ips typographus* (L.) (Coleoptera, Scolytinae) started in Sweden using pheromone traps and survey of killed trees to assess the relative level of the beetle pressure on the spruce forests. Monitoring data have been used in forest practice to decide whether or not actions are to be taken to prevent reproduction and tree killing. During the outbreak 2006-2009 following the storm in January 2005 monitoring of *I. typographus* have been performed to follow the flight activity in detail from week to week as well as between year changes. Data from the monitoring is also used in research e.g. to study the dynamic of related predators as *Thanasimus formicarius* (L.) and *T. femoralis* (Zett). In this presentation I will describe the monitoring system and discuss how data can be used in practice and research related to climate change, population dynamic and landscape ecology.

The outbreak of *Ips typographus* in Sweden 2005 -2009 – what is the role of weather and host resistance?

Bo Långström
Department of Ecology, The Swedish University of Agricultural Sciences (SLU), P.O. Box 7044, SE-75007 Uppsala, Sweden; e-mail: bo.langstrom@ekol.slu.se

A huge storm-felling of spruce in January 2005 triggered an outbreak of the spruce barkbeetle *Ips typograhus* (Col., Scolytinae) in southern Sweden. Since spring 2005, beetle populations, host resistance, tree mortality and control options have been studied on different scales. In cooperation with the Swedish Forest Agency, beetle flight and tree mortality have been monitored in southern Sweden.

So far ca 3.2 million m^3 of spruce forest have been killed in 2006- 2009. The outbreak peaked in 2006 when half of the above volume was killed mainly in late season by the second beetle generation due to an exceptionally warm and dry late summer. In 2007, heavy rains in July prevented beetle attacks in late season and probably restored host resistance, resulting in "only" 0.8 million m^3 tree mortality. In 2008 and 2009, the outbreak declined further and is expected the end in 2010.

On-going studies indicate that host resistance properties may play a major role in outbreak dynamics. A large proportion of the flying population seems to fail to colonize trees and a joint Swedish-Norwegian study has shown that failed attacks trigger increased host defence reactions that make trees more resistant to beetle attacks in the following year.

Spreading the risk of winter mortality in *Ips typographus* L. (Coleoptera, Scolytinae)

Kai Dworschak, Daniel Meyer, Axel Gruppe, Reinhard Schopf
Animal Ecology, Department of Ecology & Ecosystem Management, Technische Universität München, Hans-Carl-von-Carlowitz-Platz 2, 85354 Freising, Germany

Hibernation is a critical stage in the life-cycle of insects. Winter mortality can reduce populations severely and thus may have an important impact on population dynamics. Regarding *Ips typographus*, an economically important pest species, two locations for overwintering are discussed: the host tree or the soil litter.

In the National Park Bavarian Forest (Germany) we observed that up to 40% of the beetles from the first generation remained in their host trees for hibernation early in a season, even though they would have been expected to emerge. Furthermore, data from stem emergence traps indicated that beetles from the second generation did not leave their host trees in autumn. In spring, experiments with soil emergence traps showed that significantly more beetles overwintered in the soil litter at the base of infested but highly excorticated trees than at the base of less excorticated ones. Moreover, the number of beetles on the ground correlated significantly with the amount of bark fallen off. When we removed the bark from the ground before spring dispersal a significantly lower number of beetles emerged from that area than from controls where the bark was left. This implicates that a considerable amount of beetles reaches the ground passively. Nonetheless, a varying proportion of the population is hibernating in the host trees, and the proportion of soil hibernating beetles depends on the degree of decortication.

We conclude that the observed partial induction of hibernation early in a season and the splitting of hibernation locations result in spreading the risk of winter mortality in the studied beetle populations.

Spreading of bark beetle infestations in the National Park Bavarian Forest

Markus Kautz, Axel Gruppe, Reinhard Schopf
Chair of Animal Ecology, Technische Universität München, Hans-Carl-von-Carlowitz-Platz 2, D-85354 Freising

The European spruce bark beetle *Ips typographus* is the most important pest infesting Norway spruce in Central Europe and Scandinavia. This species spends the longest period of its life cycle inside the bark of the host tree where it develops as juvenile and undergoes a maturation feeding as adult. Only for a few days the mature beetle appears outside the tree when it forages for a new host. Dispersal, aggregation and colonization of new hosts cover a short time period but they are a very crucial point in the survival strategy of *I. typographus*.

Infestations were documented by aerial surveyed time series for the unmanaged core zone of National Park Bavarian Forest. Based on a data set covering the years 2000 to 2009, we identified about 13.000 infestation spots in space-time relations. Moreover we estimated the area of those spruce trees which remained alive as potential host trees, decreasing from 7.100 to 4.800 ha in the investigated time period.

In order to evaluate the spreading of infestations we applied the nearest distance method. Infestation spots occurring in the year X are understood as source populations to cause further attack after dispersal of the beetles. These spots were encircled by concentric bands of increasing distance and new infestations appearing in the year X+1 were assigned to the nearest source population of the year X. Results show that about 70% of new attacks occurred within a distance of 100m and more than 94% within 500m. Therefore we conclude that sanitary buffers of about 500m surrounding the core zone of the National Park are sufficient to protect adjacent forests against outside spreading infestation.

Influence of seasonal changes in brood tree quality on the pubescence and the breeding success of the bark beetle *Ips typographus* (Col., Scolytinae) originating from different climatic regions

Nina Dobart, Martina Olifiers, Axel Schopf
Institute of Forest Entomology, Forest Pathology and Forest Protection, University Natural Resources and Applied Life Science, Vienna

Differences in the nutrition quality of host trees influence the emergence rate and the development of the offspring of *Ips typographus*. To analyse the influence of those changes, beetles from three different regions (a mostly multivoltine population from lowland, a multi- and univoltine population from a montane-subalpine region from Austria and a univoltine population from Northern Sweden) were used in the experiment.

Beetles from the same generation were reared synchronously on host trees cut in spring and autumn. Freshly cut logs from spring were used and deep frozen logs cut in autumn of the last year or vice versa, on freshly cut logs from autumn with deep frozen logs cut in spring of the same year. The experiments were done under long- and short-day conditions at 20°C.

The emerged beetles and the beetles which stayed under the bark until the termination of the experiment were analysed according to their emergence behaviour, their gonadal development and their breeding willingness.

The results are discussed in context to the origin of the beetles and the nutrient content (carbohydrates, starch, nitrogen and total lipid content) of the various breeding material.

S3: Aquatic insects I.

Room Rome

Microhabitat preferences of stream macroinvertebrates

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In 2008 aquatic macroinvertebrate samples were taken from 30 sampling sites of 26 streams (1) around Lake-Balaton, (2) in the river-system of Zala and (3) streams of Mecsek Mountains. 20 subsamples were taken at each sampling sites and the 20 types of the microhabitats were determined by using AQEM protocol which supports microhabitat samplings. In this particular survey we tried to prove our supposition that different microhabitats could be characterized by different aquatic invertebrate communities and, besides, all the microhabitats have their own few character-species. Moreover, we compared the results of the streams of hilly (Balaton, Zala) and mountainous (Mecsek mts.) areas. Using the IndVal procedure we revealed for example that adults of *Elmis maugetii* significantly choose habitats with mesolithal substrate, *Athripsodes aterrimus* chooses habitats with high amount of organic mud. We also showed that some of the investigated species do not hang on particular microhabitats; they appear at almost all types of habitats. For example *Gammarus roeseli*, *Gammarus fossarum* and *Baetis nexus* could be found at numerous different types of microhabitats with relatively high density. Besides, we embodied the similar microhabitats (e.g. all the lithic ones) and found chararacter-species, too. We also showed significant differences and similarities in species richness and quantitative patterns between microhabitat types by using Non-metric Multidimensional Scaling.

Comparison of explanation power of environmental variables for Ephemeroptera, Plecoptera and Trichoptera larvae communities in a karst river system

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Ephemeroptera, Plecoptera and Trichoptera (EPT) larvae are widely used in water quality assessment, but still not enough is known about their ecological characteristics. The aim of our study was to explore the relationship between different EPT larvae community structures (E, P, T, EP, ET, PT and EPT), and selected environmental variables. Larvae were monthly sampled in lowland karst rivers in Slovenia from January to December 2005 using multi-habitat sampling approach. Environmental variables were measured simultaneously. Altogether, 49 assemblages and 108 EPT taxa, i.e. 26 Ephemeroptera taxa, 17 Plecoptera taxa and 65 Trichoptera taxa, were collected. Canonical correspondence analysis (CCA) was performed to define and compare explanation power of environmental variables for investigated communities. Environmental variables explained similar percentage of the total variability of the community composition for different community structures ranging from 36.0% (T) to 38.2% (EP). Number of variables with high relative importance (>0.8) varied between communities. One variable (conductivity) with high explanatory power was observed for E, ET and EPT communities, two (conductivity and water depth) for EP and PT communities, whereas three variables for P and T communities with water depth as only common highly important variable. Forward selection procedure revealed that four variables (five for P community) always significantly ($p<0.05$) explained community structures. Some selected environmental variables showed importance independent of the community, but level of the explanation power was community depended.

Aquatic Coleoptera and Heteroptera assemblages and diversity in relation to habitat type and flood dynamic structure

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The abundance and taxonomic composition of the aquatic insect fauna were investigated, with the focus on adult water bugs, water beetles and water scavenger beetles (Heteroptera: Nepomorpha, Gerromorpha and Coleoptera: Hydradephaga, Hydrophilidae), in two different freshwater habitats — (1) periodically flooded area of the Special Zoological Reserve and (2) melioration canals of the wider area of the Nature Park Kopački rit during 2005. Aquatic insects are generally abundant in various waters, including floodplains which are exposed to fluctuations of water level. Our aims were (1) to characterize the assemblage of aquatic insects in relation to habitat type and flood dynamics and (2) to evaluate the diversity of aquatic insects with detecting character species in two different freshwater habitats. There was a difference in species abundance and diversity between canals and flooded area. Rényi diversity profiles showed that the diversity of two habitat types vary depending on months, but NMDS and INDVAL analyses clearly shows that there are remarkable differences in species pool and their abundance. There were 11 species associated with the canals and 21 species associated with the flooded area. Also, 2 species bounded significantly to the canals and 9 to the flooded area. The collection of two endangered species (*Graphoderus bilineatus* and *Berosus geminus)* in the flooded area, illustrates the value of the Kopački rit floodplain.

The relationships among Trichoptera species assemblages, biological traits and ecological requirements: a focus on lowland freshwater habitats in Flanders

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Trichoptera are the second most diverse group of aquatic insects. Their larvae occupy a wide variety of freshwater habitats and exert numerous ecological functions. Furthermore the order displays a high variability in ecological profiles, hence their importance in macroinvertebrate based biomonitoring systems, including the multimetric macroinvertebrate index (MMIF) which is currently being used in Flanders. Apart from family-level data for the purpose of water quality monitoring, however, little information exists on the occurrence of caddis flies in Flanders, while studies on the ecological requirements of the individual species are completely lacking. The aim of our research therefore, was to register the distribution of the Flemish Trichoptera and to investigate the influence of environmental variables, both on a local in-stream as well as on a regional scale.

Throughout Flanders 103 sampling sites were selected including brooks, rivers, canals as well as standing waters and on each occasion a wide range of environmental variables was recorded. Using PCA, plausible causes for the absence of larvae at certain locations were formulated, thereby recognizing the importance of anthropogenic influences. A TWINSPAN analysis divided the sampling sites containing larvae according to their species composition, thus defining the Trichoptera communities and their corresponding

indicator species. These species assemblages were linked to environmental gradients using a CCA, assessing the importance of the different geographical scales. Finally, the relationships between on the one hand biological traits, e.g. feeding strategies, and on the other hand habitat type and environmental gradients were characterized.

Structural changes of macrozoobenthos in acidified streams in the Bohemian Forest (Czech Republic)

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Outflows from two atmospherically acidified lakes in the Bohemian Forest were studied in 2005 and 2007. While Čertovo Lake is strongly acidified (~pH 4.6), Laka Lake is recovering (~pH 5.2). Water chemistry and macrozoobenthos composition were analyzed along longitudinal gradients of the both outflows to determine the present status of the streams. Either stream chemistry reflected the particular lake chemistry. A certain progress in stream chemistry to more neutral conditions was observed along the longitudinal gradients of both streams (induced by circum-neutral tributaries). A remarkable recovery of macrozoobenthos was evident only in the Laka outflow, mainly by increasing Ephemeroptera and Trichoptera taxonomy richness both along the longitudinal gradient and between the years. In contrast, no considerable changes were observed in the macrozoobenthos composition in the Čertovo outflow, because its chemistry was harmful for acidosensitive taxons, such as Ephemeroptera or Trichoptera, whereas Plecoptera, Chironomidae, and Oligochaeta were the most abundant organisms in this stream. Biological recovery of both streams will depend on further chemical improvement in their catchments as well as on dispersal capability of benthic species.

S4: Insect behaviour (incl. Insect acoustics) I.

Room Maastricht

Resolving an evolutionary paradox? Fertility of diploid males in a parasitoid with complementary sex determination

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In hymenopterans with single-locus complementary sex determination (sl-CSD), gender is determined by multiple alleles at a single locus. Haploids are always male, while diploids are female when heterozygous and male when homozygous at the sex locus. Diploid males are typically either inviable or effectively sterile. The production of diploid males thus imposes a genetic load on populations, especially when inbreeding prevails and matings between partners sharing an allele at the sex locus are common. We show that the parasitoid wasp *Cotesia glomerata* is one of only two known species with sl-CSD and sexually competent diploid males siring fertile diploid daughters. Microsatellite genotyping of females revealed that one in two matings involved siblings in a natural population. Moreover, replicated experimental populations initiated with different effective size were similarly prone to extinction, regardless of the extent to which they were burdened by the production of diploid males. Hence, we argue that fertility of diploid males is an adaptation fuelled by systematic inbreeding that contributes to the welfare and persistence of small isolated populations of species with sl-CSD.

Inbreeding avoidance in a parasitoid wasp: Choose the mate or the spot?

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As in many other hymenopteran species, sex in the parasitoid *Cotesia glomerata* L. (Braconidae) is determined by one single locus with multiple alleles, a mechanism termed single locus complementary sex determination (sl-CSD). Under sl-CSD, haploid individuals are always males and diploid individuals are females if heterozygous at the sex determination, but males if homozygous. In species with sl-CSD, inbreeding leads to an increased production of diploid males. Diploid males cause an undesirable sex ratio distortion and can be of inferior fitness, thus jeopardizing population persistence. Therefore, species with sl-CSD are expected to have evolved behavioral and/or genetic mechanisms minimizing the deleterious consequences of diploid male production.

We investigated two potential behavioral strategies of inbreeding avoidance in this parasitoid, kin discrimination in female mate choice and natal dispersal. Females did not prefer to mate with unrelated males, but a fraction of wasps departed the natal patch prior to mating, independent of any extrinsic trigger or of intrasexual competition. Our results indicate that kin discrimination is not a relevant inbreeding avoidance strategy, but that natal dispersal might indeed contribute to reducing the incidence of inbreeding in *C. glomerata*.

The role of experience and altered host cues in rejection by the parasitoid *Bracon hylobii* of nematode-infected pine weevil larvae

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Parasitoids frequently fail to discriminate between healthy hosts and those infected with pathogens. We investigated the responses of *Bracon hylobii* to larvae of the pine weevil (*Hylobius abietis)* infected with entomopathogenic nematodes (*Heterorhabditis* spp and *Steinernema* spp.). These nematodes typically kill their hosts within days of infection. Once the weevils were dead, none was accepted for oviposition, although searching and probing behaviour by some parasitoids was observed. Hosts that were infected but not yet dead were accepted for oviposition by a proportion of *B. hylobii*, and a normal-sized clutch was laid on them. Learning affected the rejection of infected hosts: naïve *B. hylobii* were more likely than experienced ones (parasitoids that have had one successful oviposition on a live host) to reject an infected host. We further investigated whether *B. hylobii* identify infected hosts and reject them, or whether they are less successful in locating the host due to a change in host cues resulting from infection. Pine weevil larvae live under the bark of dead trees, where they feed, and so vibrational stimuli may be important in host location. Nematode-infected insects typically display reduced activity and feeding rate before dying. Entomopathogenic nematodes vector bacteria which begin to proliferate in the host within hours of infection. Therefore, *B. hylobii* might reject a nematode-infected insect due to its altered chemistry or its reduced movement, or both; the potential relevence of these factors in the rejection of infected hosts (and the detection of healthy hosts located under bark) by naïve and experienced wasps will be discussed.

Generalists and specialists in cuckoo bees: Is there just one evolutionary way?

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Cuckoo behavior is a common life strategy at least in birds and bees. Cuckoos lay their eggs to the nests of their hosts. Then the host brood is damaged and the whole investment of host parents goes to the development of the parasite. In our study, we test the hypothesis about two-way evolution of two basic cuckoo strategies. Cuckoos can attack more than one host species of one or more genera – generalist, or they can be specialized to just one host species or closely related group of species – specialist. The common sense says that specialization is an advanced strategy, but is it really right? Thus we ask: Does the phylogenetic analysis of cuckoo bees support this statement? We analysed partial sequences of three genes of cuckoo bees of the genus *Sphecodes* (Apoidea: Halictidae). It is the first study showing the evolution of *Sphecodes* with their host specialization in detail and bringing new questions to the evolution of cuckoo behavior in bees. The results indicate that the evolution does not go by the simplest way and the explanation is more difficult than we thought. As we use the most parsimonious interpretation, we can say that the evolution is bi-directional. Specialists can evolve from generalists and vice versa. However, this view of bi-directional evolution is questionable. We have found alternative interpretations, which are more likely. Specialists can be relics of individually specialized generalist species. We can find them at the base of most lineages.

On the life of solitary bees: nesting behaviour of *Andrena vaga* (Panzer) (Apoidea: Andrenidae)

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We present our study on nesting behaviour of gregarious solitary bee species *Andrena vaga* (Panzer). The knowledge of behaviour in solitary bees can be very important, because solitarity must have represented the initial point in the evolution of eusociality and obligate cleptoparasitism. One population of the studied species with individually marked females was observed continuously for two nesting seasons (April – May) and we described basic demographic characteristics of studied species (e.g. lenght of bee season, longevity, density of population, etc.) as well as nesting behaviour. We constructed detailed ethogram describing all the observed behavioural patterns; we measured the duration of each activity and determined their sequence in provisioning cycle. Our observation confirmed the existence of distinctive pollen and nectar days in provisioning activity of *A. vaga* and we showed that the behaviour differed markedly between nectar and pollen days. Bees performed mostly one provisioning trip and carry no pollen during the nectar day, while bees during the pollen day performed as much as four provisioning trips per day, but usually one or two. Duration of one pollen trip depended on their number and sequence per a day, the shortest usually being the latest in the day. We also proved the existence of intraspecific cleptoparasitism in form of nest usurpations during our field observation, but we found no indication for existence of intraspecific brood parasitism in *A. vaga*.

S5: Chrysomelidae I.

Room Strasbourg

Cytogenetics, cytotaxonomy and chromosomal evolution of chrysomelinae revisited (Coleoptera, Chrysomelidae)

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Nearly 250 species and subspecies of the Chrysomelinae subfamily have been chromosomally analyzed, that is about 12.5% of the whole described species. Their range of diploid numbers is very wide from 2n = 12 to 2n = 50 chromosomes, and among them some genera, such as *Timarcha, Chrysolina, Cyrtonus, Oreina, Gonioctena Chrysomela, Calligrapha* and *Leptinotarsa,* are especially surveyed. The most frequent number is n = 12 (34.2%), followed by n = 10 and n = 17 (9.6% both), and n = 20 (7.6%), which means that there is not a striking modal value, contrary to what found in two other leaf beetle subfamilies like Eumolpinae and Cassidinae, and in some other coleopteran families, namely Tenebrionidae, Scarabaeidae, Buprestidae and Cerambycidae. Several types of sex-chromosomes are found in Chrysomelinae but the parachute-like system (Xy_p or XY_p) is clearly prevalent (78.7%), although the XO is well represented too (9.2%), and conversely, the chiasmatic types neoXY and XY, are very seldom (2.1%). The polyploid parthenotes in Chrysomelinae are exceptions since they have been only reported in a few species of the nearctic *Calligrapha.* When we analyze the chromosome numbers within different well-sampled tribes and subtribes of Chrysomelinae, they show particular modal values, for instance Timarchini has n = 10 (53.6%), Chrysolinina n = 12 (40.2%) as well as Paropsina (96.2%), Doyphorina n = 18 (57.7%), and Chrysomelina n = 17 (65.7%), which may have some taxonomic significance. Among the distinct classes of structural chromosome rearrangements, it seems that centric fissions and pericentric inversions have played the main role in the chromosomal evolution of chrysomelines, but this is not necessarily true for all genera and higher taxa. The karyotype architecture obtained from almost a 30% of the checked species, shows symmetric sets of mostly sub/metacentric often with a few acrocentric chromosomes of similar sizes in species with high chromosome numbers, whereas more or less asymmetric sets of diverse chromosome sizes are found in those with low numbers (n < 15). The shifts in genome size are also remarkable in almost 30 species of examined chrysomelines, from 1C = 0.3 to 3.7 pg, also with significant differences among congeneric species, a fact which precludes assuming any consistent phylogenetic trend. And the same could be said for the few data obtained on species-specific satellite DNA sequences. Finally, the NOR site location may supply clues for chromosome evolution.

The natural history and evolution of subsociality and defensive fecal constructions in leaf beetles (Coleoptera: Chrysomelidae)

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Many factors must have stimulated the enormous radiation of leaf beetle species (Chrysomelidae; 40,000 species). Host plant association has been promoted as the most important factor driving this diversification. I focus on two behavioral patterns, subsociality and defensive constructions, that may be additional evolutionary drivers for particular chrysomelid clades. Parental investment in offspring may involve host selection, egg-clustering, ovoviviparity, viviparity and larviposition, defensive constructions, and even subsociality (guarding by single females) in Cassidinae and Chrysomelinae. Defensive structures of larvae, and of eggs

and pupae in some cases, comprise feces primarily and sometimes trichomes or plant debris. Special morphological structures are associated with the building, retention and maintenance of these constructions in Cassidinae, Chrysomelinae, Criocerinae, Cryptocephalinae, Galerucinae, and Lamprosomatinae. Current phylogenetic hypotheses are used to compare these interesting behaviors and explore their evolutionary beginnings.

Reflexions on cycloalexy among Chrysomelidae (Coleoptera)

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Cycloalexy is a form of gregariousness. Individuals, in a group, show special behaviour and reactions, which may be called group effect and group reactions (Grassé 1952). It may be seen in the larval stage, or in the adult stage. The name comes from the Greek: kuklos = circle and alexo (=I protect). Gregariousness in the larval stage may or may not show features of cycloalexy. Cycloalexy is an attitude adopted at rest, by some insect larvae, both diurnal and nocturnal, in which they get arranged in a tight circle, with either the heads or ends of the abdomens juxtaposed at the periphery, and with the remaining larvae at the centre of the circle. Coordinated movements, such as the adoption of threatening attitudes, regurgitation of toxic chemicals, and biting movements are used to repel predators or parasitoids. The concept of cycloalexy was created by Vasconcellos-Neto & Jolivet (1988), reviewed in 1990 (Jolivet et al. 1990) and despite many papers published on this gregarious behaviour, it took time for the concept to be "officially" accepted. Before coining the word cycloalexy, one of us (P. J.) used to name this phenomenon: "the ring defence behaviour". Cycloalexy is seen among larvae of Coleoptera, Diptera, Hemiptera, Homoptera, Neuroptera, Hymenoptera, and more or less in compactness among some Lepidoptera caterpillars. It is known to be sporadically distributed among insects. It also exists among mammals and some other Vertebrates. Here we concentrate on the Coleoptera Chrysomelidae in which family only species of few subfamilies (Criocerinae, Chrysomelinae, Galerucinae, and Cassidinae) show that kind of coordinated defence. Gregarism exists elsewhere, with Aulacoscelinae adults, for instance, on *Zamia* leaves, in America, but without any real sign of cycloalexy.

A Converse Bergmann Cline in an Australian eucalypt pest: *Paropsis atomaria* Olivier (Coleoptera: Chrysomelidae)

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Eucalyptus is a diverse genus of trees almost entirely endemic to Australia. Eucalypts are, in turn, attacked by a large number of Australian insects. The leaf beetle subfamily Paropsinae contains a number of endemic Australian species that have become serious pests of eucalypt forestry. One major pest species is Paropsis atomaria, a species occurring across a wide geographical range along the east coast of the Australian continent.

As part of a wider study into intra-specific variation for this species, and more specifically to assess whether body size (measured by pronotum width) correlated with latitude, both fresh and museum specimens were collected from locations across an approximate 2000km latitudinal distribution (35º19'S to 24º29'S). Additionally, individuals from the two extreme populations were reared under a range of constant temperature conditions to determine the effect of temperature during development on adult body size, and whether this environmental variable could account for the latitudinal cline.

Results demonstrated that a converse Bergmann cline exists for P. atomaria (i.e. progressively smaller at higher latitudes) and that P. atomaria follows the temperature-size-rule commonly observed for ectotherm species (i.e. smaller adults result from higher temperatures during development).

We propose that the converse Bergmann cline observed for P. atomaria is not directly related to temperature, but likely the product of local adaptation to season length.

S6: Biorational control of arthropod pests: mechanism and application II.

Room Copenhagen

Insecticides with novel modes of action: Mechanism, selectivity and importance in pest management

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Efforts have been made during the past three decades to develop insecticides with selective properties that act specifically on biochemical sites present in a particular insect group, but whose properties differ from those present in mammalian system. This approach has led to the discovery of compounds that affect the hormonal regulative of molting and developmental processes in insects such as the ecdysone agonists, juvenile hormone mimics and chitin synthesis inhibitors.

The search for potent acylureas has led to the development of novaluron (Rimon) developed by Makhteshim Chemical Works. The LC_{50} value of novaluron on 3rd instar *Spodoptera littoralis* fed on treated leaves is approximately 0.1 mg a.i./liter. This value resembles that of chlorfluazuron and is tenfold lower than that of teflubenzuron. Novaluron affects nymphs of *Bemisia tabaci* to a much greater extent than does chlorfluazuron and teflubenzuron. Artificial rain, at a rate of 40 mm/h, applied 5 and 24h after treatment in a cotton field had no appreciable effect on the potency of novaluron on *S. littoralis* larvae or *B. tabaci* nymphs. Hence, novaluron can be used in tropical areas and in rainy seasons. In general, benzoylphenyl ureas had no direct effect on parasitoids and phytoseiids and are considered to have a mild effect on other natural enemies. Novaluron has no cross-resistance with conventional insecticides, the juvenile hormone mimic pyriproxyfen and neonicotinoids; as such, it is considered an important addition in pest management programs.

Ecdysone and JH agonists and antagonists: Important agents for insect pests control

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Insect metamorphosis is regulated by several hormones including juvenile hormone (JH) and 20-hydroxyecdysone (20E). Both ecdysone and JH analogs are widely used to control insect pests. The biological actions of 20E, 20E analogs. .JH and JHA are well studied, but the molecular mode of action of JH and JHA is not well understood. However, there has been a great progress in our understanding of mode of action of JH and JHA based on the data reported during past few years. Molecular mode of action of methoprene on midgut remodeling was investigated by studying nuclear stained whole mounts and cross-sections of midguts and by monitoring the mRNA levels of genes involved in 20E action in methoprene-treated and untreated

Ae. aegypti. Most of the larvae treated with methoprene died during the pupal stage. In *Ae aegypti* larvae, the programmed cell death (PCD) of larval midgut cells and the proliferation and differentiation of imaginal diploid cells were initiated at about 36 hr after ecdysis to the fourth instar larval stage (AEFL).The destruction of larval midgut epithelium and formation of pupal/adult midgut were completed by 12 hr after pupal ecdysis. In methoprene-treated larvae, the proliferation and differentiation of diploid cells was initiated at 36 hr AEFL and the PCD was initiated later after ecdysis into the pupal stage, but the terminal events that occur for completion of PCD during pupal stage were blocked. As a result, the pupae developed from methoprene-treated larvae contained two midgut epithelial layers until they died during the pupal stage. Real-time PCR analyses showed that methoprene affected midgut remodeling by modulating the expression of ecdysone receptor B, ultraspiracle A, broad complex, E93, FTZ-F1, DRONC and DRICE, the genes that are shown to play key roles in 20E action and PCD. We conclude that methoprene acts on *Ae. aegypti* by interfering with the expression of genes involved in 20E action resulting in a block in midgut remodeling and death during pupal stage. A model proposed based recent findings will be discussed. Recent progress in understanding the mode of action of JH and JHA by themselves or in modulation of ecdysteroid action will be summarized. This model could serve as a basis for future studies on molecular mode of action of JH and JHA. Supported by NIH, NSF and USDA.

Juvenile hormone biosynthetic enzymes as bio-rational target sites

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Juvenile hormone (JH) is a sesquiterpenoid compound produced by insects and is involved in the regulation of metamorphosis and reproduction. During early larval development, high levels of JH prevent the onset of metamorphosis, while its disappearance at the end of larval development sets the stage for the pupal-adult transformation. Because inhibition of JH biosynthesis in young larvae can trigger a precocious metamorphosis, typically generating unviable adults, some JH biosynthetic enzymes are viewed as promising targets for the development of insect-specific pest control molecules. JH biosynthesis proceeds through the mevalonate pathway up to the formation of the universal sesquiterpene precursor, farnesyl diphosphate (FPP); enzymes in this pathway have homologs in most living organisms. In contrast, enzymes responsible for the conversion of FPP into JH are insect-specific. Although the latter are viewed as the most likely to provide insect-specific targets (e.g., JH acid methyltransferase), some insect mevalonate pathway enzymes display unique structural features expected to permit targeted inhibition (e.g., FPP synthase and isopentenyl diphosphate isomerase). This presentation will provide an overview of recent work aimed at (i) characterizing some of these enzymes, (ii) examining the impact of blocking their expression on larval development and (iii) assessing the activity of potential insecticidal molecules designed to provide target-specific inhibition.

Plant lectins as tools for controlling pest insects

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In recent years the exploitation of defense proteins that confer resistance towards insect pests has received great attention as these may help to develop a balanced IPM strategy reducing pesticide use. Until now, the successful development of *Bacillus thuringiensis* (*Bt*) has revolutionized the field, but another interesting group comprises lectins that are a large, heterogeneous group of carbohydrate-binding proteins. This paper will give an overview of the recent progress that has been made in the study of the insecticidal properties of different classes of plant lectins and their potential use as tools in controlling pest insects. Interestingly, lectins show toxicity against biting-chewing insects like caterpillars and piercing-sucking insects like aphids. Also the combined use with beneficial organisms/natural enemies and *Bt* will be discussed. Finally, possible target sites inside the insect and the mode of action for ingested lectins are presented.

Racemic female sex pheromone as a useful IPM tool for *Diabrotica* management in various parts of Europe and North America

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Modern pest management (IPM) strategies for prevention and/or suppression of harmful insect pests require new, preferably nontoxic approaches with the ability to exploit the specificity, environmental tolerance, and sustainability inherent in natural products. The synthetic female sex pheromone of the Western corn rootworm (WCR) *Diabrotica virgifera virgifera* (Coleoptera:Chrysomelidae) is an excellent example for this approach and a highly welcome research tool. While Sonnet et al. 1982 presented a first synthetic route for the pheromone 10-methyl-decane-2-ol propanoate, a bulk scale synthesis for field uses, however, was still lacking. We now found a suitable synthesis scheme providing a respectable 40 %+ overall yield. It meets the technical requirements for its upgrading to the bulk scale level (Mori 2010).

Racemic synthetic WCR pheromone has been tested successfully during the last decades in a larger number of field studies both in the US and within Europe. Three different uses are prominent:

1. *Monitoring* WCR adults in maize fields can provide information on their presence and population level, both in time and space. A suitable, inexpensive, and highly sensitive IPM tool among others is the sex pheromone baited Metcalf trap.

2. *Mass trapping with mass capacity traps* is a second IPM strategy. Its usefulness, however, is limited to fields with moderate population densities.

3. *Mating disruption* is an alternative strategy for behavioral control of adults, but is suitable for larger scale IPM. It already has been experimentally shown to be effective on small areas (Hummel 1983) shortly after the first synthetic WCR pheromone became available from Sonnet et al. 1982. - Very recent advances in novel dispenser technology prompts us to replace the manual, cost-intensive distribution of dispensers with a cheaper, mechanized strategy. So far, first

results have been obtained in a vineyard, a perennial crop (Hein et al. 2009, 2010). We will extend this new technique to annual row crops like maize. Bulk scale WCR pheromone in combination with such novel dispensers will be investigated in 2010. First field results will be presented.

S7: Forest entomology II.

Room Brussels

Phylogeography of *Pityogenes chalcographus* (Coleoptera, Scolytinae) in Europe - is *Wolbachia* involved?

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Since the 1970's, the spruce bark beetle, *Pityogenes chalcographus* poses a unique case in European entomology as populations revealed crossing incompatibility being divided into two major geographic groups – Scandinavia and Central Europe. Recently, a phylogeographic study of 42 European *P. chalcographus* populations based on mitochondrial markers confirmed this hypothesis. Additional crossing experiments, demonstrated that the crossing barriers are raised between mitochondrial cladotypes – haplotypes within a clade. Incompatibility however can also be caused by an array of endosymbionts. The most prominent one causing changes in the reproduction of the host is *Wolbachia*. A nested PCR technique was applied on several mitochondrially genotyped individuals of *P. chalcographus*. Despite the fact that 35.5% of the individuals were found infected by one to two *Wolbachia* strains, no distinct pattern of infection was revealed, since infections were detected in all clades. It can therefore be excluded that these two *Wolbachia* strains shaped the current distribution of genetic diversity among *P. chalcographus* populations in Europe.

Alternate attractors in populations of southern pine beetle

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There is a long-standing but poorly tested hypothesis that some forest insects have population dynamics with alternate stable states of either low or high abundance. Such dynamic behavior can produce persistent consequential changes in ecosystem services. We evaluated this model for *Dendroctonus frontalis*, a globally notable forest pest. Frequency distributions of abundance were distinctly bimodal as predicted if there were alternate attractors. Time series abundance data refuted the existence of strong delayed density-dependence as required by the competing model of endogenous cycles. The model of alternate attractors was further supported by the existence of positive density-dependence at intermediate abundances. Finally, experiments with lightning-struck trees (the refuge habitat for small beetle populations) showed stabilizing density-dependence even when abundance is low, as required to produce alternate attractors. Lightning-struck trees with experimental additions of *D. frontalis* pheromone attracted 7x more predator landings and 2x more attacks by heterospecific competitors than paired trees lacking signs of occupancy by *D. frontalis*. Thus predation augmented by interspecific competition could create a locally stable equilibrium in small populations of *D. frontalis*. Finally, there is high variation among regions and years in the abundance of the predator and competitors, which can permit switches between alternate states. Where regime shifts arise from key populations switching between alternate states, the theory of alternate attractors in population dynamics can improve management tactics to predict and avert deleterious shifts in pest abundance.

Overwintering biology of the spruce bark beetle, *Ips typographus* (Col., Scolytinae)

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We studied the overwintering biology of the spruce bark beetle, *Ips typographus*, throughout several years. We followed brood development in infested logs and recorded cold hardening and winter mortality of larvae, pupae, and adult beetles and related the data to the weather conditions.

Depending on the air temperatures, brood development proceeded until the first frost period. In 2008, 10% of the beetles from a brood established in early September had reached the pupal stage until December. Mortality was very low during this time (5%). However, all immatures died during a 3-week cold period that followed in January 2009 with minimum temperatures of -8°C that occurred in a single night. This was unexpected because the mean supercooling points (SCP) of larvae and pupae were -9°C and -11°C, respectively, indicating that the immature stages suffer from chill injury well above freezing.

From October to February, winter mortality of adult beetles increased to 50%, but then remained constant until April. In contrast to larvae, adult supercooling points declined to less than -20°C until January.

Both lipid and carbohydrate metabolism are involved in the cryoprotectant system. Seasonal adjustment to cold hardiness is initiated by a significant increase in the unsaturated fatty acids oleic and palmitoleic acid from August to October, followed by a prominent accumulation in trehalose from October to January.

We hypothesize that immatures, which remain in the inner bark of their host trees, are especially vulnerable to mortality from contact freezing in the brood galleries, while adult beetles are able to avoid freezing by using a hibernaculum in the outer part of the bark.

Agrilus viridis L. as an underestimated harmful insect of European beech

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The European beech (*Fagus sylvatica* L.) is the most important tree species of natural forest communities in Central Europe. In comparison to other tree species, beech seems less susceptible to biotic and abiotic harmful factors. Therefore European beech takes an important role in

strategic consideration of forest conversion in regard to climate change.

In recent years damages in beech stands increased. Especially after summer drought events like 2003 and 2006 an increasing crown defoliation was observed. Initial investigations of the disease indicate an involvement of the beech splendor beetle. The beech splendor beetle (*Agrilus viridis* L.) is known as a secondary bark breeding species. Mass outbreaks were rare in the past. The last description of an outbreak in Germany is older than 60 years. This outbreak coincided with dry and warm summers since 1945 – 1952. It is feared that the beech splendor beetle will benefit by climate change. This beetle will probably contribute to an increased endangerment of well established beech stands in the future. Silvicultural actions has to be developed for minimizing the risk of infestation. However, there is a lack of findings about the infestation factors of the beetle which enhance outbreaks. There may be links between the infestation risk and stand density, age, exposure, nutrition status of soil, water regime or thinning grade. First results are shown and discussed.

Invasive insect pests on forest trees and their parasitoid assemblages in Croatia

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Several new insect species on forest trees have recently been accidentally introduced to Europe. Their pattern of introduction and spread in Croatia has been very similar to the same pattern in other European countries. *Phyllonorycter issikii, Ph. robiniella, Ph. leucographella, Parectopa robiniella, Cameraria ohridella, Obolodiplosis robiniae, Leptoglossus occidentalis, Metcalfa pruinosa* have spread on forest and amenity trees in Croatia. This research has focused on new invasive species on forest trees in Croatia especially the leafminers. The parasitoid assemblages of the new invaders among leafminers have been studied and compared to the parasitoid assemblages of native leafminers. All the parasitoids reared from new invasive species are generalists, common and abundant on native leafminer species of woody plants. From the obtained data can be concluded that the native, polyphagous parasitoids have allready adapted to the new introductions in the fauna of leafminers.

Comparative study on the biology of gypsy moth (lymantria dispar L.) on different tree hosts in laboratory conditions

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The gypsy moth is one of the most important pests of forests and ornamental trees in the world. At recent years it significantly influenced plantation coniferous and hardwoods. This polyphagous insect during larval stages feed voraciously on the leaves of both deciduous and coniferous trees. In this study biology and host preference of gypsy moth on four species quercus castanifolia, alnus glutinosa, parotia persica, and acer velutinum, was considered. Other parameters that were measured here are relative consumption rate (RCR), relative growth rate (RGR), efficiency of conversion of ingested food (ECI), efficiency of conversion of digested food (ECD), and approximate digestibility (AD). Also some chemical components of trees species leaves such as N,P,K, and C were measured. Collected data ere analyzed with spss statistical software for comparison of mean with Duncan test. Results showed that shortest and longest lif cycle is on quercus castanifolia and acer velutinum respresently. The maximum weight of larva, pupa, and adult was belonging to quercus and was at least in acer . the maximum mortality of larva and pupa occurred in acer and quercus was minimum . inthis study with two method of host preference of gypsy moth founded that larvae had a high tendency to quercus and a low tendency to acer . results showed too that the most RCR is related to acer and least for alnus glutinosa and RGR was greatest for quercus and least for acer. According to this study maximum ECI was related to alnus minimum was concern with acer and ECD was greatest for quercus castanifolia and least for acer . finaly AD index in acer was higest from other host trees.

S8: Aquatic insects II.

Room Rome

Mitochondrial phylogeography of Corsican mayflies

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Corsica, a continental island with a complex geological history, possesses an original fauna with a low specific diversity but a high level of endemism. The current knowledge of Corsican mayflies (Ephemeroptera) based on morphology confirms this statement, with about 16 species of which 1/3 are endemic to Corsica and 1/3 endemic to Corsica and Sardinia.

Mayflies constitute an appropriate tool for biogeographical studies because of their limited dispersal powers and ancient origins. A 658bp fragment of the mitochondrial gene CO1 from taxa from Corsica, Sardinia and surrounding continental areas was sequenced in order to clarify the phylogenetic relationships and biogeography of Corsican mayflies. Particular attention was paid on the following families: Baetidae, Ephemerellidae, Heptageniidae and Leptophlebiidae. Results suggest that the Corsican faunal composition is the result of a combination of factors such as vicariance, radiation and recent colonisation, depending on the group investigated. Moreover, some of the genera were found to be more diversified in Corsica than previously thought because of the presence of several putative cryptic species. Morphological evidence is being synthesized to corroborate the status of these species.

Ephemeroptera and Plecoptera fauna of Bosnia and Herzegovina

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Ephemeroptera are one of the best researched orders in aquatic ecosystems of Bosnia and Herzegovina (Klapalek, 1898, 1906, Pongraz, 1914, Tanasijević, 1970, 1974, 1975, 1977, 1978, 1980, 1981, Trožić-Borovac, 2000, 2002 , 2003). In Bosnia and Herzegovina, there are up to know 58 species of mayflies in 20 genera and eight families recorded, most of which belong to the family Heptagenidae. More intensive studies of these insects have been undertaken since 1970 and last until today. The first data on the species of Plecoptera in Bosnia and Herzegovina can be found in early works of foreign researchers (Klapalek 1898, 1901, 1906, 1906, Pongracz 1913, 1914, Aubert 1963, 1964). More intensive research dates from the year 1970 on (Kaćanski, 1970, 1971, 1978, 1981, 1983, 1987, Kaćanski & Zwick, 1970), representing the results of studies that were conducted within the Biological Institute of the University of Sarajevo. Until today there have been recorded 73 species and two subspecies from 15 genera within seven European families. The largest number of species is recorded from the

genus Leuctra (24 species and one subspecies). Mayflies and stoneflies are included as important bioindicators in saprobiotic water quality assessment table (Kolwitz, Marson, 1909, Sladaček, 1973, Wegl, 1983) in running waters. Fauna of Ephemeroptera and Plecoptera in recent years has been intensive researched in the Department of Biology at Faculty of Science Sarajevo, with the purpose of verification and confirmation of so far investigated species and their habitats.

Distribution, ecology and phylogeny of the sea skater *Halobates* - Do they still avoid the Mediterranean?

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The commonest and most conspicuous aquatic insects in Europe are probably the pond-skaters or water-striders which belong to the family Gerridae. It is one of the largest family of aquatic Heteroptera with 8 subfamilies, over 70 genera and at least 500 described species worldwide. Most members are freshwater and can be found in a wide variety of habitats ranging from lakes to temporary roadside pools. About 80 species belonging to 10 genera are marine. The most well studied are those belonging to the genus *Halobates*. It is almost exclusively marine with 45 described species, 5 of which are found in the open ocean, thousands of kilometers away from land. Coastal *Halobates* species are found predominantly in the Indo-pacific region, in near shore habitats associated with mangroves or coastal vegetation. A fossil *Halobates* estimated to be at least 45 million years old was found in a marine deposit near Verona, Italy but no extant *Halobates* has yet been collected in the Mediterranean. We will discuss the known distributions of coastal *Halobate*s species, their habitat requirements, phylogeny, and whether species are likely to be discovered around the Mediterranean where climate changes are expected due to global warming.

Size dependent pore-respiration in water beetles

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All Dytiscid and Haliplid water beetles can, for a limited time, ranging from hours to a few days, survive submerged by respiring oxygen from an air bubble, replenished during frequent visits to the water surface. A few waterbeetles, however, have an optional respiratory mode. They can survive submerged through weeks and months, because they can extract oxygen, dissolved in the water, through respiratory pores in the integument. An air flux from the outside to the inside through the respiratory pores has been demonstrated.

A limit to this respiratory mode can be predicted be the size of the beetles. All waterbeetles, capable of pore respiration, are small, but not all small waterbeetles have pore respiration. Each respiratory pores dimension determines the amount of oxygen flux into the tracheal system. With increasing size of the beetle, the oxygen requirements increase. The surface of the beetles increases by an exponent of 2, while the oxygen consuming volume increases by an exponent of 3. With increasing size, more and more of the surface must be covered by respiratory pores to meet the increasing demand of oxygen. The largest known water beetle with pore respiration is Stictotarsus duodecimpustulatus: Length 5, 5 mm, body wet weight 15, 5 mg. Every part of its body, even the legs, is covered by respiratory pores. In contrast, the smaller Oreodytes sanmarkii (Body length 3,3 mm, and body wet weight 3,2 mg) have respiratory pores on the upper surface only, mainly on the elytra (c.14,000/mm2), fewer on pronotum (c. 8,000/mm²) and head.

So far, pore-respiration is found in one Haliplid species only: Brychius elevates, which lives in streams. In Dytiscids app. a mere dozen species are now known or supposed to have pore-respiration. In some cases, one species has pore-respiration, while its close relative is dependent of bubbles replenished from the surface. Hydroglyphus hamulatus can survive submerged, while H. pusillus cannot. Hygrotus versicolor can survive submerged, while H. inaequalis cannot. All investigated species in Porhydrus, Graptodytes, Oreodytes, Stictotarsus, and Nebrioporus can stay submerged, while all of the investigated species in the genus Hydroporus are dependent of air from the surface.

In running water species the pore-respiration mode is regarded as an adaptation to life in current exposed substrates, thus avoiding the risk of being swept away during frequent surface visits. For stagnant water species the respiration mode reduces the risk of falling victim to pelagic predators.

The submersion tolerant species can switch to surface respiration during low oxygen content (< 2-3 mg/l).

The respiratory mechanism is believed to be a specialized plastron. The oxygen flue through the small respiratory pore area (app. 10% of total surface) may be enhanced by the special configuration of the boundary layer covering the surface.

Variation in male and female secondary sexual characters in the diving beetle, *Agabus bipustulatus* (L.) (Coleoptera: Dytiscidae)

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Sexual conflict can drive rapid intersexual arms races, and lead to pronounced sexual dimorphism. Such dimorphism is frequent in diving beetles, where males typically possess expanded front and middle tarsi, supplied with adhesive setae to grasp females during mating, and females often have rough dorsal surfaces which hinder male attachment. In some taxa, including the widespread Palaearctic species *Agabus bipustulatus* (L.), females are polymorphic for surface sculpture, showing a range of states between a smooth and shiny, and rough, heavily sculptured dorsum. Here we quantify variation in surface sculpture across three populations of *A. bipustulatus*, and demonstrate that variation in female sculpture appears to be associated with shifts in male tarsal sucker arrangements. The possible evolutionary drivers of this variation are discussed.

S9: Insect behaviour (incl. Insect acoustics) II.

Room Maastricht

Sphragis-bearing and female size in the Clouded Apollo butterfly

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Sphragides are produced by males and placed externally to cover and block females' copulatory pores, and suggested to prevent successive mating in a few species of butterflies mainly in Papilionidae and Nymphalidae. They are supposed to be evolved from mating plugs, widely known in insects, as a consequence of sexual conflict. Only a handful of studies have investigated sphragis, and neither its evolution, nor the mechanisms of its production is clearly understood.

We carried out field observations and experiments near Budapest, Hungary, 2007-2009, to study sphragis-bearing in the clouded Apollo butterfly (Parnassius mnemosyne). Clouded Apollos are sexually dimorphic, e. g. males have longer wings and thinner thoraces than females, indicating strong sexual and/or differential natural selection.

Most mated females bore sphragis but some did not. Sphragis-bearing females had wider thoraces and flew earlier than non-bearing mated females in 2007 and tended to do so in 2009. We found no such difference in 2008. Sphragis-bearers in 2007 were larger than any other groups. Sphragis-removed were more likely to get new sphragis than mated females without sphragis. We suggest that choosiness in investment may pay off for males in certain circumstances while not in others. Operational sex ratio may influence the benefits of choosiness via male-male competition: the proportion of males (total captures, most individuals caught) were 0.51 and 0.64 in 2008 and 2009, respectively.

Male choice in a sexually cannibalistic praying mantid *(Stagmomantis limbata):* males prefer well-fed females

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One can expect male choice as the reproductive costs for males increase. In species where females cannibalize males during courtship or copulation, mating is especially costly, as it involves the risk of death for males. In sexually cannibalistic taxa, previous studies have examined male choice for virgin females, but phenotypic traits that reflect female quality, such as large body size or high fecundity, remain unexplored. We examine male choice in the sexually cannibalistic praying mantid *Stagmomantis limbata*. We integrate experiments in captivity with field data to demonstrate male choice for well-fed females, and to evaluate the viability of male choice in an ecological context. In paired choice trials in captivity, males preferentially mated with High diet females over Low diet females. High diet females had greater body mass, thicker abdomens, greater fecundity, and were less cannibalistic than Low diet females. Dorso-ventral abdominal thickness reliably predicted female fecundity. In the field, mounted females had abdomens that were significantly thicker than that expected from random sampling of available females. Data on population parameters indicate that male choice for well-fed females is a viable behavioral strategy: sex ratio was female-biased, females became increasingly aggregated over the season, and females showed considerable variation in abdominal thickness. High diet females in field cages attracted males, whereas Low diet females failed to attract any males. While this last result supports male choice, we note that it also suggests state-dependent female pheromone emission, with female pheromones being a possible reliable signal of female fecundity and/or sexual receptivity.

Male stalk-eyed flies (Diopsidae) in action: An exclusive anatomical modification to enhance fight outcome

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Stalk-eyed flies (Diopsidae) have eyes displaced laterally from the head on elongate, rigid stalks in both sexes. Males have exaggerated eye-span that functions as a sexual ornament. In addition to being favoured by females, large eye-span helps determine winners in the competition for lek sites. Visual assessment of the opponent can turn into full contact fights, where legs are primarily used. We recently discovered a male front leg modification (similar in mechanical setup to a nutcracker), which may have an important role in antagonistic interactions. The inner structure of the femora reveals an anatomical solution of the problem to save energy while holding on to something (eg. the opponent's leg). We studied the morphology of this setup and found a nodule on a tendon and a lump on the inner femur, which make this possible.

In addition, we studied the fight outcomes of two males of matched eye-span size in a laboratory environment, when the leg hooks of one of the males was filled in with paint. There were more winners of flies with altered legs in contests that did not involve contact. In contrast, flies with unaltered legs won more escalated fights that involved contact. A possible explanation is that altered front legs appear to be larger and are advantageous in signalling (e.g. leg threat), but are less useful as a "power tool" when the contest escalates (e.g. wrestling). Implications of these findings will be discussed with illustrations and explanations.

Geographic variation of male calling song and female song preference in Isophya posthumoidalis (Orthoptera) in the Eastern Carpathians

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Significant geographic variation of acoustic signals has been reported only in a relatively small amount of species in singing Orthoptera. Examining the pattern of variation in male song features and female preferences may help us to have a better understanding of the processes involved in the evolution of song patterns and speciation. We have found marked inter-population differences in the calling song of the bush-cricket Isophya posthumoidalis. Four populations of this species were studied along a 400 km transect in the Eastern and Southern Carpathians (Romania). Our results show that duration of syllables differ significantly between the studied populations and change directionally along the Carpathians. In these phaneropterid bush-crickets pair-formation is achieved during an acoustic duet in which females respond to male calling songs with simple "clicks". Playback experiments with females from the northernmost and southernmost populations of the cline showed that the divergence between the male songs has significant effect on the response proportion of females: female response-proportion decreased as the distance between the source population of song and source population of tested females increased. Our results fit the model of signal evolution where male song features and female preferences co-evolve with small gradual steps.

Signal recognition in chorusing environment in *Nezara viridula* (L.)

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Animals that communicate in aggregations face the problem of recognizing conspecific signals due to interference and overlapping. On plants vibrational signals are often perceived in a one-dimensional environment. In such situations signals from several sources could be perceived as one signal. We tested in N. viridula whether (1) males can discriminate alternating signals emitted from two conspecific sources, (2) males can discriminate alternating signals from a conspecific and heterospecific source, (3) males responsiveness increases when unattractive short signals from two sources combine into an attractive longer signal. Animals were tested on a bean plant in playback experiments with natural and

modified conpecific signals of different durations, as well as with heterospecific signals. While male responsiveness was not affected when conspecific female signals were presented in synchrony, it was reduced when signals were alternating. Similarly, alternating heterospecific and conspecific signals reduced male responsiveness. Male responsiveness did not increase when two unattractive signals were combined to form an attractive one. We conclude that (a) males interpret conspecific female signals emitted from two sources as one signal with repetition time outside species-specific values, (b) males do not interpret two combining unattractive signals as an attractive one. These results indicate that vibrational signalling in aggregations is influenced by complex interactions.

How to explain the lack of clear oviposition preferences in a myrmecophilous butterfly?

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Oviposition site selection in phytophagous insects may determine offspring survival due to limited larval mobility. *Maculinea* butterflies are obligate social parasites of *Myrmica* ants. Larvae feed on specific host plants, then, if taken by their hosts, in ant nests. In each generation, large proportion of offspring dies since the host plant they hatch on is out of the ant hosts' foraging range. We (i) counted the eggs on randomly selected host plants at the end of the flight period and (ii) tracked females and observed egg-laying to reveal if *Maculinea alcon* oviposition was influenced by the presence of host ants and/or the characteristics of the host plant (*Gentiana cruciata*) and its microenvironment. (i) Number of eggs per plant was not significantly affected by explanatory variables. (ii) Only the number of conspecific eggs present on host plants influenced significantly, by increasing, the number of eggs laid at each alightment. Since we studied only post-alightment choice, we suspect that females' decision was a result of pre-alightment choice influenced by factors we failed to take into account. The lack of clear oviposition preferences implies that females can not predict the most important larval mortality factors, such as probability of adoption and degree of intraspecific competition of progeny in ant nests. Oviposition is time-limited, thus female decision may rather be affected by a trade-off between choosiness and the total number of eggs they are able to lay.

S10: Chrysomelidae II

Room Strasbourg

Peptides of the adipokinetic hormone family in Chrysomeloidea

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The superfamily Chrysomeloidea is mostly divided into 5 families of which the Cerambycidae and Chrysomelidae each contain about 35,000 species.

Peptides belonging to the adipokinetic hormone family are structurally characterised by a chain length of 8 to 10 amino acids, by blocked N- and C-termini and by aromatic amino acids at position 4 and 8. In four species of cerambycid beetles (*Phryneta spinator*, *Ceroplesis thunbergi*, *C. capensis* and *Phoracantha recurva*) a single octapeptide with the primary sequence pGlu-Val-Asn-Phe-Ser-Pro-Asn-Trp amide, denoted as Peram-CAH-I, is found.

Two chrysomelid beetle species have been investigated to date with respect to their adipokinetic hormones, *Leptinotarsa decemlineata* and *Chrysolina kuesteri*. Both species each contain two octapeptides, one of which is common to both species and is identical to the peptide Peram-CAH-I sequenced from Cerambycidae. The second peptide in the potato beetle is denoted as Peram-CAH-II with the sequence pGlu-Leu-Thr-Phe-Thr-Pro-Asn-Trp amide. *C. kuesteri* has Emppe-AKH, which is pGlu-Val-Asn-Phe-Thr-Pro-Asn-Trp amide, and this structure can evolve easily from Peram-CAH-I by point mutation (S5 to T5). Thus, at a certain level, relatedness of species can be assumed from the primary sequence of the adipokinetic peptides.

Financial support from NRF and UCT is acknowledged.

Evolutionary origin of the elogated genitalia in the leaf beetle subfamily Criocerinae (Coleoptera, Chrsysomelidae)

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Extreme elongation of genitalia is widely spread phenomenon in internal fertilizers. Due to its curiosity, evolutionary background bringing such a long genitalia has attracted attention from many researchers. Generally, sexual selection and sexual conflict are regarded as main force. In addition, male genitalia more actively move during copulation, because genitalia are stored in limited body cavity in many taxa. Therefore, these morphological and behavioral points may constrain evolution of elongated genitalia, and even if longer genitalia are strongly favored, this selection pressure alone may not promote elongation of genitalia. Here, we presented preliminary results from our investigation on the evolutionary origin of genital elongation using a chrysomelid group as a case study.

In the subfamily Criocerinae (Insecta, Coleoptera), males and females of *Lema* (*Lema*) are known to have an elongated part in their genitalia. Especially *L*. (*L*.) *coronata* has extremely long genitalia that reach more than twice the body length. We confirmed that the largely modified structure of the male genitalia enable them to quickly insert it into and withdraw it from female genitalia. Now we are investigating what happened at the evolutionary origin of the genital elongation in *Lema* (*Lema*), using comparative morphology and developmental biology. As far as we investigated, it is suggested that fusion and rotation of genital sclerites had happened at its origin, and also such large modifications evolved independently three times. These results also suggest that the evolutionary novelty produced by a large modification was obtained through a relatively simple mechanism.

Types of geographical distribution of leaf beetles in Central Europe

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Comparison of the patterns of geographical distribution of 647 species of Chrysomelidae revealed 13 types of distribution: widely distributed, southern, southeastern, southwestern, northern, eastern, southeastern, southwestern, patchy, montane, subalpine & alpine, scattered, unusual, and simply an irregular pattern produced by insufficient data. Some of these are trivial (e.g. northern, eastern, etc., alpine) but others are surprising. Some cannot be explained, e.g. a remarkable gap in the distribution of *Chrysolina limbata* (Fabricius, 1775) and in *Aphthona nonstriata* (Goeze, 1777).

Although our 54.000 records are definitely not sufficient to draw reliable conclusions, we found it interesting that the distribution maps produced on that basis reflect in that many cases the common knowledge on the occurrence of leaf beetles in certain areas. Therefore, we state that also the unusual findings provide a rewarding start for further investigation.

Károly Sajó's pioneering entomological discoveries in Hungary

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The excellence of Károly Sajó as a researcher into Hungary's natural history has been undeservedly forgotten. Yet he did lasting work, especially in entomology, and a number of his discoveries and initiatives were before their time.

Born in 1851 in Győr (Győr-Moson-Sopron, Hungary), he received his secondary education there and went to Pest University. He taught in a grammar school in 1877–80 before spending eight years as an entomologist at the National Phylloxera Research Station and then moving to the Royal Hungarian State Entomological Station. Pensioned off at his own request in 1895, he moved to Őrszentmiklós, where he continued making entomological observations on his own farm and wrote the bulk of his published materials: almost 500 longer or shorter notes, articles and books.

Sajó was the first in the world to publish in 1896 a study of how the weather affects living organisms, entitled *Living Barometers*. His *Sleep in Insects*, which appeared in the same year, described his discovery, from 1895 observations of the red turnip beetle *(Entomoscelis adonidis)*, of aestivation in insects —in present-day terms diapause. This he later observed also in the life cycles of several other leaf beetles (*Oulema melanopus* and *Crioceris* species).

Unfortunately, Sajó's publications in Hungarian were almost forgotten, but his writings on the diapause of insects were later republished in the highly popular natural history periodical Prometheus in Berlin, so that they entered the world literature.

It was a great loss to Hungarian entomological research when Sajó ceased publishing about 25 years before his death. His unpublished notes, with his library and correspondence, were destroyed in World War II.

Anatomy of Mikado sp. (Coleoptera: Ptiliidae), one of the smallest free-living insects and limits to insects miniaturization

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We present the first morphological study of larvae and adults of Mikado sp. – one of the smallest known beetles and free-living insects (body length of adult is 390–455 mm). Morphological and developmental consequences of miniaturisation in Mikado and insects in general are discussed. We used histological sectioning, scanning electron microscopy, laser confocal microscopy and 3D-computer reconstruction. For the first time we report that according to the morphometric data of Mikado sp., at least some ptiliid beetles have three larval stages. We studied the muscular system of adults and larval stages. It is shown that ptiliid beetles have nearly the complete set of muscles found in larger staphyliniform beetles. Developmental and size dependent changes in the relative volume of different organs are addressed. All organ systems change allometrically in the development of Mikado sp. as well as in comparison with larger representatives of Ptiliidae and closely related groups of beetles, such as Staphylinidae. We conclude that the factors limiting miniaturisation are the size of the neural system, associated with the number and size of neurons, the mass of the skeleton, the egg size (free-living insects), and consequently the volume of the reproductive system.

S11: Biorational control of arthropod pests: mechanism and application III.

Room Copenhagen

Molecular and proteomic investigation of bursicon's novel function beyond cuticle sclerotization and wing expansion

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Insects are encased in a semi-rigid exoskeleton (cuticle). Exoskeleton provides insect protection and attachment sites for muscles and internal organs, thereby facilitating locomotion. On the other hand, it also limits insect growth. Insect must shed its old exoskeleton periodically (molt) to allow growth and metamorphosis. The newly formed exoskeleton after each molt is usually soft, flexible, and lacks physical strength for protection. Sclerotization (hardening and tanning) of cuticle must occur in a relatively short period of time after each molt in order for the new exoskeleton to be functional for protection. Bursicon is a heterodimer neuropeptide responsible for cuticle sclerotization and wing expansion via a G protein–coupled receptor (DLGR2) in diverse insect orders. Using recombinant bursicon, we have identified a set of bursicon-regulated genes and signaling components from neck-ligated flies (*Drosophila melanogaster)* in DNA microarray and proteomic analysis. Most importantly, the microarray and proteomic data have led to the identification of a novel function of bursicon beyond cuticle sclerotization and wing expansion (unpublished information). We have shown that bursicon regulates insect immune response gene expression via the immunodeficiency (IMD) pathway. Proper hardening of cuticle and developing of immune response is vital to insect survival. Understanding the key biochemical events involved in the cuticle tanning and immune response could lead to the development of more efficient insect control agents to disrupt the cuticle hardening process and immune response system.

A metabolomic approach to identify secondary plant defense compounds involved in thrips resistance

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Western flower thrips (*Frankliniella occidentalis*) has become a key insect pest of agricultural and horticultural crops worldwide. Little is known about host plant resistance to thrips. We applied a metabolomic approach to compare the metabolomic profiles of thrips resistant and susceptible plants. As study systems we used F_2 hybrids of *Senecio jacobaea* and *Senecio aquaticus* as a wild plant and chrysanthemums as an ornamental plant. We identified thrips resistant plants applying bioassays. Subsequently, nuclear magnet resonance spectroscopy (NMR) was applied. NMR facilitates a wide-range coverage of the metabolome, making NMR especially suitable if there is no *a-priori* knowledge of the herbivore defense compounds (1). We show that thrips resistant and susceptible plants can be discriminated on basis of their metabolomic profiles. Thrips resistant *Senecio* hybrids contained higher amounts of the pyrrolizidine alkaloids (PA), jacobine and jaconine, especially in younger leaves. Also, a flavanoid, kaempferol glucoside,

accumulated in the resistant plants. Both, PAs and kaempferol, are known for their inhibitory effect on herbivores and pathogens (2). In resistant and susceptible F_2 hybrids young leaves showed less thrips damage than old leaves. Thrips resistant chrysanthemums contained higher amounts of the phenylpropanoids chlorogenic acid and feruloyl quinic acid. Both phenylpropanoids are known for their inhibitory effect on herbivores as well as pathogens (3). The effect of chlorogenic acid on thrips was further studied in bioassays with artificial diets. These experiments confirmed the negative effects on thrips. Our results prove NMR to be an important tool to identify metabolites involved in thrips resistance. It constitutes a significant advance in the study of plant-insect relationships, providing key information on the implementation of herbivore resistance breeding strategies in crops and ornamentals. Most of the compounds identified also affect pathogens. This may form the basis of a multi resistance program. Besides their negative effect on thrips kaempferol and the phenylpropanoids are investigated for their positive effect on human health preventing cancer development. This unique combination makes them the candidates of choice to improve host plant resistance.

UV-absorbing nets interfere with the ability of whiteflies and aphids to find their host plants

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Most insects use UV-light for orientation during flight, especially during take-off activities. It is well known that UV-absorbing materials covering greenhouses can significantly reduce pest attack and insect-transmitted virus disease incidence. A UV-deficient environment may affect the development and growth of host plants, which may indirectly affect population growth of herbivorous insects. Furthermore, some insects such as whiteflies tend to avoid UV-deficient environments, which interfere with their vision during flight and reduce their spread.

In the present work we tested host plant finding ability of *Bemisia tabaci* and *Myzus persicae* under two types of 40 and 50-mesh UV-absorbing nets, Optinet 40® and Optinet 50®. Young adults were released in a flying platform on one side of a 60 x 60 x 100 cm cage, which was covered with one of the UV-absorbing nets or with a 50-mesh standard control net. On the opposite side of the cage, a tomato or turnip plant, previously coated with Tanglefoot® adhesive was used as a target to assess insect landing rate. The plants were replaced 2, 8 and 23 hours after insect release. Experiments were run inside a glasshouse at 24 ± 2ºC and 50% RH. Our results show that *B. tabaci* tend to land faster on target plants covered by the standard net than on those covered by UV-absorbing nets. These results show that UV-absorbing nets can reduce the ability of *B. tabaci* to find their host plants.

Toxicity data on 'reduced risk insecticides' required for the development of IPM programs in North American orchards

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Biological control of phytophagous mites in tree fruit crops is now realized by conservation and augmentation of different species of phytoseiids, stigmaeids and anystid predatory mites. Other pests and diseases are managed by pesticides that are toxic to the target pest but innocuous to the predatory mites. With the demise of OP insecticides, new compounds with novel modes of action have been developed. These new compounds also called 'reduced risk insecticides' are safer to the user but not necessarily of lower risk to arthropods. Using 'worst case lab. exposure' techniques we estimated LC_{50} values, adult mortality and fecundity of imidacloprid, acetamiprid

thiamethoxam, thiacloprid, spinosad and methoxyphenozide to the two key predatory mites found in North America. Imidacloprid was very toxic to both species, acetamiprid toxic to *G. occidentalis* but intermediate toxicity to *N. fallacis*, thiamethoxam non-toxic to *G. occidentalis* but toxic to N. fallacies, spinosad non-toxic to G. occidentalis but intermediate toxicity to *N. fallacis*, methoxyfenozide and thiacloprid safe to both species. The results of this study indicates that data developed for one species from one region may not readily be applicable for a different region or another species. *G. occidentalis* is dominant on the Pacific coast whereas *N. fallacis* is dominant on the Atlantic coast.

Behavioural and physiological responses of *Spodoptera litura* (F.) (Lepidoptera: Noctuidae) larvae to neem kernel extracts

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Spodoptera litura is a devastating insect pest, which has developed resistance to insecticides. There is a great need to develop alternative methods for its management. Neem is a potential tropical plant which has been reported to possess biological activity against insects. Present work was initiated to evaluate the activity of aqueous, methanolic and hexane extracts of neem seed kernel, against *Spodoptera litura* larvae using leaf-dip bioassays. 0.5% to 4% concentration of extracts was tested for their antifeedant activity against fourth (L4) and sixth-instar (L6) larvae in choice and no-choice bioassays under laboratory condition. Also fourth and sixth-instar larvae were fed treated leaves for 24 h, and then transferred to normal food for recording their survival, deformities and pupation. In no-choice tests, insects were repelled by neem extracts and repellency was even more pronounced when insects were offered treated and untreated leaf discs in choice test. A dose-response relationship was found for all three extracts with respect to antifeedant index and pupation. At 4% concentration highest antifeedant activity and larval mortality was observed for all the extracts. Pupae failed to pupate when fourth-instar larvae were fed 4% concentration of extract. Pupation was significantly lower when larvae were fed on 1% methanolic extract (40%) as compared to control (94%). However, rate of pupation at 0.5% hexane extract was statistically same as that of control. The difference was more pronounced when larvae were fed higher concentration of extract and no pupation at 4% concentration of extract. Methanolic extract seemed to be the most effective and hexane extract was the least Moreover, aqueous and methanolic extract treatments resulted in loss of body setae and anorexia in L5 larvae. Pupae produced in all the treatments exhibited various deformities, which were more pronounced in aqueous and methanolic extracts than hexane extract. Thus treatment with all three neem extracts exhibited both behavioral effects and post-ingestive chronic toxicity in larvae. Further study for isolation and identification of active components of extract is in progress.

S12: Forest entomology III.

Room Brussels

Forest management and pest dynamics

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Highly productive plantations in Southern Europe are characterized by intensive sylviculture and the introduction of fast growing trees to increase productivity. Sylvicultural practises are common tools to improve yield but also stand condition and tree vigour. We tested how thinning affects the population dynamics of the two major pests in the area, bark beetles borers and the defoliator Processionary moth. The study was carried out within 4 thinned and 4 unthinned plots of the native species (*Pinus pinaster* Ait.) and 3 thinned and 3 unthinned plots of an introduced pine (*Pinus radiata* D.Don), located in sites with similar characteristics. Bark beetles showed a strong preference for the native species. Both abundance and diversity were much higher in stands of *P. pinaster*, both as measured by funnel trap captures and by study of trees under attack. There was no effect of thinning on the abundance and diversity of the population flying within plots, but there was a strong effect of thinning on the number of trees under attack located mainly in unthinned plots. Thinning treatments did not have an effect on the abundance or diversity of natural enemies, but again the native stands showed a significantly greater abundance of natural enemies and almost twice more species. The native stands were better defended against bark beetles with higher constitutive resin, but there was no effect of thinning on resin flow. Finally the native species seems to be also a more suitable tree for bark beetles than the exotic and the thinning treatments had a positive effect on the nutritional quality of phloem. Larvae of the Processionary moth weigh more and survive better when feeding on *P. radiata*, but there was no effect of thinning. N contents were higher in *P. radiata* needles, independently of the treatment. In summary, borers and defoliators seem to have different preferences, but native stands seem generally better defended against native pests. In addition bark beetle populations within stands of native trees are subject to stronger controls by natural enemies.

Characterizing browntail moth local outbreaks in the Iberian Peninsula by combining life table data and non-linear statistics

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Life table studies have been an essential tool for the comprehension of insect population dynamics. However, they are methodologically biased by a primary focus on mortality factors, especially natural enemies. Thus, life table studies may relegate important mortality sources to the "unknown" or "residual" mortality categories. To overcome this limitation life tables may be complemented by combining them with other approaches. The aim of this study is to provide insights into browntail moth *Euproctis chrysorrhoea* L. (Lepidoptera: Lymantriidae) local outbreaks by combining life table data and statistical modelling. First, we have compared *E. chrysorrhoea* population density, mortality dynamics, net reproductive rate and reproductive potential in two different Mediterranean habitats (i.e. coastal and inland). Second, by means of generalized additive modelling (GAM models), we have investigated the relationship of reproductive potential as well as residual mortality in the life tables with several variables likely to influence *E. chrysorrhoea* population dynamics. Our results suggest that local outbreaks are more likely in coastal habitats where higher mortality was compensated by higher reproductive potential. GAMs revealed that residual mortality increased with *E. chrysorrhoea* population density non-linearly, and that realized fecundity was negatively and linearly related to extremely hot temperatures. Results may be useful for forecasting *E. chrysorrhoea* local outbreaks.

Diversity of *Pemphigus* galls on the Lombardy black poplar (*Populus nigra* 'Italica')

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Populus nigra 'Italica' trees have been planted under different environmental conditions. Their genetic uniformity represents a unique opportunity to study the local effects on a particular genotype. Most of the *Pemphigus* species are associated with black poplar (*Populus nigra*), causing various types of galls. In our study we have examined the diversity, the frequency and the life-strategy of *Pemphigus* species living on *Populus nigra* 'Italica' trees in north-western part of Hungary. We investigated the effect of the local environmental conditions (biogeographical species pools, site conditions, surrounding vegetation) on the diversity of *Pemphigus* species under three different conditions: urban, village and rural environment. Altogether eight *Pemphigus* species were recorded. The dominant species was *P. spyrothecae*; however the frequency varied strongly among the sites. The less frequent species was *P. borealis*. These gall makers showed higher species diversity in the village sites than the urban and rural sites. *Pemphigus* species have different life strategies which can help to adapt to the various conditions. Based on the life-strategy eight species were classified into four groups. These groups were compared on the different survey sites.

Invading pine processionary moths benefit from escape from natural enemies

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Under temperate latitudes, low temperature is usually a key factor constraining the distribution of insects species through minimal thresholds required for survival and development. Thus, range shift is one of the striking observed effects of global warming on a number of cold sensitive species. However, the consequences of such range shifts on inter-specific interactions, especially with natural enemies, are largely unexplored. The winter-developing pine processionary moth, Thaumetopoea pityocampa (Lepidoptera, Notodontidae), occurs around the Mediterranean Basin and expanded considerably its range distribution towards higher latitudes and altitudes over the last two decades. This range expansion is clearly associated with better winter survival and enhanced feeding activity related to climate warming. We tested whether the egg parasitoids actually tracked the expanding host populations. Egg parasitism rates and structure of egg batches were surveyed along three transects from the moth endemic area to the front area in several regions of France. Observations were made on a total of 71757 eggs from 426 egg batches. Parasitism rates and structure of egg batches significantly differed along the expansion transects. Total parasitism decreased from the

endemic area to the front area whilst the mean number of eggs per batch increased. The degree of polyphagy also influenced the species- specific response of egg parasitoids. These results suggest that expanding populations may escape from natural enemies for a given period at least. With a lower parasitism rate combined to more eggs laid, the colony size might be greater and could provide higher winter survival enhancing the expansion speed.

Increasing defoliator pressure on the Hungarian Forests

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The analysis of the Hungarian meteorological data shows increasing frequency and severity of droughts in Hungary during the last 50 years. In the same time both the total insect damage and the insect defoliation recorded in the Hungarian forests also show increasing trend. The last outbreak of *Lymantria dispar* peaked in 2004 with 212,000 ha are damaged. This damage area is more than 6-fold larger than the earlier maximum recorded in 1994. On top of the severely increased damage area its damage also expanded vertically causing considerable damage in montane beech stands. Yearly damage area of both *Euproctis chrysorrhoea* and *Thaumetopoea* show steadily increasing trends in the last decades. On top of these "classic" species of defoliators (earlier not known as pest) are emerging year by year. Reasons and consequences of these trends are discussed in the presentation.

Studies on tolerance resistance mechanism of poplar clones and willow species against the willow and poplar lace-bug, *Monosteira unicostata* (Mulsant & Rey) (Hemiptera: Tingidae), under natural conditions

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Willow and poplar lace-bug, *Monosteira unicostata*, is considered as an important pest of willow and poplar species and clones in Iran. The pest feeds on leaves by sap sucking and damages the chlorophyll leading to their yellowing and finally dropping after heavy infestation. During the Spring 2008, tolerance mechanisms of five poplar clones, including *Populus alba* 44.9, *P. deltoides missouriensis*, *P. euramericana grandis*, *P. e. marilandica* and *P. nigra* 56.53, and four willow species, including *Salix acmophylla*, *S. alba*, *S. elbursensis* and *S. fragilis*, were evaluated under natural conditions. Four young branches with 50 cm length, each with 4-5 similar leaves, were chosen from each poplar clone and willow species, as replications. After releasing 10 pairs of male and female bugs in each replication, the branch was completely surrounded by net cloth. One young branch with similar characters was also chosen in each clone or species as control. All infested and control stems were taken and moved to the laboratory and leaf yellowing surfaces were measured using Leaf Area Meter. Thereafter, leaf Functional Loss Potential (FLP) was computed and the data was statistically analyzed in which significant differences ($P<0.05$) were observed between the genera *Populus* and *Salix* based on FLP. So, willow had less tolerability than poplar trees and was more susceptible. Among the willow species, *S. alba* and *S. acmophylla* had the maximum FLP and were considered as susceptible species, respectively, and *S. elbursensis* had more tolerability than other willow species. Among the poplar clones, *P. a.* 44.9 and *P. d. missouriensis* had maximum and minimum FLP and were considered as the most susceptible and most resistant clones, respectively.

S13: Aquatic insects III.

Room Rome

Diel and seasonal dispersal of aquatic Coleoptera and Heteroptera species – Are the diel dispersal patterns species- or environment-dependent?

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Both the daily and the seasonal dispersal dynamics of aquatic Coleoptera and Heteroptera species were studied in 2005 under various environmental circumstances by monitoring number of species and number of individuals of insects attracted to highly and horizontally polarizing shiny black plastic sheets laid on the ground. During our weekly samplings insects landed on three 9×3 meter sized test surfaces were collected continuously by manual sampling and using insect aspirators. Samples were separated hourly and the environmental variables (e.g. wind speed, air temperature, air pressure, relative air humidity, light intensity and indirectly polarotactic detectability of water surfaces), possibly affecting the dispersal, were continuously registered. During the sampling periods (30 days, 24 hours every day) more than 45000 individuals were captured, belonging to 86 (69+17) aquatic Coleoptera and Heteroptera taxa. Species and/or species groups could be characterized by different diel and seasonal dispersal activity patterns. We observed at least 3 seasonal and 4 diel basic types and several remarkably different subtypes of flight activity. Our results suggest that diel flight activity patterns are not species-dependent, diel patterns could be changed between seasons: one and the same species shows extreme and statistically significant differences in diel flight pattern among spring, summer or autumn periods because of different environmental circumstances.

Dispersal in aquatic beetles – effects of environmental variability and species and individual traits

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We studied the flight activity of aquatic beetles in a semi-permanent wetland using a light trap in 2002-2006. Our goal was to measure the effects of environmental conditions (temperature, weather conditions and water level fluctuations), sex, maturity and body size on the flight activity of aquatic beetles.

Flight activity (individuals per night) was highest in summer and major peaks coincided with periods of rapid desiccation of the wetland. No flight occurred when the temperature

dropped below a certain threshold, which seems to be at least family-specific and depends on body size. Key factors influencing short-term fluctuations of the total abundance and species composition were air temperature and water depth. Moreover, we detected significantly higher proportion of females and immature adults at light compared to individuals collected in water. This suggests high dispersal rates of females prior to reproduction.

Our results indicate that dispersal of water beetles in standing water bodies is driven by several simple mechanisms with clear adaptive value and allow us to predict behavioural responses of various groups of water beetles to environmental change.

Comparison of aquatic weevils fauna (Coleoptera: Curculionoidea) of four artificial lakes in Central Serbia

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Reservoirs of water-supply are interesting lakes' ecosystems, successively replaced former river ecosystems. The weevils' assembly develops following their host macrophytes. In the frame of weevils' fauna researching realized during 2001 and 2002 in wet habitats connected with four artificial lakes in Central Serbia (Gruža, Grošnica, Šumarice and Bubanj) the 268 aquatic adults were collected. They belong to 13 species from two families, Eryrhinidae (*Tanysphirus lemnae* and *Notaris scirpi*) and Curculionidae (*Bagous bagdatensis*, *B. collignensis, B. lutulentus, Pelenomus canaliculatus*, *P. comari*, *P. waltoni*, *Phytobius leucogaster*, *Rhinoncus castor, R. inconspectus*, *R. pericarpius* and *R. perpendicularis*). Quantive and qualitative results as well as indices of similarity of aquatic weevils' settlements clearly correspondence with dimensions and ecological characteristics of studied aquatic systems.

Ecology of the watersnipe-fly, *Atherix ibis*: Myths and facts

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This paper presents recent and realistic, Danish distribution data showing the species to be widely distributed in streams in the Jutland peninsula, but markedly absent from the numerous islands.

Density of flies in clusters were estimated at c. 5 flies per cm^3. Some observations hint that pheromones may lead females to the cluster. The flies fasten to surfaces and each other by nanostructures (acantae) on the feets pulvilli.

There is no increased temperature inside the cluster as compared to the ambient temperature. When the eggs hatch, the larvae stay in the cluster for some time, probably 1-2 days, before they drop into the water.

Most larvae in the cluster had an egg-tooth (ovi ruptur), but it was absent from most larvae which had just left the cluster. There were, however, no significant difference in larval length between the two groups of larvae, and no empty larval skins were found in the clusters. There were no signs of larval feeding on dead flies or predation. No signs of larval growth were observed in the cluster.

The majority of larvae left the cluster during night time, also when the normal day-night rhythm was eliminated by black out. A light rhythm may not be detectable in the interior of a dense cluster in the shade under a bridge. It is suggested that a temperature rhythm rather than a light rhythm trigger larval departure from the cluster. In experimental setups, physical disturbance of clusters greatly enhanced the number of larvae leaving clusters night and day.

Observations of larvae in micro-stream aquaria revealed glimpses of the elusive life of the larvae in the stream interstitial. Apparently they stun their prey at some distance (< 1 mm) before they penetrate them with their needle shaped mandibles.

Hemocyanin in Plecoptera order: recomposing a puzzle

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In this work we present the current knowledge about presence and distribution of hemocyanin in the Plecoptera as it comes out from our researches. We have been studying the presence of hemocyanin across the order Plecoptera since 2005. We cloned and sequenced cDNAs corresponding to the conserved hemocyanin fragment in domain II and studied their expression with PCR. Amino acidic sequences were analyzed in immune detection and mass spectrometry techniques. Also, phylogenetic analyses on the obtained sequences were carried out and commented. We assessed presence/absence of hemocyanin in the larval and adult stage on chosen species belonging to the seven families of the European stonefly fauna. Selected Oriental and South African stonefly species living in environments with different ecological features respect to those of the Palaearctic streams have also been tested.

On the basis of our outcomes, we have revealed that hemocyanin seems to be not uniformly distributed within this order. Phylogenetic relationships, environmental induction and biological aspects are discussed as possible factors that may be correlated with the presence or absence of hemocyanin in the studied species. As a consequence, we have taken into account the potential multifunctionality of hemocyanin, that in the Plecoptera could act not exclusively as a respiratory protein.

S14: Insect behaviour (incl. Insect acoustics) III.

Room Maastricht

Erythroneura spp. (Cicadellidae) feeding behaviour on grapevine

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Among the 135 leafhopper species collected during a three-year survey in Canadian vineyards, *Erythroneura* spp., reported as Aster Yellow phytoplasma carriers, were the most abundant. As phytoplasmas are transmitted during food intake, feeding behaviour of three *Erythroneura* species (*E. elegantula*, *E. vitis* and *E. ziczac*) was investigated using electropenetrography (EPG). Waveforms generated by stylets penetration in plant tissues allowed the distinction of different patterns of feeding, characterized by their voltage amplitudes and frequencies. EPG analyses showed that *Erythroneura* spp. essentially fed in mesophyll and xylem but did not feed in the phloem sap. These results were confirmed by histological studies, interrupting EPG recordings after each characteristic feeding phase.

Because phytoplasmas are known to be localized in phloem sap, our results question the mechanisms by which *Erythroneura* spp. acquire and potentially vector phytoplasmas.

Effect of drought stress on plant resistance to specialist and generalist insect herbivores

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Drought events are predicted to increase in frequency due to global climate change, yet consequences for plant–insect interactions remain to be elucidated. Drought may increase or reduce plant resistance to insect herbivores. Possible explanations for contradicting findings are differences in stress intensity or in the degree of herbivore feeding specialization. We investigated effects of different drought stress intensities on plant resistance to a specialist and a generalist leaf-chewing insect herbivore. Resistance of host plants grown under different watering regimes was assessed in feeding choice and insect development tests. We found that drought stress influenced herbivore feeding choice and development, however, the generalist and the specialist showed opposite responses in host acceptance. The generalist herbivore consumed more of plants grown under severe drought stress, while the specialist preferred feeding on well-watered plants. Inconsistent with the feeding choice, the specialist performed significantly better on drought stressed plants, as development time was reduced and pupal mass was higher compared to individuals developing on well-watered plants. The generalist was unable to complete development independent of drought stress intensity. We conclude that drought events are likely to cause shifts in herbivore feeding preference or host plant suitability for insect development. Differing responses of the specialist and generalist herbivore emphasize the need to consider herbivore characteristics such as diet breadth to understand and predict the effects of changing drought patterns on plant–herbivore interactions.

Climate change alters phenology and abundance in butterflies and dragonflies

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Phenology refers to the study of seasonal appearances and timing of life-cycle events. Phenological activities of ectotherm animals are influenced by environmental temperatures. It is hypothesised that, due to increasing temperatures, spring activities will shift forward in time while autumn activities will occur later in the year. In the scope of the Flemish Nature Report, we analyse flight periods of butterflies and dragonflies. To assess flight periods, we used the data collected between 1980 and 2006 by volunteers of the Flemish butterfly and Flemish dragonfly working groups. These data were related to temperature data collected over the same period by the Belgian Royal Meteorological Institute. Overall, the flight period in most butterfly species changed over 26 years. Early generations generally shifted forward in spring; late generations occur later. Some species did not change. In dragonflies, the flight period did not change over time for most species. Annual flight period is correlated with temperature in 20 of the 23 species tested in butterflies and in 18 of the 22 tested dragonflies. Species where the flight period extended also showed an increased abundance over the same time span.

Monday poster session

MO 1-8: Urban entomology, urban pest

MO 1
Insecticide products for houshold use as one of the way mosquitoes-control

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The role of mosquitoes in transmission of infectious diseases is very important. Various insecticide products are used to control mosquitoes indoors. For household application against mosquitoes more often are used electrofumigators (EF) which are presented by the cellulose plates (mats), the special vials with a liquid, and tablets as complete units with the electric device (electric heaters). These products are approved for using in the presence of people in the rooms with open windows within 4-8 hours a day. Pyrotechnic products (as coils, sticks, etc.) are recommended to be used in open or well ventilated areas such as verandahs, summer small houses, etc.

The analysis Register of the Insecticide products allowed for household use in Russia within the period from 2003 to 2009, showed that since 2003 the quantity annually registered insecticidal products decreases, but thus the share of EF in total amount of all of the others forms remains high. In 2003 53 items of the EF have been registered, between 2004 and 2006 per 20-24 items annually; in 2007 – 17, in 2008 – 15, 2009 – 9 items. Among total amount of the EF, registered annually, shares of the plates and a liquid in the vials are approximately identical.

For the last years the assortment of these products has extended due the new active ingredients (a.i.) that has allowed to broaden a spectrum of target objects. With application as a.i. vaporthrin to target objects were added house flies, wasps. In 2008 such new form EF as a tablet impregnated by the pyrethroid transfluthrin was registered.

The basic actives used in the EF are highly volatile pyrethroides providing fast knock-down at insects: prallethrin, d-allethrin, d-trans-allethrin, S-bioallethrin, vaporthrin, transfluthrin. In plates use prallethrin in quantity from 7 to 15 mg/plate, s-biothrin - 15-25 mg/plate, vaporthrin – 25-50 mg/plate. In liquid use prallethrin in number of 0,7 %-2,2 %, s-biothrin 2,8 %-6,6 %, vaporthrin 2,8 %-5,0 %.

The assortment of products against mosquitoes for household use is represented by both domestic and imported ones. In Russia and nearby foreign countries there are several large facilities manufacturing insect control mats and liquid for electric heaters. The most significant manufacturers are INVENT (the Moscow area), BIOGARD (Moscow). There are the factory of household chemical goods in Brest (Byelorussia), SC Johnson (Ukraine), etc. Each of mentioned forms of products against mosquitoes has advantages and disadvantages, and generally supplement each other. However in any case their use demands strict observance of safety measures according to a label as the insecticide gets into the air.

MO 2

Adult insecticides susceptibility status of *Aedes albopictus* Skuse, *Culex quinquefasciatus* Say and *Culex vishnui* Theobald collected from a pig farm in Tanjong Sepat, Selangor

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The susceptibility of *Aedes albopictus*, *Culex quinquefasciatus* and *Culex vishnui* obtained from a pig farm in Tanjong Sepat, Selangor against chemical insecticides were evaluated. The adult mosquitoes were collected by using human landing catch (HLC) and identified. The adult bioassay procedures of WHO was performed against field collected *Ae. albopictus*, *Cx. quinquefasciatus* and *Cx. vishnui*. Four groups of insecticide were used in the adult susceptibility test, namely organochlorines (DDT, dieldrin), carbamates (propoxur, bendiocarb), organophosphates (malathion, fenitrothion) and pyrethroid (permethrin, deltamethrin, cyfluthrin, lambdacyhalothrin, etofenprox). *Culex vishnui* exhibited complete mortality at 24 hours post-treatment against all groups of insecticides; while *Aedes albopictus* exhibited complete mortality against all insecticides tested. *Culex quinquefasciatus* showed various susceptibility status against all groups of insecticides. It was only susceptible to lambdacyhalothrin, etofenprox, bendiocarb and fenitrothion, with percentage mortality of 80.00, 93.33, 93.33 and 100, respectively. This study indicates that only lambdacyhalothrin and etofenprox were able to achieve high mortality (>80%) against *Ae. albopictus*, *Cx. quinquefasciatus* and *Cx. vishnui* in the pig farm in this study. The data obtained from this study can be used as a reference for vector control programme to select the effective insecticides against these adult mosquitoes.

MO 3

Temporal changes in the distribution and abundance of medically important mosquitoes in residential areas in Kuala Lumpur, Malaysia

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The distribution and abundance of medically important mosquitoes was studied in 6 selected residential areas in Kuala Lumpur, Malaysia. The sampling was carried out from January to December 2006 by using human landing catch (HLC) conducted by staff of Kuala Lumpur City Hall. Data obtained from all sites were pooled and analysed. The correlation between abundance of mosquitoes and meteorological conditions (temperature, rainfall and humidity) were also analysed. Mosquitoes belonging to the genera *Aedes*, *Culex*, *Armigeres*, *Mansonia* and *Anopheles* were collected in year 2006. The *Aedes* mosquitoes comprised *Ae. albopictus*, *Ae. aegypti* and *Ae. niveus* gp.; while *Armigeres* mosquitoes consisted of *Ar. kesseli* and *Ar. subalbatus*. The *Culex* mosquitoes collected were those of *Cx. quinquefasciatus*, *Cx. vishnui* and *Cx. gelidus*; while *Mansonia* mosquitoes consisted of *Ma. uniformis* and *Ma. indiana.* The anophelines collected were those of *An. maculatus*, *An. karwari*, *An. barbirostris* and *An. hycanus* gp. *Aedes aegypti* and *Culex quinquefasciatus* were the most abundant and the major nuisance mosquitoes found in all study sites. The abundance of *Aedes aegypti* ($r = -0.817$, $p < 0.05$), *Culex quinquefasciatus* ($r = -0.850$, $p < 0.05$) and *Armigeres kesseli* ($r = -0.733$, $p < 0.05$) were significantly correlated with rainfall. However, no significant correlation was found between the abundance of mosquitoes and other meteorological parameters (temperature and humidity).

MO 4

Field evaluation of residue efficacy of insect growth regulators (IGRs) against *Aedes aegypti* (Linnaeus)

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The residue efficacy of the 2 groups of insect growth regulator (IGR) namely, juvenile hormone mimic (methoprene and pyriproxyfen) and chitin synthesis inhibitor (diflubenzuron, novaluron and cyromazine) was evaluated against laboratory strain *Aedes aegypti* larvae under field conditions. *Bacillus thuringiensis israelensis* (*Bti*) and temephos were also tested for comparison purpose. Plastic containers holding 5L of water was placed outdoor under the eave. Five replicates for each tested IGRs, *Bti* and temephos were used. Thirty early 3rd instar larvae were introduced into each containers and monitored daily. Adults emerging from each containers were collected and recorded. A 50% of the volume of water in the containers was removed and replenished weekly. The test procedure was repeated weekly by introducing a new batch of larvae into the containers. The indicators of effectiveness were (i) residual activities, and (ii) percentage emergence inhibition (EI) or mortality of IGRs, *Bti* and temephos. A cut-off point at 50% emergence inhibition (EI) or mortality was considered effective. Pyriproxyfen (19 weeks) showed longest residual activity with EI ≥ 50%, followed by temephos (16 weeks), methoprene (15 weeks), novaluron (13 weeks), cyromazine (8 weeks), diflubenzuron (6 weeks) and *Bti* (2 weeks). This study indicated that pyriproxyfen was effective for long-term control against container breeders, especially *Aedes* larvae, in comparison to other IGRs, *Bti* and temephos.

MO 5

A data base devoted to the insects of the Cultural Heritage

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The Interregional Center of Conservation and Restoration of cultural Heritage of Marseille (CICRP) and the National Institute of the Agronomic research (INRA), of Montpellier in collaboration with the National Center of DNA sequence (GENOSCOPE) of Evry, realized a database devoted to the" Insects of the Cultural Heritage ".

The database inventories and describes the dangerous insects present in heritage places constituting a risk for the conservation of the cultural property : museum collections, libraries and archives and historic buildings.

The database is a tool allowing survey and identification of the insects present in these places, these data are essential for preventive and curative measures to undertake in case of infestation.

It is dedicated to any professional in charge of cultural heritage conservation and to any other professional and scientist concerned or interested by these questions. Its contents, its ergonomics and its presentation makes the database accessible to any public.

For each species several entries are proposed such as the common names and the scientific names, the infested materials, the molecular sequence, the keys of identification (dichotomic and visual) ... These entries are related to a descriptive form for each species and gives information about their survey, their biology, their frequency, their distribution and their dangerousness towards cultural heritage materials (see Internet site).

MO 6
Effects of natural compounds on stored product pests evaluated by repellency and perforation ability trials

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In the view to develop an innovative system for the prevention of insect damages to food packs, repellency and perforation ability tests were performed to evaluate the effects of two essential oils (basil and vetiver) and of an azadiractin based formulation on the stored product pests *Rhizopertha dominica, Sitophilus oryzae, Tribolium castaneum* and *Stegobium paniceum.* Repellency was tested by means of Petri dishes lined with filter paper where a half was treated with the test substance and the other half left untreated. The position of 10 insects was recorded after 1, 2, 4 hrs and repellency indexes were compared. Perforation ability trials were carried out using an especially designed apparatus where 5 insects had to perforate a paper layer treated with the test substance in order to reach the food. Latency to perforation and mortality were recorded. All substances were tested at 3 concentrations (1, 5, 10 ml/m^2). From repellency trials emerged that vetiver oil was repellent for all species even at the lowest concentration; basil oil was attractive for almost all species except *R. dominica*; the azadiractin based product was slightly repellent for *T. castaneum*, slightly attractive for *R. dominica* and toxic to *S. paniceum*. Perforation ability trials were performed only on *R. dominica*, whose penetrating capacity was reduced by all substances, especially at the highest concentrations, and on *S. oryzae*, where only vetiver oil showed an evident inhibitory effect to perforation.

MO 7
Survey on flies species and density in a restricted rural area of north-eastern Italy characterised by a high breeding concentration

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The aim of this work was to estimate the flies species, density and correlation with territorial and climatic data in a rural area in which flies are often reported as a trouble by the local population. The area (total 153 Km^2) including 6 municipalities was split in 53 squares (1.5x1.5 km) and a sticky chromothropic Trap (SC Trap) was put in each cell to estimate the flies density, along with 13 Iglu traps for species determination. Flies were collected every 10 days and only the species annoying to man counted.. The mean and total number of flies were correlated (ANOVA and linear correlation) with number and type of breeding, animal stabled, distance of the trap to the closer farm and climatic data. Overall 63.945 flies were captured by SC Traps from March to November 2009. The main genera identified were: *Musca, Sarcophaga, Lucilia, Pollenia* and *Fannia*. There was no correlation among fly density and the type, number of breeding and their distance from trap during the whole period. A positive correlation was found between total number of animal in poultry farm ($r=0.301$, $p<0.05$) and increasing fly numbers only in August and October. The flies density peaks were apparently not influenced by climatic conditions but by agricultural management in specific months (i.e. spreading of the manure). This study has been useful to check "the fly problem" and stressed the importance of a correct management of dung, which is more important than the density of breeding and animal stabled.

MO 8
Climate change and insect biodiversity in Pakistan: A critical review

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Studies have been made to investigate the impacts of climate change on this region and biodiversity in Pakistan. Climate change affects biodiversity directly, and leads to the extinction of plants and animals that cannot keep up with rapid climate change. This is especially devastating in places where there are few plants or animals scattered over large areas. Because ecosystems are interlinked (i.e. if one plant dies out, it may affect a whole range of animals and insects (and possibly even other plants) that rely on it for food, shelter or reproduction) then even small changes may be important to the system as a whole. It is predicted that a major shift of flora and fauna is due to the increased temperatures and variable rains, especially on tropical dry forests, arid and semi-arid regions and deserts of Punjab, mangrove and sandy desert of Sindh, rocky desert of Balochistan and moist & dry savanna and pine forest of North-West Frontier Province of Pakistan. Climate change may alter the range and abundance of species present in an ecologic community. Nutrient cycle changes, community relocation, and biodiversity loss may each affect vector physiology and behavior (such as host-seeking characteristics and biting rates), vector populations (by increasing or decreasing birth or death rates), and vector migration (by changing availability of suitable habitats). Similarly, the ecologic factors may each directly influence pathogen dynamics for non-vector-borne diseases. Increase in rainfall and temperature could involve expansion of the malaria-carrying Anopheles mosquito into areas where

malaria has never existed, or had been eradicated. Desertification may counter this effect, but "on the whole, increasing temperatures could be expected to increase the reproduction rates both of the parasites and their vectors and hence augment transmission of malaria. Humid and warm weather throughout July and into August has provided an ideal environment for bed bug, cockroaches, termite, ants to breed. It is expected that these insects infest thousands of Pakistani homes.

There has been little research on Insect Biodiversity of Pakistan with reference to climate change. About 5,000 species of insects have been recorded (out of which 1,000 species of true bugs, 400 species of butterflies and moths, 256 species of grasshoppers & locusts and crickets, 135 species of beetles & weevils, 103 species of bugs, 110 species of flies, 73 species bees, wasps & ants, 65 species of plant hoppers, 52 species of thrips, 49 species of termites, 48 species of dragonflies and damselflies, 42 species of neuropterans, 32 species of cockroaches and few number of species in minor insect's orders are reported by the Department of Entomology, University of Agriculture, Faisalabad and University of Karachi, Pakistan, Biodiversity Action Plan for Pakistan, WWF - P, IUCN - P and GoP.

Climate change impacts many of insect populations i.e., reductions in the extent of distribution size of some of the species that feed on pests in forest, grassland, and agricultural ecosystems. Pollinators' population in plains has been decreased and observed to shift to mountainous region (northern part of Pakistan) whereas bees' swarms which were moved from southern part to central and to northern part have been decreased 50 percent since last 10 years due to environmental change including high temperature, dust and pesticide sprays. Few years back in Murree, Galiat, AJK typical die back symptoms were observed in Kail pine trees during summer. A pine shoot beetle (*Tomicus piniperda* L.) was the culprit. Its population flourish owing to the climatic change in the area like high temperature, less snow etc. resulting a severe outbreak while Leaf butterfly- *Kallima inachus* (Nymphalidae: Lepidoptera) in Pothohar region has been extinct due to this climate change.

MO 9-18: Role of biodiversity in pest management

MO 9
Study on the effects extent of the cultivar variation on the injury severity of pests and diseases of date palm

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The extent of cultivar variation is one of the effective factors on the pests and diseases injury. Date palm cultivation pattern in Iran is so that in most of the date groves many different date cultivars have been planted, and a single cultivar-cultivated plantation rarely can be found. In this study that has been carried out for evaluating the effects of date cultivars variation on stability increasing and intensity of important date pests and diseases injury. 30 date groves have been chosen thought the date cultivated areas of Khuzestan province. In each grove, the injury intensity of each pests and diseases has been estimated by sampling 15 date palms randomly. Cultivar variation index (CVI) in each grove has been calculated basis of Shannon method. In Khuzestan province there are more than 74 date cultivars. Correlation between CVI and injury severity of pests and diseases such as *Oligonychus afrasiaticus* M ،*Batrachedra amydraula* Myer، *Arenipses Sabella* Hmpsn ، *Microcerotermes diversus* Silve**.** ،*Oryctes elegans* Prell ، *Pseudophilus testaceus* Gab ، *Parlatoria blanchardi* Targ ، *Mauginella scattae* Cav and leafspot was –0.58, , -0.53, -0.6, -0.36, -0.3, -0.55, -0.33 , –0.79 and –0.55 respectively. This factor has significant effect (Significant level = 5 percent) on Khameje, Big date moth, Date palm spider mite, lesser date moth, Long horn beetle and Leaf spot but no significant effects on Termite, White Scale and Rhinoceros beetle. So the pests and diseases injury were reduced by CVI increasing and ecological stability.

MO 10
Defoliating and fruit boring Lepidoptera associated to Criollo Cocoa, *Theobroma cacao* L., in agroecosystems with a different plant composition in Mérida state, Venezuela

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The neotropical species *Theobroma cacao* L. is one of the most relevant agricultural products sold in the European market. During the colonial period, it was one of the main Venezuelan exports and, despite of its great quality and international appreciation, its culture suffered a marked drop during the last decades. Nowadays there is a great interest in the recovery of this traditional variety. Cocoa is usually cultivated under shade conditions in tropical rainforest, which has promoted a close relationship between the culture and the shade trees and a great insect species richness. Defoliating and fruit boring Lepidoptera are frequent pests of this culture. In Venezuela, only few lepidopteran species are recorded as pests of cocoa cultures. This study compares the diversity of defoliating and fruit boring species of Lepidoptera in two cocoa plantations with different plant species richness. Sampling was conducted every 15 days, from September 2009 to February 2010. Larvae found on cocoa leaves and infested cocoa pods were collected by hand in each plantation. Our results showed a high Lepidoptera species richness associated to the cocoa culture, with 18 defoliating and 3 fruit boring species. Parasitoids associated to these Lepidoptera were also recorded. Plant species richness and Lepidoptera abundance show a close relation, with the richest plantation showing the abundance of Lepidoptera larvae, with about 50 larvae versus 26 larvae recorded in the poorest.

This research was supported by the "CAMBIOS: Cacaocultura en Ambientes Biodiversos para la Sustentabilidad" project (LOCTI project supported by SOCAOVEN) and the Valrhona Foundation.

MO 11
The effect of vegetation management on apple orchards carabid (Coleoptera: Carabidae) assemblages

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Cover crops are useful tools for enhancing natural enemies in orchards. However, little is known about their effect on generalist predators on the orchard ground surface.

The effect of different groundcover management on the activity-abundance of carabids was investigated in an

experimental (IPM) apple orchard in Hungary. In the orchard we established three 1-ha plots where different groundcover management was applied: (i) flowering herbs in the alleys - FLOWER, (ii) mowed grass vegetation in the alleys - GRASS, (iii) bare ground in the alleys - BAREgr. Samples were collected by pitfall traps from April to October between 2002 and 2007.

The composition of carabid assemblages showed substantial differences in the plots with different groundcover management. Harpalus rufipes (De Geer, 1774), Harpalus griseus (Panzer, 1797), Calathus melanocephalus (Linnaeus, 1758), Dolichus halensis (Schaller, 1783) and Harpalus anxius (Duftschmid, 1812) were connected to the plots with higher herb coverage in the alleys, especially to the plot FLOWER. In contrast the activity-abundance of Harpalus distinguendus (Duftschmid, 1812), Amara aenea (De Geer, 1774) and Harpalus affinis (Schrank, 1781) decreased with the increasing herb coverage in the alleys and was especially high in the plot BAREgr. Calathus ambiguus (Paykull, 1790) Harpalus smaragdinus (Duftschmid, 1812) and Harpalus tardus (Panzer, 1797) were more common in the plot GRASS.

MO 12
The population dynamics of leafhoppers in Northern Vineyards

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Vineyards are attacked by a number of arthropod pests. The list includes 135 different species of leafhoppers. To-date 40 species have been identified as carriers of Aster yellows phytoplasma (Olivier et al. 2010). Twenty two data sets obtained from bi-weekly samples were used to develop a model driven on degree day accumulations made from March 1. The model predicted cumulative leafhopper abundance at 5 50 and 95% levels in vineyards to optimize leafhopper management. Moinitoring for leafhoppers in vineyards should be initiated at 630 degree-days 9 5% cumulative abundance) and discontinued at 1140 degree-days (95% cumulative abundance). Maximum abundance would be attained between 85 and 860 degree-days (50% cumulative abundance) calculated from March 1.

MO 13
Monitoring of the susceptibility of codling moth (*Cydia pomonella*) populations to *Cydia pomonella granulovirus*

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Codling moth (*Cydia pomonella*) is one of the most important pests in apple orchards. Preparations based on *Cydia pomonella granulovirus* (CpGV, family *Baculoviridae*) are main control agents used in IPM and organic production against this pest. CpGV is highly effective and environment friendly control agent. CpGV products are commonly used in many countries worldwide, while the registration of CpGV in the Czech Republic is still in progress. Although these products are very effective, several codling moth populations resistant to CpGV were found locally in Europe. Regarding the registration process of CpGV in the Czech Republic, susceptibility of different field populations of codling moth to CpGV was evaluated. Three codling moth populations originated from 2 localities with different control strategies. Parental generation was sampled from orchards (diapausing larvae) and the efficacy of CpGV was evaluated next year in bioassay with neonate larvae of the F1 generation. Larvae were tested on discriminating concentration of CpGV ($3x10^5$ occlusion bodies/ml), which enable to distinguish resistant and susceptible individuals after 7 days in bioassay. Two populations originated from Central Bohemia were susceptible to the virus, while the part of the population from South Moravia was resistant to the virus. The latter was experimentally treated with CpGV for more than 10 years.

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MO 14
Genetic polymorphism of codling moth in Croatia assessed by SSR markers

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This paper describes the effectiveness of SSR markers in assessing genetic polymorphism of codling moth (Cydia pomonella L.) sampled in Croatia. For this purpose nearly equal number of male codling moth individuals (total n=86) have been trapped both in conventional and organic orchards and using GenEluteTM Mammalian Genomic DNA Kit (Sigma-Aldrich, Germany) their genomic DNA was isolated. To assess genetic polymorphism 13 previously published microsatellite primer pairs developed for this pest were selected (Franck et al., 2005, Mol. Ecol. Notes 5: 99-102 and Zhou et al., 2005, Mol. Ecol. Notes 5: 226-227). Amplification of PCR products was performed as described by Franck et al. (2005) and Zhou et al. (2005) and visualization of fragments was done on 6% polyacrylamide gels followed by silver staining (Bassam and Caetano-Anolles, 1993, Appl. Biochem. Biotechnol. 42: 181-188). Four loci showed very good level of polymorphism (9 – 13 alleles per locus), eight loci showed satisfactory polymorphism (2 – 4 alleles per locus), while only one locus was monomorphic. Mean expected heterozygosity (HE) ranged from 0.01 to 0.84, while mean observed heterozygosity (HO) ranged from 0.01 to 1 for all loci across all individuals. This results give new insight on genetic structure of this economically important pest in Croatia.

MO 15
Determination of whitefly biotypes in oman through molecular techniques

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The sweet potato whitefly, Bemisia tabaci, is one of the major agricultural pests in different Gulf countries including Oman. Though, several biotypes of B. tabaci have been identified in different parts of world, no scientific study was done to know if there are different biotypes of whitefly present in Oman. The present study was designed to develop a suitable biotype detection method by using polyacrylamide gel electrophoresis (PAGE). A polyacrylamide gel electrophoretic method has been developed and used for detecting the presence of different whitefly biotypes / populations in Oman. The current technique was found to be successful for all the B. tabaci samples collected from different regions of Oman and also some samples from the neighbouring UAE and Jordan.

MO 16

Faunestic of pistachio aphids and identification by using galls form in Kerman – Iran

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The pistachio gall aphids (Hom.: Aphidoidea) are a major pest of fruit crops, vegetables and ornamentals in Iran. Economic losses from this pest may be caused through made of gall and by direct damage to the plants. The phonestic of pistachio gall aphids were studied during 2005. The infested leaves containing nymphs and adults were collected from Kerman province pistachio tress. At this study were collected following species with host and locate of collection and identify with gall forms.

Aphis gossipi on P.vera from Rafsanjan Aphis Craccivora on P.vera from Glosalar-Rafsanjan Aploneura lentisci on P.khinjuk from Meymand-Sahre babak Asiphonella cynodonti on P.vera/P.khinjuk from Giroft Baizongia pistacia on P.khinjuk from Khabr-Baft Rectinasuns buxtoni on P.vera/P.khinjuk/P.mutica from Sarcheshmeh/ Nogh Geoica urticularia on P.vera /P.mutica from Sarcheshmeh Geoica setulosa on P.khinjuk from Sardoyeh Slavum lentiscoides on P.mutica from Rafsanjan Slavum esfandiarii on P.mutica from Giroft/ Khabr / Sarcheshmeh Slavum wertheimae on P.mutica from Sarcheshmeh Slavum mordvilkoi on P.vera from Rafsanjan / Shahr babak Forda.kaussarii on P.khinjuk from Giroft Forda.marginata on P.khinjuk from Giroft Forda hirsute on P.vera from Rafsanjan Smynthurodes betae on /P.mutica from Kerman/Sarcheshmeh Paracletus cimiciformis on P.vera from Nogh/Zarand

MO 17

Distributional Patterns of five heteropteran key natural enemies in Iran

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Having information on distributional patterns of pest species and their natural enemies and the effects of climatic condition on their distribution model can help growers to manage them in a more accurate manner. Furthermore, a risk assessment for an invasive species that has not yet been established in a new habitat with a similar climatic condition of its present habitat nowadays is a very important aim of mapping its dispersal. In addition, knowledge of favorite environmental and climatic conditions for beneficial species can help in their better use in the biological control programs and increasing the chance of establishment of them in exotic habitats.

Climatic distribution maps of five heteropteran predators, e.g. *Andrallus spinidens, Arma custos, Arma inspenata,Picromerus bidens* and *Picromerus confomis,* were prepared using ArcGIS version 9.3. The maps were made using Spatial Join of bug's dispersal layers and the climatic zoning of Iran by UNESCO approach.

The result showed that among the 22 climate zones of Iran, *P. bidens* distribution was only limited to the SH-K-W climate zone. Most of the distribution (47%) of *A. spinidens* was in PH-C-W climate zone. It was also found in A-M-VW (24%), SH-C-W (14.29%), H-C-W (10%) and SA-K-W (5%) as well. Other species; *Arma custos, Arma inspenata,* and *Picromerus confomis,* were distributed in the same climate with a percentage of 100. Considering the distribution of these predators in climatic conditions in northern part of Iran (Gilan and Mazandaran provinces close to the Caspian Sea), it is concluded that their distributions is mainly dependent on high relative humidity.

Considering the importance of *A. spinidence* as a natural enemy of the key pest, *Chilo suppresalis*, in main rice growing areas of Iran, the predatory activity of *Arma* on at least 40 species of agricultural and forest pest, and the potential of *P. bidens* for controlling of the Colorado potato beetle in Europe and the presence of this pest in north and north-west parts of Iran, the obtained results could be applied in practical biological control programs in future.

MO 18

Faunestic study on soil mites in fruit orchards in Hamedan province of Iran

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In order to study the soil mite fauna of fruit orchards in Hamedan province including Heydareh, Abbasabad, Abshineh and daremoradbiyg, an investigation was carried out during 2008-2009. By using the Berlese funnel, soil mites were separated and microscopic slides were prepared. On the basis of obtained results, 10 families, 14 genera and 17 species were collected, indentified and described. Larva, male and protonymph of *Eupalopsellus hamedaniensis* Khanhani & Ueckermann (2007) for first time in the world was described. The species which marked with asterisk is new for Iran.

EUPALOPSELLIDAE: *Eupalopsellus hamedaniensis* (Khanjani et al).

STIGMAEIDAE: *Stigmaeus pillatus** (Wainestein) ; *S. elongates* (Berlese) ; *S. malehkii* Bagheri ; *Ledermuelleriopsis zahiri* (Khanjani & Ueckermann).

CALIGONELLIDAE: *Neognathus terrestris* (Summers & Schlinger) ; *Caligonella humilis* (Koch) ; *Molothrognaths azizi* (Khanjani & Ueckermann).

CHELETIDAE: *Acaropesella kulagini* (Rohd).

ANYSTIDAE: *Anystis baccarum* (Linn).

PSEUDOCHEYLIDAE: *Anoplocheylus malayeriensis* (Ueckermann & Khanjani). PACHYLAELAPIDAE: *Pachchylaelapes karawaeiewi* (Berlese); *Pachylaelapes siculus* (Berlese).

VEGAEIDAE: *Vegaia nemorensis* (Kock).

RAPHGNATHIDAE: *Raphignathus hecmatanaensis* (Khanjani & Ueckermann); *Raphignathus collegiatus* (Atyea et al); *R. protaspus* (Khanjani & Ueckermann). BDELLIDAE: *Bdella* sp.; *Spinibdella cronini* (Baker & Balock).

MO 19-35: Forest entomology

MO 19
Temporal changes in insect population form an important component of pest management

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The population dynamics of *Calopepla leayana* Latr., a serious defoliator of the commercially important timber species, *Gmelina arborea* (Roxb.) in Assam, India was studied in terms of the fluctuation in their abundance in relation to temporal changes in abiotic environmental factors. Adults and larvae were recorded from March to November after which they undergo a brief period of diapause during winter. The population peaked in August when temperature and precipitation were high. Forward stepwise regression and principal component analyses revealed temperature and rainfall to be the most important factor influencing the population. Forecast values for rainfall through time series analysis gave high values for 2008 (736.75mm). The rainfall in Assam during June, 2008 was 730 mm (Assam Tribune). Present day weather-associated fluctuations in forest insect pests may be useful analogues in understanding/predicting future pest outbreaks in forests.

MO 20
A large-scale experiment to control the spruce bark beetle *Ips typographus* using pheromone-baited and insecticide-treated trap logs in Sweden

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In 2006-2009, ca 3.2 million m^3 of spruce forests have been killed by the spruce bark beetle *Ips typographus* (Col., Scolytinae) in southern Sweden following the huge storm in January 2005 that blew down ca 70 million m^3. Salvage logging has been the main control option but in 2008, two large Swedish forest companies, Sveaskog and Södra Skogsägarna decided to set up a large-scale control experiment in cooperation with SLU in order to try to evaluate the efficiency of pheromone-baited trap logs in reducing beetle-related tree mortality.

Six beetle-damaged areas, each ca 2000 ha in size, were selected and divided in two parts which were randomly assigned to trapping and control areas. Altogether, 446 log traps, i.e. spruce logs sprayed with insecticides and baited with pheromones, and 490 untreated control spots were laid out at stand edges close to last year's beetle attacks. Beetle flight was monitored using 12 groups of pheromone traps, six in the trapping and six in the reference areas. Tree mortality was recorded in the autumn in all areas within 60 m from the trapping spots with or without traps. In addition, the areas were surveyed from the air using helicopters.

Data-analyses are still in progress, but two conclusions can already be drawn. The recorded tree mortality was ca 30% lower in the trapping areas than in the reference areas. A similar reduction in beetle catches in the monitoring traps can be seen in late season compared to early season. Further analyses will show if the reduction in tree mortality goes beyond the 50 m radius and can justify the costly trapping efforts.

MO 21
A contribution to bee fauna (Hymenoptera; Apoidea) in East Azerbayjan province- Iran

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Superfamily Apoidea are common pollinators in the mountainous areas of Iran. Bees visit the flowers not only for the carbohydrates but also to collect the nectar produced by the plant. In most species the larvae feed and develop upon a mass of pollen stored in the cell by the female bee. Nests are typically constructed in the soil, but a wide variety of natural cavities may be used. Many plants such as alfalfa depend on the cross pollination to produce valuable seeds or fruits thus their presence is very important to survive of the grasslands. Totally 826 specimens from 36 different species belonging to Apidae, Anthophoridae, Halictidae and Megachilidae families were collected in mountains' grasslands of East Azarbayjan province during 2008- 2009. Among them four species, *Rhodanthidium septemdentatum* (Lepeletier, 1841), *Coelioxys afra* Lepeletier, 1841, *Megachile nigriventris* Schenck, 1870 and *Megachile lagopoda* (Linnaeus, 1761), are the new records for the Iran insect fauna.

MO 22
Ecology of the Galling Aphid *Forda riccobonii* (Stefani) on *Pistacia atlantica* Desf. in Natural Habitats

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Pistacia atlantica is a dominant tree of the Irano-Turanian vegetation in the Levant. It is parasitized by a guild of 7 gall inducing aphids, among them the uncommon *Forda riccobonii*, which ecology was not studied in details. This aphid has a complex life cycle, forming two different galls on the host tree: first, created by the fundatrix, the second by their offspring. During this research, 427 trees, growing in natural habitat in the northern region of Israel, were searched for the presence of secondary galls. This species occurred on only 29 trees in 7 of the 12 research sites, indicating that *F. riccobonii* is less common in natural habitats than previously presumed. In the galled trees, a mean of 22.7 galls ± 6.30 (SE) was located in 20 randomly selected branches. The distribution of the galls among the leaves on the galled shoots was not random: they were more on the leaves that developed in the mid–season. Gall size varied greatly, depending on the number of chambers they comprised, from 1 to 10. A high correlation was found between the number of chambers in the galls and the reproductive success of the F_2: a mean of 62 ± 2.5 offspring (range: 47-81), more than other galling aphid species that create two different galls in *P. atlantica* trees during their life cycle.

Compared with other galling aphids in *Pistacia,* relatively few galls (19%) were occupied by predators, parasites, or inquilines. Of these, parasitoid wasps comprised more than 50%. The colonies in the parasitized galls succeeded in producing the same mean number of offspring as those living in intact galls: it seems that the specific morphology of the galls provides suitable protection from large enemies.

MO 23

Crude leaf extracts from *Schinus molle* are effective against the elm leaf beetle *Xanthogaleruca luteola*

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The *Ulmus* species (Ulmaceae) insect defoliator *Xanthogaleruca luteola* Müller (Coleoptera: Chrysomelidae) is present in several regions of Chile, especially in the central area. It causes strong damage in elm trees mainly in parks, street tree-lines and gardens. Extracts of crude leaves of *Schinus molle* Rev L. (Anacardiaceae) obtained with water or ethanol as solvents were evaluated in the laboratory for their insecticidal effect on adults of the elm leaf beetle, *X. luteola*, at 2.0, 2.5, 3.5, 4.3, and 4.7% w/v for the ethanol extracts, and 2.5, 3.0, 4.3, and 5.6% w/v for the aqueous extracts. The extracts were applied onto leaves of elm trees to observe the feeding of adults, and later their effectiveness and determine the LC_{50}. Both extracts were effective and caused mortalities greater than 97% with the ethanol extract at the two highest concentrations (4.3 and 4.7% w/v), and near to 27% with water at 4.3 and 5.6% w/v. The LC_{50} of the ethanol extract, calculated through Probit analysis was 1.88% on the 2nd day, lower than the LC_{50} of 8.52% on the 4th day achieved by the aqueous extract. Additionally, the antifeeding effect of both extracts on adults was determined. The aqueous extract inhibited feeding completely (100%), whereas the ethanol extract did not cause any antifeeding effect.

MO 24

Toxicity and repellence of fruit extracts from *Melia azedarach* on the elm leaf beetle *Xanthogaleruca luteola*

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Xanthogaleruca luteola Müller (Coleoptera: Chrysomelidae), an insect defoliator of *Ulmus* species (Ulmaceae) currently in several regions of Chile, especially in the central zone. This insect causes strong damage in trees present mainly in park wooded areas, street tree-lines and gardens. To determine the insecticidal effectiveness of aqueous and ethanolic extracts from immature fruits of *Melia azedarach* L. (Meliaceae) on adults of this insect species, bioassays were carried out in the laboratory. Different concentrations of the extracts with a diverse range of solvents were evaluated and their effectiveness and lethal concentration to kill 50% of the insects (LC_{50}) were determined. Additionally, the antifeeding activity of the extracts was evaluated. The extracts from fruits of *M. azedarach* were effective as insecticide agents against adults of *X. luteola*, and the higher concentrations caused greater mortality. The ethanolic extracts performed better than the aqueous ones, and had LC_{50} of 0.94 and 6.55%, respectively. Results corroborate the antifeeding action of the extracts of the immature fruit of *M. azedarach* on adults of *X. luteloa*.

MO 25

Changes of infection level caused by protozoan disease *Gregarina typographi* in beetles of *Ips typographus* (Coleoptera: Curculionidae) in nuptial chambers

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Changes in the infection levels of Gregarina typographi (Apicomplexa: Gregarinidae) were studied in bark beetle Ips typographus L. (Coleoptera: Curculionidae, Scolytinae), which live associated with Norway spruce (Picea abies (L.) Karst). Three samples were repeatedly collected from four section of ten trap trees during 2009 (May, June, July) in one study site in Beskydy Mts. (Czech Republic). In May, a total 792 beetles were dissected and analysed, the average level of protozoan disease Gregarina typographi reached 10.66%. In June, the infection level of G. typographi averaged 19.78% (454 beetles) and only in single individual microsporidium Chytridiopsis typographi (0.002%) was found. In July, the level of disease G. typographi was only 6.61%; and 8.87% of individuals were infected with Mattesia schwenkei (Protozoa: Neogregarinida). Statistically significant difference was found between the infection levels of G. typographi in collection in different periods (Kruskal Wallis test, chi-squared = 13.034, $p < 0.01$); the differences between sections and traps were not statistically significant. The twice increasing of G. typographi infection level had to be a result of disease transfer between beetles in nuptial chambers during the copulation and egg laying (May-June). Because of existence of only one generation in studied altitudes, population of beetles collected in July originated from beetles flown from lower altitudes and other places. It explained significantly lower infection level of G. typographi.

MO 26

Pupal parasitoids of the Pine Processionary Moth *Thaumetopoea pityocampa* (Denis & Schiffermüller) (Lepidoptera: Thaumetopoeidae) in the Aspromonte Mountain Park (Italy)

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In 2008, in the mountain park of Aspromonte, Calabria, Italy, a study of Thaumetopoea. pityocampa (PPM) pupal parasitoids was carried out from collected pupae. The parasitoid species: Villa brunnea, Becker (Diptera: Bombylidae) Phryxe caudata (Rondani, 1859) (Diptera: Tachinidae) and Coelichneumon rudis (Fonscolombe, 1847) (Hymenoptera: Ichneumonidae) were identified. The Diptera parasitoids emerged mainly in the same year of collection, while C. rudis emerged in the following year 2009. The emerging adults (PPM and parasitoids) affected only 24.75% in 2008 and 6.01% of total pupae in 2009. On the adults which emerged, P.caudata was the predominant parasitoid (10.90%) followed by V. brunnea (5.30%) and C. rudis (1.77%) on a total of 396 undamaged pupae observed. As to the order of adults' emerging, the PPM appears first, followed by V. brunnea, P. caudata and, last, C.rudis, in the May of the following year. PPM moths emerged from pupae mainly during the night time, P. caudata during the first part of the day and no difference was found for the emerging of V. brunnea and Crudi. in day time (24 hours periods). V. brunnea starts flying 28 minutes after emergence. Ecological implications of such parasitisation are discussed.

MO 27

Ecological diversity in the population of curculionid pests of forest plantaion (Curculionidae: coleoptera)

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The curculionids form an important part of the phytophagous beetles and are associated with variety of flora. A large number of curculionids are pest of forest trees of economic importance like *Tectona, Dalbergia, Eugenia, Pinus, Mangifera, Quercus, Ficus, Acacia, Tamarix, Shorea, Cassia,* etc. The study has been made by observing the type of flora of different regions for working out the possible co-relation of the concerned species with biotic and abiotic factors. Sympatric and Allopatric occurrence of the species has shown promising relationships which are likely to be proved extremely useful in establishing ecological patterns of distribution. The various aspects which were studied to correlate their ecological characteristics with behavioural patterns pertaining to the amount of host plant range , seasonal prevalence , fecundity, development and population structure will be highlighted.

MO 28

Comparison on the biodiversity of butterflies in a primary and human disturbance forests in Peninsular Malaysia

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This paper presents the diversity of butterfly (Insecta: Lepidoptera) found in pristine primary and disturbed forested areas in Peninsular Malaya. The butterflies were collected from a pristine primary forest located in Southwestern Region of Endau-Rompin Johor National Park and a human disturbance forest located in Kenaboi Forest Reserve, Jelebu, Negeri Sembilan, Malaysia. Our survey yielded 254 species belonging to 129 genera of 5 families from Kenaboi Forest Reserve and 206 species belonging to 103 genera and 5 families from southwestern region of Endau-Rompin Johor National Park. Of these species, 9 were classified as rare and 6 were classified as very rare species in Kenaboi Forest Reserve; while 84 species were new records and 10 species were reported as rare in southwestern region of Endau-Rompin Johor National Park. The data obtained in these 2 sites were compared and discussed.

MO 29

Life cycle of cedar processionary moth *Traumatocampa ispartaensis* in Turkey

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Traumatocampa ispartaensis Doğanlar and Avcı (Lep.: Notodontidae) is one of the most dangerous pests of *Cedrus libani* A. Rich forests in the Isparta region and in some forests of Taurus Mountain in Southern Turkey. *T. ispartaensis* has been identified as a new species from Turkey in 2001. The caterpillars feed on the needless of cedar trees and produce tiny hairs containing and urticating substance, which causes contact dermatitis. The wingspan of the males is 26-29 mm and that of the females 34-37 mm. The adults appear from the mid of August until the end of September, depending on the temperature and altitude. The moth distribution between 1250-1650 meters. The females are lay on the underside of twigs of *C. libani*. Egg batches are covered by grayish, brown scales, similar to color of the bark and therefore inconspicuous. The number of eggs in each egg batch varied between 39 and 245 (mean 121). The eggs hibernate and hatch in the spring (mostly in the second half of April) of the following year. The caterpillars of the 5th instar live together in subsocial populations with a nest. Caterpillars build their nests on the trunk or branch of host trees and feed about 2.5 month, generally between end of the April and mid of the July. The old stage larvae are the most destructive ones whose serious infestation results in the complete defoliation of vast surfaces of the cedar forests. The pupation takes place in the first half of July, in a depth of 5-15 cm of soil, in sun exposed places in cedar woods along the sides of the roads. The pupa develops in a cocoon which is grey-brown in color.

MO 30

Insect pests in an elevated CO_2 atmosphere: a multiyear study with gypsy moth, *Lymantria dispar* and its natural enemy *Glyptapanteles liparidis*

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Here we present data from *in situ* feeding trials with the generalist herbivore *Lymantria dispar* and its most important natural enemy, the hymenopteran endoparasitoid *Glyptapanteles liparidis* conducted at the Swiss FACE site from 2005 to 2007. The data link changes in foliar chemistry of three tree species (*Quercus petraea, Fagus sylvatica, Carpinus betulus*) exposed to 540 ppm CO_2 since 2001 with growth and performance of caterpillars and parasitoids caged in the treetops.

Under elevated-CO_2, leaves from all tree species produced significantly more carbohydrates, especially starch and sucrose. Additionally, *Quercus* foliage responded with a decrease in water, nitrogen, protein, and fiber, and an increase in allelochemicals (e.g. condensed tannins). Little variation or changes in opposite directions occurred in *Fagus* and *Carpinus*.

Responses of the developing gypsy moth larvae were highly host-plant specific. The larvae compensated adverse effects (e.g. low nitrogen in elevated-CO2 Quercus) by increased and longer feeding. Favourable conditions (e.g. high nitrogen and carbohydrates in Fagus and Carpinus) resulted in higher body mass and shorter development time. Caterpillars from elevated-CO2 trees produced up to twice the normal amount of faeces, probably because they were eating more and the leaves were harder to digest.

The results of our feeding trials showed conclusively that low nitrogen in leaf tissue had the potential to affect insect fitness negatively. Larvae performed inferior when developing on low nitrogen (elevated-CO_2 *Quercus*) and performed better on high nitrogen diets (elevated-CO_2 *Carpinus*). Under both CO_2 treatments, gypsy moth male pupae achieved similar weights. However, female pupae from elevated-CO_2 *Quercus* and *Fagus* were smaller, while those from elevated-CO_2 *Carpinus* were bigger than pupae from ambient-CO_2 trees. After two generations on elevated-CO_2 trees, the moths produced egg masses with equal numbers of eggs on *Quercus*, but a significantly lower number of eggs on *Fagus* and *Carpinus*. In general, CO_2 induced effects observed in the first generation remained significant also in the second generation.

Overall, mortality of host larvae parasitized by *G. liparidis* was 4x higher in hosts from elevated-CO_2 trees. However, we observed little CO_2 effects on parasitoid life-history

parameters (number of parasitoids/host, endoparasitic and total development, wasp biomass, mortality during pupation, etc.), except for *Carpinus* where parasitoid development was significantly accelerated and the number of wasps that emerged successfully from their cocoons increased.

When given a choice, female wasps opted for larvae from ambient-CO_2 *Quercus* suggesting that the parasitoids prefer hosts with the highest nutritional quality for their progeny.

MO 31
Diversity of Diptera in a deciduous forest: The role of tree and herb diversity

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Plant diversity can exert a strong influence on the diversity of insects. In contrast to grasslands, little is known about this relationship in forest ecosystems. Temperate deciduous forests contain a distinct herb layer whose diversity is determined by factors such as light availability, soil parameters and the composition of the tree layer. Tree and herb layer diversity might influence insect diversity by affecting resource heterogeneity or through indirect effects.

Here, we examine the effects of tree and herb species diversity on the diversity of Diptera in a temperate broad-leaved forest. We collected pan trap and suction samples at 84 plots across forest stands featuring a gradient of herb and tree species richness in the Hainich national park (Germany), one of the largest continuous areas of deciduous forest in Central Europe.

First results indicate that herb species richness indirectly influences fly diversity via changes in herb cover: A higher herb layer diversity is linked to a higher herb cover, which in turn has a positive effect on both diversity and abundance of Diptera. Increasing tree canopy cover leads to lower levels of herb cover, thereby exerting an indirect negative effect on fly diversity. However, tree diversity is positively correlated with herb diversity and therefore has a positive indirect effect on fly diversity.

From our first results we conclude that forests with a diverse plant community promote the diversity of Diptera. In the light of ongoing conversions from monospecific to mixed forest stands in Central Europe, this study contributes to our understanding of how plant diversity in forests affects insect communities.

MO 32
Canopy research in the botanical garden of the University of West-Hungary, Sopron

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We investigated the insect fauna in the botanical garden of the University of West-Hungary, Sopron using trap chains installed in the tree canopy. We hanged one trap chain onto a broadleaf (London Plane - *Platanus x hybrida*) and another one onto a coniferous (European larch - *Larix decidua*) tree species at the height of 4, 7, 10, 13 and 16meters respectively. Trap capture was checked every other week in 2009.

From 2nd of April to 27th of June in 2009 we caught altogether 577 *Coleoptera* individuals (245 in the traps on the broadleaf and 332 on the conifer tree). We have determined 74 beetle families, 83 genus and approximately 130 species. Besides of common and widely distributed species we caught some unique species too: this is the first record of *Cryphalus intermedius* (Curculionidae, Scolytinae). We also caught 970 individuals of non-*Coleoptera* species in this period.

Capture patterns and species composition will be illustrated and discussed in the presentation.

MO 33
Recently emerged or forgotten native pests in the Hungarian Forests

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Department of Forest Protection, Hungarian Forest Research Institute

An increasing number of insects – earlier has not been known as pest - became abundant enough to cause considerable damage in the Hungarian forests during the last two decades.

Chrysomela cuprea Fabricius had been considered as a rare leaf beetle until 2006, when it caused severe defoliation in both young and old hybrid and native poplar (*Populus alba*) stands in Central Hungary. Its mass occurrence repeated in 2009. Hardly anything is known about the biology of this species.

The notodontid, *Pheosia tremula* Clerk is widespread and common in the Hungarian *Salix* and *Populus* stands, the traps of the Hungarian Forestry Light Trap Network catch the adults at many places but its abundance has never reached the damage level in Hungary. It caused serious defoliation in 2009 in Central Hungary (overlapping with the former species). Bivoltine, the pupa hibernates. Flies from March to September. The caterpillars feed from May to October. Hosts are the *Populus* and *Salix* species but the caterpillars were also recorded feeding on *Robinia*.

Two smaller scale damage events of *Agrilus viridis* Linnaeus were recorded in oak and hornbeam stands more than 70 years ago. In 2004 and 2005, following the extremely dry period (2000-2003) it caused mass mortality in SW Hungary.

These and a few other examples are presented and discussed on the poster.

MO 34
Half a century of the Hungarian Forestry Light Trap Network

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The Hungarian Forestry Light Trap Network (HFLN) was established in 1961. New traps were installed in the following years, so the number of light traps increased year by year. Today 25 Jermy-type light traps (with 125 W mercury light bulb) are in operation from sunset to sunrise between 1st March and mid/late December (depending on the air temperature). The traps are emptied daily. All Macrolepidoptera, the more important Microlepidoptera and some important Coleoptera (i.e. *Melolontha* spp.) are identified. The results (including exact numbers of specimen caught) are recorded in a computer database in daily base. Specimens of other insect groups (i.e. lacewings, weevils) are kept for further studies on demand. The main aims of the HFLN are:

Forest protection prognosis: Based on the long term data sets, the abundance dynamics of different outbreak species can be followed and predicted (early signs of the outbreaks, cycle length, etc.).

Faunistics: Light traps provide important and valuable data to knowledge on the fauna of Hungary. Many Lepidopteran species rare or even new for the Hungarian fauna were caught by the light traps.

Taxonomy: Relations of lower taxa within a species can be clarified using material caught by the light traps.

Ecology and environmental sciences: Influence of climate change on range expansion and phenology trends can also be well studied.

MO 35

The pest attack on *Shorea Leprosula* plants on nona mountain forest in Ambon Indonesia

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This objective of this research was to know intensity and frequency of the pest attack on *Shorea leprosula*

The research was conducted in of 2009 in Nona Mountain Forest in Ambon with the plant age of 20 years old. The observe of the pest was conducted directly by seeing the sign and symptom of on each plant observed (census).

The result of this research indicated that all of plants in Nona Mountain Forest were attacked by fruit gall but there was no plant that attacked by branch gall. However, the intensity of the fruit gall attack was in the level of light damage (25, 6%). The gall mite are caused by small insect (louse) brought by vector of flies (Agromyzidae, Diptera). The effect fruit gall attack on the plants was that almost of the leaves were fallen, but the plants were not dying.

The intensity of fruit gall and branch gall was in the level of middle and heavy damage respectivelly. The branch gall caused the death of the plants about 24, 4%. Branch gall caused by insect but the insect has not yet been identified.

MO 36-57: Insect behaviour (incl. Insect acoustics)

MO 36

Life history of the earwig *Forficula auricularia* (Order: Dermaptera) in Arak city

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The common earwigs *Forficula auricularia (Order: Dermaptera),* was biologically studied and identified according to the taxonomic keys followed by *Borror et al (1992)* and *Richards and Davies (1977*). In field surveys in summer 2008, earwigs individually and separately were found inside the garden between leaves and flowers and soil, under rocks and pots. Almost at the end of the year to September 2008 males' tendency to females increased so that often in a group (males and females) under the garden stones and other secure areas were observed. It seems that these animals from the herd after the pair were separated and seeking to live in pairs to continue, because the presence of these animals in October and November 2008 in pairs and often apart from the rest of earwig was recorded. In late January 2009 was observed that from depth of 90 cm to 185 cm depth, female earwigs have been stuck to the roots of *Lonicera caprifolium* plant and in the vicinity to take care of their eggs and they were resting, male earwigs at this time were not observed. Egg hatch with relatively air warming (18 ° C) in the middle of April 2009 began by passing the time, reducing soil moisture and temperature increase biological growth would accelerate nymphs. At the end of third week number of dead female earwigs in the environment dramatically increased. Some of dead female earwigs, feeding their children were played. At the beginning of June 2009 a number of young male and female earwigs (F2) collected and laboratorial study was done, observations showed that the second generations have no morphological differences with the first generation. At this stage, only that remarkable point was the special smell like oil or gasoline by this group of earwig was produced. From mid June 2009 gradually young earwigs separated from each direction and went away. at this stage of life anything wasn't registered as a sign an evidence that shows their propensity to opposite sex . Laboratorial studies at aquarium environment showed that earwig had good mobility, and were fed until the end of June 2009 as the year continued to live separately, but in any case didn't mating, didn't lay and didn't produce a new generation.

MO 37

Aging and food source effects on mandibular stylets teeth wear of phytophagous stink bug (Hemiptera:Heteroptera: Pentatomidae)

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Laboratory studies were conducted to test the effect of age and different food sources on wear of the mandibular teeth of the phytophagous stink bug, *Euschistus heros* (F.) (Hemiptera: Heteroptera: Pentatomidae). To date, no study was made to measure mandibular wear of phytophagous stink bugs of different ages feeding on natural or on artificial diet. To test this, we selected females of the pentatomid *Euschistus heros* (F.) of known ages, and offered them different types of food sources. We wanted to test the hypothesis that aging and tougher food source will increase mandibular wear. Results indicated that the total length (µm) of the area bearing the mandibular teeth, the length of the 1st tooth, and the height of the 2nd tooth for adults that did not have any feeding activity (teneral adults < 1 day-old) were significantly greater compared to those that fed on natural foods such as green beans, *Phaseolus vulgaris* L. pods, raw shelled peanuts, *Arachis hypogaea* L., and mature soybean seeds, *Glycine max* (L.) seeds, for 30 or 60 days. Adults that fed on the artificial dry diet showed, in general, similar results to those of teneral adults, indicating that the diet did not cause wear of the mandible teeth. Forces (Newtons) required to penetrate the natural foods were significantly greater than that required to penetrate the artificial diet. Therefore, the greater hardness of the natural foods is regarded as the main factor to cause increased mandibular serration wear.

MO 38

Duration of feeding and superficial and in-depth damage to soybean seed by selected species of stink bugs (Hemiptera: Heteroptera: Pentatomidae)

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Laboratory studies were conducted to compare duration of feeding and superficial and in-depth damage to soybean [Glycine max (L.) Merrill] seeds (mature and water imbibed) by selected species of pentatomids, major pests of field crops in the neotropics such as, the southern green stink bug, Nezara viridula (L.), the neotropical brown stink bug, Euschistus heros (F.), the red-banded stink bug, Piezodorus guildinii (Westwood), and the green belly stink bug, Dichelops melacanthus (Dallas) (Hemiptera: Heteroptera: Pentatomidae). Results indicated that feeding time was significantly longer for N. viridula (≈ 133 min) compared to E. heros and D. melacanthus (≈ 70 min); P. guildinii fed for about 103 min, which did not differ significantly from N.

viridula. There was a positive correlation between feeding time and resulting damage to seeds for E. heros, N. viridula and P. guildinii, but not for D. melacanthus. The deepest seed damage (2.0 mm) occurred when P. guildinii penetrated the seeds while the shallowest seed damage (0.5 mm) was observed when D. melacanthus fed on them. The depth of seed damage for E. heros and N. viridula (0.8 and 1.2 mm, respectively) was intermediate in comparison to the other species studied. Feeding damage to the seed cotyledons caused variable cell disruption and protein bodies were destroyed, particularly when P. guildinii fed on seeds. This suggests that the deleterious action of salivary enzymes was greater for this bug compared to the others.

MO 39

Effect of photoperiod on important life traits of *Anarsia lineatella* (Lep: Gelechiidae) in the laboratory

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The effect of different photoperiodic regimes (16:8h, 14:10h, 12:12h, 10:14h and 8:16h L:D) on the oviposition patterns and larval development of the peach twig borer Anarsia lineatella (Zeller) (Lep. Gelechiidae) was investigated. Individuals were collected in northern Greece and reared on a natural substrate (peach twigs) and stable laboratory conditions (20o and 25oC and RH 65±5%). Photoperiod exhibited a strong effect on the oviposition patterns of female moths in both temperatures that were tested. The oviposition process was significantly suppressed under the short day photocycle (8:16h L:D) and females laid a considerably lower number of eggs (81.3±13.1 eggs/female at 25oC), whereas individuals reared at intermediate (12:12h) and long day photocycles (14:10h or 16:8h L:D), deposited in most cases a higher number of eggs (143.4±9.5 eggs/female at 25oC) ($F=4.084$, $df=4.55$, $P<0.05$). Photoperiod appeared not to be critical for larval development that were reared at 25oC and developmental times until pupation were in general similar (25.3±0.2days) under all photoperiodic regimes ($F=2.038$, $d.f.=4.60$, $P=0.101$). On the contrary, individuals that were reared at 20oC, revealed significantly longer developmental times (67.7±2.01 days) at the short day photocycle (8:16h L:D), compared to those (31.5±0.82days) reared under the long day photocycles (14:10h or 16:8h L:D) ($F=156.844$, $d.f.=4.64$, $P<0.05$). The reported herein combined effect of photoperiod and temperature on the biology of A. lineatella, explain to some extent referred differentiations in the number of generations in respect to regions located at different geographical altitudes and longitudes. Moreover, photoperiodic and temperature sensitivity in the neonate instars is also probably related to the facultative diapause of A. lineatella, as second or third instar, although extensional stimulus sensitivity of prior stages as well cannot be excluded.

MO 40

Influence of cell phone radiations on foraging behaviour of honey bees

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The increasing use of electronic gadgets particularly the indispensible "cell phones" is responsible for the production of the so called "electrosmog" polluting the environment today. Exposure to electromagnetic radiations from phone networks has been implicated for changes both functional and behavioural in a variety of organisms including man, mice, birds and insects. Amongst insects honey bees are ideal models for studying the influence of such radiations because they possess unique navigation skills based on the geomagnetic field and direction of sun rays. They are rare species to possess magnetite in their abdomen which helps them in this orientation mechanism. It was therefore planned to study the effect of cell phone radiations on the foraging behaviour of honey bees. Two cell phones of the same make and model , using the same network were installed in the bee hive and put in the live (listen- talk) mode for a fixed period of time. The flight activity was then monitored. It was observed that significantly lesser number of bees went out for foraging. About 54% of the foragers did not return. The pollen and honey storing ability was negatively influenced. The colony became weak to extent of ultimate collapse. The paper discusses experimental details and results.

MO 41

Spontaneous motor activity of *Drosophila subobscura*

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Motility is an important behaviour trait which is implicated in almost all behaviour activities. *Drosophila* is one of the most applicable and very useful model-system in motor behaviour investigation. *Drosophila* show diurnal rhythm in motor activity with separated bouts of morning and evening activity. The aim of this research was to examine spontaneous motor activity of *Drosophila subobscura* in the morning time intervals*. Drosophila subobscura* experimental lines were derived from a single gravid female ("isofemale lines") collected in the beech and oak forest (Serbian mountain Goč), maintained in 5 full-sib inbreeding generations. Motor activity was videotaped in 4 morning time intervals (8-8:30am, 9-9:30am, 10-10:30am, 11-11:30am) and analyzed with ANY-maze software. Three motor activity parameters were measured: distance travelled, mobility and immobility time. The results showed that motor activity of both sex individuals decreases with time in each time interval. The slowest tendency in decreasing is observed from 8-8:30am. Also, in this time interval there is statistically significant variability in activity only between females. Our results reveal sex- and locality-dependent differences in motor activity of *Drosophila subobscura* during analyzed morning time intervals.

MO 42

Water foraging honeybees - parameters influencing load weight and drinking time

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A honeybee colony needs water to regulate the hive temperature on hot days by evaporative cooling, to dilute stored honey, and for the consumption by nurse bees to produce jelly for feeding of the larval brood. Water is collected during the whole breeding season by specialized foragers. We measured the body temperature, the load weight and the duration of stays of water collecting bees on a rain-water barrel.

The duration of the foraging stays declined exponentially from 113 seconds to 27 seconds as ambient temperature (T_a) increased from 5 to 38 °C. The mean crop loading increased linearly from 48.7 to 61.7 mg water as the T_a increased from 11.5 to 25.0 °C. We correlated the duration with the environmental factors (ambient air temperature, water temperature and solar radiation) and the bees' body temperatures (thorax, head or abdomen). Results revealed

that the duration of the foraging stays correlated best with the bees' head temperature. From the amount of crop loading and the duration of the foraging stays we estimated the mean suction rate per stay (crop loading/duration of foraging stay), which increased exponentially with T_a (Q_{10} = 1.8) and T_{head} (Q_{10} = 3.7). This steeper dependence on the head temperature elevated suction rate from v = 0.6 mg s^{-1} at T_{head} = 26 °C to v = 2.2 mg s^{-1} at T_{head} = 36 °C. Even at low T_a the bees regulated the thorax temperature at a high level during the whole foraging stay. Their high thorax temperature allowed them regulation of the head temperature high enough (>22 °C) to guarantee a proper function of the suction pump, and this way to shorten the duration of foraging trips.

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MO 43

Do non-potato aphids exhibit adapted behaviour for PVY vection?

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Aphids are the most common vectors of plant viruses, and aphid-borne non-persistently transmitted viral diseases are of great economic importance in several annual crops. Transmission efficiency of this non-persistent plant virus by aphids is related to the early steps in host plant colonization process (i.e. superficial intracellular brief stings by stylets after landing) and to interplant movement ability. In Europe, *Myzus persicae* and *Macrosiphum euphorbiae* are considered as the most serious virus vectors on potato. Nevertheless, several itinerant alate aphid species, that do not colonize potato plants, can be trapped in potato crops. Therefore, we investigated, through laboratory experiments, host plant selection behaviour in two cereal aphid species *Sitobion avenae* and *Rhopalosiphum padi*, the pea aphid *Acyrthosiphon pisum*, the black bean aphid *Aphis fabae* and the cabbage aphid *Brevicoryne brassicae*.

A dual choice test was used to evaluate aphid landing propensity and interplant movements. The electrical penetration graph (EPG) technique was used to investigate aphid probing behaviour on potato plant.

The role of itinerant aphids in the spreading of non-persistent phytoviruses in potato fields is discussed.

MO 44

Sexual conflict in the wood cricket (*Nemobius sylvestris*): males prevent early spermatophore removal

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Mating effort hypotheses on the evolution of nuptial feeding involve the central notion of sexual conflict, in that nuptial feeding can increase a female's willingness to mate with a particular male, while often decreasing the female's sexual receptivity after mating. This latter mating strategy can be viewed as unilateral, because it increases the male's paternity share while reducing the female's benefits gained through polyandry. Male wood crickets provide several types of nuptial feeding to females: forewing secretions, a spermless microspermatophore, and sperm-filled macrospermatophores. After the transfer of the macrospermatophore, the male often aggressively pursues the female, which may be a tactic to prevent early spermatophore removal by the female. In this study, we manipulated: 1) female hunger level, to examine its effect on macrospermatophore consumption, and 2) male physical (but not visual) access to the mated female after macrospermatophore transfer, to examine whether male access to the female affects spermatophore removal. We found that macrospermatophore consumption was not influenced by female hunger level. In trials where the male was not allowed to be in physical contact with the female, the female removed the macrospermatophore significantly sooner than in trials where males were allowed physical access to the female. Thus, male behavior, possibly through a combination of pursuit and physical contact, appears to prevent early removal of the spermatophore.

MO 45

Involvement of odorant cues in the process of superparasitism avoidance

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The ablility to avoid superparasitism provides a selective advantage to parasitoid females allowing them to avoid depositing eggs in lower quality host. In this context, it has been demonstrated that the parasitic wasps could use either externally and/or internally markers present on their host. However, no information was available on volatile odorant cues potentially involved in this discrimination process.

We observed in a Y-olfactometer that generalist aphid parasitoids, *Aphidius ervi* and *Aphidius rhopalosiphi* (Hymenoptera, Braconidae), were able to discriminate non-parasitized and parasitized *Sitobion avenae* (Hemiptera, Aphididae).

In order to study the chemical cues involved in this host dicrimination process, we collected the odors released from crushed aphids using an electronic nose. Healthy aphids and aphids parasitized for 2 and 6 days were compared. *Sitobion avenae* alarm pheromone, (E)-ß-farnesene (EßF), was the only chemical identified, and was found in lower quantities in parasitized aphids.

Both parasitoid species provided pronounced electrical depolarizations to EßF in electroantennography (EAG), and both were significantly attracted to the latter compound in the Y-olfactometer.

This suggest that in addition to internally and/or extarnally markers, volatile compounds such as EßF could also be used by parasitoid females to discriminate healthy and already parasitized hosts, and thus lead to a reduction of superparasitism occurence.

MO 46

Sexual communication and complexity of male copulatory organs in (neuropterid) insects

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The type of sexual communication is known definitively in several neuropterid families, or subfamilies In the families Inocelliidae (Raphidioptera) and Coniopterygidae (Neuroptera) the main attractive signals (namely sex pheromones) are given by females, thus recognition of the opposite gender of the same species first of all is a male function. In Chrysopidae (Neuroptera), Corydalidae: Corydalinae and Sialidae (Megaloptera) substrate transmitted vibration communication is known, initiated usually by males, while in Myrmeleontidae (Neuroptera) males release attractive pheromones. In the latter cases the females play a more active role in recognition of the conspecific mating partner. Simultaneously, in Coniopterygidae and Inocelliidae the male copulatory organs show a very large variability and complexity, while in the other mentioned taxonomic groups these organs are rather uniform within their own group and show significantly lower level of coplexity. Taking other insect orders (Ephemeroptera, Odonata, Lepidoptera, Trichoptera) into the consideration also, a general tendency seems to be recognizable: the male copulatory organs show high level of complexity when the recognition of the conspecific mating partner is a task fulfilled first of all by the males.

MO 47

Are digger wasps optimal foragers? A study with *Bembix merceti* (Hymenoptera: Crabronidae)

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"Central place foragers" move from a particular area (nest, territory...) to another to feed and, in the so-called single-prey loaders, they return from food patches with a single prey item each time (Stephens & Krebs 1986). The Optimal Diet Theory (MacArthur & Pianka 1966, Emlen 1966) predicts for them an optimization in prey selection, so they would pick out bigger prey if they forage farther or if their size is bigger (Lessels & Stephens 1983).

Digger wasps (Hymenoptera: Crabronidae) are central place foragers and their aggregations constitute good models to explore the theory. We studied the foraging behaviour of females of *Bembix merceti* Parker, a digger wasp that nests in difuse aggregations and progressive-provisions its nests with dipteran prey to feed its larvae. Prey obtained from provisioning females when arriving to their nests were compared (in size and type) with the prey available in the neighborhood of the nesting area, where females had been observed catching dipterans. We also compared the weight of the prey transported to the nests with the maximum weight load for flying, considering the values obtained by Marden (1987) in flying animals.

Prey size was significantly higher than the size of the dipterans available. Additionally, we obtained a positive, significant correlation between individual wasp size and: (a) the average size of the prey captured by each female; (b) the biggest prey captured by each female; and (c) the coefficient of variation of the prey captured by each female. Nevertheless, the prey caught were significantly lighter than the theoretical maximum weight lift calculated for female wasps. A discussion on this topic is provided.

MO 48

Factors influencing the spatial nesting patterns of the solitary wasp *Bembix merceti* parker (Hymenoptera: Crabronidae)

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Several factors have been proposed as determining the dynamics and organization of the nest aggregations observed in some bees and wasps, including limited areas of suitable substrate for digging the nests or clumping of key resources (Michener *et al*. 1958; Brockmann 1979; McCorquodale 1989), as well as the conspecific attraction (Stamp 1987; Ramsay *et al*. 1999; Rudolf & Rödel 2005) or even a "selfish herd" response to natural enemies (Wcislo 1984).

We investigated both the nest-spatial patterns and several factors that could influence them in an aggregation of the solitary digger wasp *Bembix merceti* (Hymenoptera: Crabronidae). Females of this wasp dig individual burrows in difuse aggregations established in sandy soils. In our study, conducted in Almarail (Soria, Spain) during the summer of 2008, we analyzed the spatial distribution of 44 *B. merceti* nests with the Ripley's L(t) function. We considered also the possible influence of the presence of ant nests, common in the area, and of the presence of conspecific females in the nest-initiation events. Additionally, we analysed, for 16 females, the establishment of consecutive nests.

Our results showed an aggregated pattern of nest distribution, higher for the first period of nesting activity, when compared to the second one. We didn't find a significant correlation between the presence (or absence) of ant and wasp nests. Nevertheless, the presence of conspecific females excavating a nest could have some influence in the establishment of nests by other females in the neighborhood. Additionally we didn't observed, for specific females, a tendency to establish consecutive nests closer to the previous nests than expected by chance, maybe as an adaptation to escape from direct nest density dependent parasites or as an estrategy to expand local nesting area.

MO 49

External factors affecting *Trialeurodes vaporariorum* (Westwood) fly activity in zucchini squash greenhouse

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The flight behavior of Trialeurodes vaporariorum (Westwood) (Homoptera: Aleyrodidae), was investigated in a zucchini squash greenhouse in a Mediterranean area. Two years of data were collected from 2008 to 2009 and were identified external variables that can play a role on fly. Experiments have shown that flight activity was influenced by hours during the day time and was different in relation the different areas of greenhouse. Moreover the trials point out the positive effect of temperature in flight of the pest . The flight activity occurs variably with at least two peak during daylight hours, and in preferential area of the greenhouse in relation to density of the pest. Among the variables that affect the flight, the temperature and the density are the decisive factor for such activity with no evidence for the relative humidity. The spread of the whiteflies in the greenhouse and is certainly influenced by the behavior of the adult fly.

MO 50

Is the egg-larval parasitoid *Ascogaster reticulata* (Hymenoptera: Braconidae) answering the call of tea plants for help to defend against egg deposition by the host moth?

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Plants are able to activate direct and indirect defenses against egg deposition by herbivorous insects. A known indirect defense is the production of cues to help egg parasitoids locate their host. The wasp *Ascogaster reticulata* is an egg-larval, solitary parasitoid of the moth *Adoxophyes honmai* (Lepidoptera: Tortricidae) that lays eggs and whose larvae feed on the leaves of the tea plant *Camellia sinensis*. Here we studied whether oviposition by *A. honmai* induces tea plants to produce cues that help the parasitoid locate its host. In a contact bioassay, female parasitoids were presented with two kinds of tea leaves: one leaf infested by egg deposition and the second leaf uninfested but with an egg mass on a piece of wax paper kept below the leaf. The two leaves came from the same plant and were washed with water to remove any scales or other deposits of moths that may otherwise attract the parasitoid. Female wasps spent significantly more time on the infested leaves, suggesting that infested and uninfested leaves are perceived differently by the parasitoid. We propose that egg deposition induces tea leaves to produce chemical cues that attract or arrest the parasitoid to the leaves. The parasitoid did not discriminate between leaves infested with an egg mass less than 1-day-old and uninfested leaves, suggesting induction of leaves occurs 24 hours after oviposition. Detailed studies to elucidate the mechanisms of leaf induction and elicitation are currently ongoing.

MO 51

Voracity of *Hippodamia variegata* (Col.: Coccinellidae) fed on black bean aphid

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Hippodamia variegata Goezee is a widespread aphidophagous predator. The voracity of 4thinstars and adults (males and females) of H. variegata using *Aphis fabae* as prey was evaluated in laboratory condition (23±1ºC and 70±10% RH, and 16:8 L: D photoperiod). Based on pre-tests, different densities of 4-5 days old *A. fabae* were determined to different stage/sex of *H. variegate*. The experiment was carried out on leaf disks in Petri dishes with 15 replicates. The experimental Petri dishes were examined after 24 h to record the number of consumed aphids. Analysis of variance was performed to test differences in voracity at maximum densities of *A. fabae* in different stages of predator (First instar: 15 aphids; Second instar: 28; Third instar: 65; Fourth instar: 130; Male adult: 60; Female adult: 100). Least significant difference (LSD) test were used to separate the means. In all stages, voracity increased with increasing the prey densities. Daily Voracity of different stages of *H. variegata* at maximum *A. fabae* densities were estimated as: 2.93 aphids for 1st instar; 5.85 aphids for 2nd instar; 12.13aphids for 3rd instar; 45.13 aphids for 4th instar; 18.33 aphids for male and 44.6 aphids for female. Daily voracity of different stages of *H. variegata* at maximum densities of *A. fabae* during 24 h period was significantly different among different life cycle stages ($F_{5, 88}$ =64.67; p<0.0001). There was no significant difference between fourth instar and female adults, and these groups had the highest voracity. First instar had the lowest voracity.

MO 52

Functional response of adult male and female *Hippodamia variegata* Goeze (Col.: Coccinellidae) to different densities of *Aphis fabae* Scopoli

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Coccinellids have a major role in aphid control. *Hippodamia variegata* Goeze is an aphidophagous predator with worldwide distribution that could be found in different part of Iran. One of the criteria for evaluating the efficiency of a predator is its response to change in prey density (functional response). The functional responses of males and females of *Hippodamia variegata* were studied at different densities of *Aphis fabae* under laboratory condition (23±1ºC, 70±10% RH, and 16:8 L:D photoperiod). The experiment was carried out on bean leaf disks in Petri dishes at 15-20 replications. The results revealed that both male and female of *H. variegata* exhibited a type II functional response to different densities of black bean aphid (2, 4, 8, 16, 32, 45, and 60 for male and 2, 4, 8, 16, 40, 60, 80, and 100 for female adults). Rogers' random predator equation was used in estimation process of searching efficiency (a) and handling time (T_h). The mentioned parameters were estimated to be 0.159 and 1.194 h for male and 0.093 and 0.41 h for female, respectively. By using an equation with indicator variable revealed that there is a significant difference between handling times of females and males. Based on handling time, females and males cloud kill 58.6 and 20.1 aphids per day, respectively. This means that killing efficiency of females is more than twice of males' efficiency.

MO 53

Host acceptance and stylet activities of bird cherry-oat aphid, *Rhopalosiphum padi,* on intact plants and detached leaves of bird cherry, *Prunus padus.*

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Video recording and electrical penetration graph (PEG) techniques were used simultaneously to investigate host acceptance (in terms of reproduction) behaviour and probing activities of autumn migrants (gynoparae) of the bird cherry-oat aphid on intact plants and detached leaves of bird cherry.

There were no significant differences between the times taken to first parturition or the number of nymphs produced over 6- or 18-h period on intact plants or detached leaves. Stylet probing activities, such as the time taken to first phloem contact, the time spent on phloem ingestion, xylem ingestion, and total probe duration were also similar between the two situations.

MO 54

Reproductive behavior of the larval ectoparasitoid, *Goniozus legneri* Gordh (Hymenoptera: Bethylidae), on three different pyralid hosts

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Goniozus legneri Gordh is a gregarious ecto-parasitoid of *Apomyelois ceratoniae* (Zeller) larva, the most important

economic pest of pomegranate orchards in Iran. In this investigation, the parasitoid wasps were placed in separate Petri dishes on three different insect hosts; *A. ceratoniae*, *Galleria mellonella* L. and *Ephestia kuehniella* Zeller in sixty replications for each of the hosts at temperature of 25± 1°C, RH 60+5% and photoperiod 14L:10D. Results showed that before oviposition, female wasps bit the end of larval host body and stung the sub-pharyngeal part of the head. In most situations, numerous larvae were stinged, but the female parasitoid preferred to oviposit on larger one. The maximum number of eggs was laid on the 6 th and 7 th segments. The mean number of eggs laid on each host was 14± 3.24, 17± 2.5 and 12± 1.12 in *A. ceratoniae*, *G. mellonella* and *E. kuehniella*, respectively. Males didn't compete before and at the emergence of females.

MO 55
Mating behaviour and its significance in reproductive performance of *Dysdercus koenigii*

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The present research work was carried out on *Dysdercus koenigii* to understand various aspects of its reproductive behavior. The studies carried out on mate searching and courtship behaviour of *Dysdercus* reflected that the opposite sexes are brought together by the pheromone. The males responded to female sex pheromones by showing directional movements toward the sex partners. It was seen that a high percentage of the receptive females mate usually in a very short time span. The females of *Dysdercus* showed continued mating receptivity throughout their life. The studies pertaining to mate selection by females showed that females generally do not discriminate among males. The adults of *Dysdercus* remain in continuous copula up to 72hr. and mate 5-7 time in their life span. The multiple mated female showed enhanced fecundity and fertility, shortened preoviposition period and more regular oviposition behavior in comparison to singly mated female. It was also recorded that fecundity, fertility and oviposition behavior of the female *Dysdercus* was related to duration of mating. Sperm utilization pattern of doubly mated female indicated a very high P_2 value of 0.966. This reflected that sperms of last mating were utilized by the female for fertilization. The interrupted mating experiment conducted to understand the relationship between sperm precedence and prolonged mating indicated that the sperms of male mated last were utilized for fertilization.

MO 56
Diurnal flight behaviour of Ichneumonidae and Braconidae (Insecta; Hymenoptera) related with environmental factors in a dry tropical forest

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Seasonality has an important effect on Hymenoptera diversity; for example, temperature and rainfall have been reported as important factors influencing species richness on Ichneumonidae. If weather conditions determine seasonal patterns at the community level, the effect of these factors on daily activity of the assemblages should be assessed too. This work attempts to solve the question about the environmental factors that influence the daily activity of Ichneumonidae and Braconidae in these conditions and in what way. The study was carried out in Ria Lagartos Biosphere Reserve, Yucatan, Mexico. The vegetation present in the site of study is a matrix of tropical dry forest. The flight activity was measurement using Malaise traps, covering all daylight hours, making a total of 56 hours of sampling. The measured environmental variables were temperature, relative humidity, illuminance, and wind speed. Effect over abundance of ichneumonids and braconids was evaluated with linear simple correlations. Relative humidity and temperature were important factors for braconids and icneumónidos abundance. Illuminance did not explain diurnal activity and probably dictating diurnal and nocturnal habits. Wind speed was very variable and was not significantly correlated with flight activity.

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MO 57
Simple and effective analysis of locomotor activity in insects using SwisTrack® software and Microsoft® Excel formulas

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Locomotor activity reflects animal condition, hence it may be very useful and rapid indicator of the immediate and delayed effects of various neuroactive compounds, both toxins and stimulators (Martin, 2003). Surprisingly, it is not often used in insect studies, partially because of technical obstacles. Most often IR gates coupled with electronic counting devices are applied for this purpose. They allow long-term recording of insect activity but they lose information about the activity between subsequent crosses of the gate. Equipment that allows continuous monitoring of the activity (open field method) requires sophisticated and expensive software.

Hereby we describe simple and cost-effective method for analysis of digitally recorded locomotor activity of medium-sized insects (e.g. crickets, caterpillars, cockroaches).

We used usual commercially available digital camera with recording rate 30 fps and 640×480 pixels resolution. This appeared to be sufficient for recording activity of insects as small as about 8 mm in length. Since single continuous recording in such cameras is usually limited to several minutes it is advisable to record insect activity in particular situations. We measured locomotor activity of nonstimulated insects, then their response, and its fading with time, to standardized stressing stimulus. The measurements can be done in the lab or in the field if only sufficient light intensity for proper contrast between insect and its background is provided.

For analysis of the recorded material we used freely available SwisTrack® software (Correll *et all.* 2006, http://swis.epfl.ch/research/swistrack/) that allows simultaneous analysis of more than one insect (each one in separate and transparent flat box). Obtained digital data were transformed into movement characteristics with Excel formulas (the distance walked, and the time spent on resting and movement with various intensity). By setting calibration scale we can express walking distance in metric units that is important for comparative analyses.

Application of our method for assessment of the caffeine effects on house cricket locomotor activity will be presented.

MO 58-59: Chrysomelidae

MO 58
Is color of *Diabrotica virgifera virgifera* (*Chrysomelidae:Coleoptera*) adults influenced by color of silk maize?

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The invasive *Diabrotica virgifera virgifera* Le Conte (Coleoptera: Chrysomelidae) species has become a very important pest of maize growing areas in Europe. The maize crop in Romania occupies a large area, so numerous farmers are interested about evolution and recognition of this important insect. In the last time the adults are became more aggressively than larvae and all attention is directed by these, of course. First, we have to answer of question: "Is the color of Western Corn Rootworm (WCR) adults important in practical activities of farmers"? The answer is simple, yes, because the frequent confusions in monitoring activities of farmers. Many male individuals can be confused with the females, and reverse, of course. Based on our data from the years 2008 and 2009, we can emphasize an influence of color of silk maize on the determination of the WCR adults' color. In general, the adults have yellow-green color (like green silk of corn), but in previous studies we observed some individuals with reddish color (like reddish silk of corn). So, we tried to highlight the existence of many more phenotypic (color) groups. In following observations, we found that there is a great variability in color (10 phenotypic groups of color: 2 groups with normal features described in the taxonomic literature and 8 groups with other features). The adults were collected from different locations and from cob and silk of different colors, in corn cob forming stage. Applying a method used by us in 2004, we counted beetles/locations/colors of silk color/type of adults (using the shape of the last abdominal segment, like the differentiation criterion). Finally, we assigned the beetles to color groups.

We acknowledge gratefully funding of the project (PN-II-ID-PCE-2007-1/RO) so that we could continue these studies which started some years ago.

MO 59
Preference and feeding specificity of *Chrysolina fastuosa* (Coleoptera: Chrysomelidae) adults

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Chrysolina fastuosa (Scopoli, 1763) is an in Europe widely distributed chrysomelid beetle. According to the literature *Ch. fastuosa* has been found in association with Labiatae plants such as *Ballota nigra* L., *Galeopsis pubescens* Besser, *Lamium album* L. and *Urtica dioica* L. (Urticaceae). Its Hungarian name (csalán levélbogár) means stinging-nettle leaf beetle which suggests that the beetle must feed on stinging nettles (*U. dioica* or *Urtica urens* L.). Other common names like dead-nettle leaf beetle refer rather to the family Labiatae or to the morphology of the beetle, Ovaläugiger Blattkäfer, chrysomèle fastueuse (fastuous). In spite of many references upon the feeding of *Ch. fastuosa* on stinging nettle I have never observed the beetle on *Urtica* species. This contribution presents the results of laboratory investigations showing the feeding preference of *Ch. fastuosa* adults concerning some Labiatae and Urticaceae species.

MO 60-98: Aquatic insects

MO 60
Check list of the Hydraenidae (Polyphaga: Coleoptera) species of Turkey with detailed and current distribution

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Although Hydraenidae species diversity of Turkey is highly revealed in recent years by the several researchers, it is thought that the Hydraenidae species diversity of Turkey is richer than known. Nevertheless Hydraenidae species numbers including 3 genera were not given so far.

In this study, current check list and distributions of Hydraenidae family from Turkey were presented. For this purpose, all of the published papers up to now which are related in the Hydraenidae fauna of Turkey were investigated and 20 Limnebius, 73 Ochthebius and 111 Hydraena species were determined. Furthermore detailed distributions of the species from Turkey were given in the maps.

MO 61
Aquatic insects of the National Park «Yugyd Va» (the Komi Republic, Russia)

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«Yugyd Va» National Park was set up in 1994, and one year later it was added to the UNESCO World Heritage list, as the first natural property in Russia to be honoured. Its huge territory of nearly 2 million hectares stretches over 300 km from North to South along the high Western slopes of the Ural mountain ridge. All the rivers of the park supply fresh water to the Pechora, one of the largest rivers in Europe. Fauna of aquatic insects was studied in 1998-2009. Aquatic insects play an important role in the benthos community of mountain rivers and lakes of the park. A highest share of aquatic insects was revealed in the benthos of rivers and brooks, with the abundances of 50-80% and biomass of 30-97%, with considerable shares of caddisflies, mayflies, and stoneflies. In the lakes aquatic insects make up 17-40% of the total abundance and 40-60% of the total biomass. The vast majority of species belong to chironomids dominating in number and, in some lakes, in biomass. Running waters are characterised by 120 species of Chironomidae: 64 species were found in lakes, and 26 species in brooks. The most common were Orthocladiinae, which lead in taxa richness. List of mayflies of the rivers included 62 species, and 16 species - in the lakes. Running waters are inhabited by 64 species of caddisflies, only 14 species found in lakes. 30 species of stoneflies were found in rivers and brooks, 11 species - in the lakes. The species of Holarctic and Palaearctic ranges prevail. Representatives of Siberian and Arctic fauna are also present. Twenty-four chironomids and one stonefly species were recorded for the first time. Rare and innumerous species listed in the Red Data Book of the Komi Republic were found at the territory of the National Park.

MO 62
Distribution of halophilous species of horse flies in Croatia (Diptera: Tabanidae)

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In the past twenty years, fauna and ecology of horse flies (Tabanidae) was intensively studied in Croatia, especially in the Ramsar sites as Wetlands of International Importance.

78 species classified in 10 genera, with different habitats requirements for larval stage were recorded. The true aquatic larvae are represented by species of genera *Chrysops* and some *Hybomitra* species. Some species from this ecological group are typical inhabitants in saline biotopes. The adult horse flies are occurring near water and close to the breeding sites. In Croatian fauna three halophilous species were recorded: *Chrysops italicus* Meigen, 1804, *Hybomitra acuminata* (Loew, 1858) and *Hybomitra expollicata* (Pandellé, 1883). These species were recorded in 7, 3 and 17 UTM grids in Croatia, respectively.

Specimens were primarily collected in habitats with brackish water along the Adriatic coast, such as Vransko Lake, mouth of the Cetina River and delta of the Neretva River.

Only *Hybomitra acuminata* was recorded in the continental part of Croatia. It was sporadically collected on localities along the Danube floodplain and on four localities near Drava River. This rare species was represented with only 0.96% in total catch of the *Hybomitra* genus in these areas. Distribution of *Hybomitra acuminata* in the continental part is quite interesting because it could indicate the otherwise rare salt habitats along the Drava and Danube Rivers.

MO 63

An annotated checklist of the Dytiscidae (Coleoptera) of Turkey

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As a baseline for further work to enhance our knowledge of the dytiscid fauna of Turkey, an annotated checklist of known taxa is presented. A survey of Turkish diving beetles was conducted from literature searches, collections, and the study of fresh material collected from different localities between 1996 and 2010. This study reveals the presence of 149 species belonging to 29 genera and 6 subfamilies, and gives the Turkish distribution of each species. The type localities of 24 of these 149 species are themselves located in Turkey.

MO 64

Estimating species richness of Dytiscidae (Coleoptera) in Erzurum province in Turkey

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In this study, Dytiscidae were sampled and identified in Erzurum province, northeastern Turkey, from 1996 through to 2006. The samples were collected by means of a sieve and ladle having a mesh diameter of 0,5 mm, from shallow areas of the various aquatic habitats. This region has many ponds, various running waters, springs, brooks and headwater streams that are part of the major two rivers of the country, namely the Çoruh and Aras. A total of 69 species from 21 genera were identified. These records cover about 50 % of the Dytiscidae fauna of Turkey. Using different extrapolation methods we estimate the maximum number of species, or true species richness, of the region from our data. Species accumulation curves and estimations based on species abundance and rarity were used.

MO 65

Elemental Analysis in four *Agabus* species and between elytra and alae of *Colymbetes fuscus* (Dytiscidae: Coleoptera) revealed by Energy Dispersive X-ray Fluorescence (EDXRF)

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In this study, the concentrations of inorganic elements were measured by energy dispersive X-ray fluorescence (EDXRF) spectrometry in *Colymbetes fuscus* and four *Agabus* species in Turkey. No element concentration was shown to be significantly different between *A. glacialis*, *A. biguttatus* collected from the two provinces (Adana, Balıkesir). Mn concentration is shown to be significantly different between *A. nebulosus, A. conspersus* belonging to the *nebulosus*-group, collected from the same locality (Adana Province). Si, Mn, Fr, Ac, Pa concentrations are shown to be significantly different between elytra and alae of *Colymbetes fuscus* (Dytiscidae: Coleoptera) collected from a single locality in Erzurum province.

MO 66

Effects of meteorological data on emergence of chironomids (Diptera: Chironomidae) in the Kisköre Reservoir

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In the course of our work emergence dynamic of chironomids were studied in Sarud-basin of the Kisköre Reservoir, Hungary. Samples were taken with New Jersey light trap in 2005 from March to October. Several meteorological factors were measured in parallel with sample collection such as daily maximum and minimum of air temperature, quantity of precipitation and velocity of wind. Our aim was to investigate the emergence pattern of the dominant chironomid taxa and to explore which meteorological factors have effects on the emergence of chironomids. More than 9000 specimens belonging to 25 chironomid taxa of three subfamilies (3 Tanypodinae, 2 Orthocladiinae and 20 Chironominae) were identified. We found that Orthocladiinae dominated the spring emergence and they were subdominant in autumn, Chironomini and Tanypodinae were the most frequent during the summer months and Tanytarsini were the most dominant during autumn. As a result of our study, the air temperature proved to be the main factor affecting on the emergence of the chironomids.

MO 67

Trichoptera fauna of Bosnia and Herzegovina

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Research in the waters (rivers) of Bosna and Herzegovina directed to aquatic fauna date from the end of 18th century. Throughout these researches, a special stress is given to the aquatic entofauna, furthermore the fauna of caddisflies. First described species from the territory of Bosnia and Herzegovina are found in the works of Klapalek, 1898, 1898a, 1899, 1900, 1902 when was described 8 species new to science, and later Radovanović, 1935. sites 111 species for fauna of BiH (Marinković, Krek, Tanasijević, Kaćanski, 1980).

In the later period, intensive research of the area of Dinarides have grown to the whole territory of BiH and the

result of those researches is 20 species new to fauna of Trichoptera, 37 species for the area of Dinarides (Marinković-Gospodnetić, 1955, 1966, 1966a, 1970, 1971a, 1973, 1975, 1976, 1978, 1979, 1980, 1981).

According to available referencial information (material destroyed during the war) a list of currently constated species for the territory of BiH which is consisted of 212 species and 6 subspecies, from 19 families, 77 genera (Marinković-Gospodnetić, 1955, 1966, 1966a, 1970, 1971a, 1973, 1975, 1976, 1978, 1979, 1980, 1981, Trožić-Borovac, 2001).

The largest variety has the family Limnephilidae Kolenati 1848, with the subfamilies Apataninae Wallengren, 1886, Drusinae Banks, 1916, Chaetopteryginae Hagen, 1858, Stenophylacinae Schmidt 1955, Limnephilinae Kolenati1848 and with 68 species and 2 subspecies. There are 37 endemic species out of which the largest number inhabits the territory of BiH, especially the genus *Drusus* with species group *Drusus bosnicus* Klapalek 1900 (*D. vespertinus* Marinković 1976, *D. radovanovici radovanovici* Marinković 1970, *D. medianus* Marinković 1976).

MO 68
The aquatic insects of a standard small plain river in North-Eastern France

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From 1998 to 2003, a study on the macroinvertebrates of a 55 km river (le Rupt-de-Mad region Lorraine, North-Estern France) was lead, in order to precise the richness of such a moderately degraded plain river, which could represent a standard for the region. The study was supported by the regional "Water Agency", in the frame of a global action in the whole river basin to improve the water quality by limiting both agricultural and urban inputs (the average nitrate concentration in the river had increased from less than 10 mg/l in 1970, to about 30 mg/l in 1994).

The main course as well as the tributaries were investigated, in order to draw up an inventory of the whole river basin. Odonata, Ephemeroptera, Plecoptera, Heteroptera, Trichoptera, and Coleoptera were mainly researched, but Megaloptera, Neuroptera and Lepidoptera were also collected and determined at level species, while other macroinvertebrates were determined as precisely as possible.

About 400 species were identified in all, including 300 species of aquatic insects:

Odonata 10 %, Ephemeroptera 9 %, Plecoptera 4 %, Heteroptera 8 %, Trichoptera 31 %, Coleoptera 35 %, Megaloptera + Neuroptera + Lepidoptera 3 %.

The main course of the river appeared to be rather rich in species, the richness globally increasing downstream: from 76 to 126 species at a given sampling place. But the communities were composed of mostly common potamal species, tolerating a significant level of eutrophication. Few rare or remarkable species were found there, mainly Coleoptera (for example *Gyrinus aeratus*, *G. suffriani…)*. Noticeably the family Heptageniidae was totally absent, though convenient biotopes seemed to be present. So the main course appeared clearly "trivialized".

The tributaries, on the contrary, displayed an interesting range of habitats, from slow meadow ditches to rapid calcareous brooks, some of them temporary. Among the number of tributaries, some were heavily disturbed by human activities (pollution, cattle trampling, catchments…), but some were much better preserved. They sheltered communities generally less numerous than the main course (52 to 84 species), but sometimes with a greater originality. Some remarkable species were found in calcareous brooks (for example *Cordulegaster bidentata*, *Paraleptophlebia werneri*, *Nemoura lacustris*, *Chimarra marginata*, *Ernodes articularis*, *Riolus illiesi…*).

This study, of course, was not exhaustive. However it should be considered as a good approach of the global macroinvertebrate fauna of a standard river in that part of Europe. It showed that, among 300 species of aquatic insects identified, about one half of them were more or less ubiquitous species, distributed in different parts of the basin, one forth were potamal mesosaprobic species, present only in the main course of the river, while the last fourth consisted of more stenoecious species restricted to certain tributaries.

MO 69
Aquatic arthropod biotests for environmental surveys

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Aquatic arthropods may suffer exposure to toxic contaminants directly or through leaching out due to flood or inland water. Immobilization tests on *Daphnia magna* (Cladocera, Crustacea) by the ISO 6341:1996 protocol and mortality tests on *Aedes aegypti* (Diptera, Culicidae) by a WHO method are routinely carried out in our laboratory on agro-environmental samples collected in Hungary. Of the 202 water and 423 soil samples in 2008 and 2009, 76 water and 77 soil samples contained detectable pesticide residues or microelements above threshold limit. Most common soil contaminants were trifluralin and metolachlor (3-200 ng/g), most common water contaminants were acetochlor, atrazine, metolachlor, trifluralin and diazinon (0.001-3900 µg/l), and As, B, Ba, Ni or Se contamination in both. Pollutants were found to exert not only additive, but synergistic or in certain cases antagonistic effects on *D. magna*, while *Ae. aegypti* mostly appeared to be less sensitive. This species is controlled in flooded or inland water covered areas by *Bacillus thuringiensis* subsp. *Israelensis* preparations, exerting mortality on *D. magna* only at extremely high doses (>25 mg/l). Detection of its active ingredient (Cry4) is problematic, therefore, we developed an enzyme-immunoassay and used it along with mosquito larvae biotests to measure toxin content. The analytical limit of detection, 0.08 ± 0.02 µg/ml, is below practical dosages; therefore, the method is suitable for the analysis of environmental samples.

MO 70
Stream macroinvertebrates and vegetation: do they live in the same environment?

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In most studies on stream macroinvertebrates and their environment, vegetational variables are regarded as some amongst many environmental factors. In this study we regarded vegetation also as a „community": an assemblage of living organisms, indicators of various environmental factors, mirroring in some way the same „environment" where they occur together with macroinvertebrate community of a stream. Our hypothesis was that grouping study sites – representing different sets of many background variables – using macroinvertebrate and vegetation variables may result in similar patterns at least at some spatial scales.

Macroinvertebrate samples were taken according to AQEM protocol, with 20 subsamples at each of ten near-natural sites in Mecsek hills, Southern Hungary. 53 taxa of Ephemeroptera, Plecoptera, Trichoptera, Odonata, Coleoptera and Heteroptera were determined. Vegetation was characterized at three spatial scales (10-600m) using categories of Hungary's Habitat Database (MÉTA).

Sampling locations were compared performing Mantel tests on binary and quantitative data of all macroinvertebrate taxa, and of groups EPTO and CH separately, and on vegetation data at three spatial scales. Significant correlation were found for all taxa and for CH group binary data at largest spatial scale. Significance levels rise markedly towards larger scales in all cases.

MO 71

Effect of the extreme drought on aquatic insect community in a channelized lowland river; comparison between pool and riffle

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Hydrological conditions are among the most important community structuring factors, but the studies of the extreme drought events on permanent rivers are rare. Our investigation was performed in a segment of the Ščavnica River, which in summer 2001 had interrupted surface flow due to drought. Riffles dried up for the first time after more than 40 years and stayed dry for more than one month. However, some isolated puddles were still left in the pool. Benthos was sampled monthly, separately in a pool and in a riffle using a multi-habitat time limited sampling approach. Simultaneously were measured environmental variables. First benthos sample was taken just 12 hours after reestablishment of the surface water current. Differences amongst insect assemblages were analysed using Non-metric Multidimensional Scaling (NMS), whereas Canonical Correspondence Analysis (CCA) was used to test the explanation power of hydrological variables for community structuring. In first three months changes in community structure were bigger in the pool than in the riffle. Hydrological variables that best explained aquatic taxa distribution were average current velocity, sampling date and days from drought. Wilcoxon signed-rank test revealed that differences between pool and riffle richness and diversity metrics were significant, but not for Shannon-Wiener and Simpson diversity index where high intra-annual variability was observed at the riffle. Extreme drought severely altered pool and riffle insect assemblages and biggest changes in community structure were observed within first three months.

MO 72

Life cycle of *Rhyacophila fasciata* and *Hydropsyche saxonica* in a Dinaric karst river system

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Water temperature is one of the most important factors influencing life cycles of aquatic insects. In headwaters of karst rivers water temperature fluctuates only slightly. We investigated life cycles of *Rhyacophila fasciata* and *Hydropsyche saxonica* at a karst spring site and three downstream sampling sites, respectively. Larvae, pupae and adults were sampled monthly from January to December 2005. Some environmental variables were measured simultaneously. Larval stages were defined based on the distribution of the head capsule widths. As only instars 2-5 were collected in the field, the head width of first instar larvae was extrapolated using Dyar's rule by plotting instar number against the logarithm of the head capsule width. Larvae of *R. fasciata* were abundant between spring and autumn, but pupae were present already in February. *H. saxonica* larvae were scarce in spring but abundant in autumn and winter. Canonical correspondence analysis was used to define relationship between environmental variables and larval stages. Water temperature and nitrate concentrations best explained distribution of *H. saxonica* , whereas *R. fasciata* larval instars distribution was best explained by oxygen concentration and saturation, but water temperature was relatively unimportant.

MO 73

Spatial distribution and diversity of chironomid (Diptera: Chironomidae) assemblages in a small hilly stream

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In 2006–2007 spatial variations of chironomid assemblages of a small chalky watercourse were investigated in the hilly region of Balaton Upland, Hungary. Samplings were carried out in every three weeks at seven characteristically different sites along the whole length of the watercourse. Altogether 2966 specimen were collected and identified. The chironomid fauna of the stream was relatively rich with 40 taxa belonging to four subfamilies (8 Tanypodinae, 1 Prodiamesinae, 17 Orthocladiinae, 14 Chironominae). Lowest number of species and number of individuals was found at the spring, while the highest at the middle reach. Based on multivariate analysis the different sections of the creek were characterized by distinctive chironomid communities. Rényi diversity profiles showed the highest diversity at the middle reach. It could mean close-to-natural and undisturbed hydrological and hydromorphological conditions as it is suggested by the River Continuum Concept. At the same time, evenness, Margalef's species richness and taxonomic distinctness were the highest at the upper reaches, and low at the middle and lower reaches. It suggests that in the case of even a high diversity of chironomid communities, the degrading effects of human activities are detectable.

MO 74

Comparative analysis of the species-group taxa in genus *Chalcolestes* based on different DNA sequences

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Several controversial questions have arisen in connection with two damselflies taxa *Chalcolestes viridis* and *Chalcolestes parvidens* (Insecta: Odonata). Neither their taxonomical state (species or subspecies status) nor the exact limits of their geographical distribution are sufficiently clarified. The general appearance of the two taxa is quite similar and their morphological characters, which are necessary for separation, are not always unambiguous. Many authors have reported intermediate forms where the two taxa occur syntopically. This makes the absence of the reproductive isolation probable. In the course of our research specimens were collected and analysed from different populations in a wide range of their distribution area (Germany, Austria, Hungary and Crete). Besides the morphological measurements different regions of DNA sequences [Internal transcribed spacer (ITS) region of the nuclear ribosomal DNA, mitochondrial NADH dehydrogenase subunit 1 (ND1) gene, mitochondrial 16S rRNA gene and mitochondrial cytochrome c oxidase (COI) gene] were examined through preliminary studies. Based on the ITS sequences the difference between the two dissimilar types, which were determined according to a few regards, was ~ 2%. In case of ND1 gene this value was ~7%, for 16S rRNA it was ~1% and for COI gene it was ~11%. Thus COI seemed to be the most variable region therefore it was chosen for investigate the occurrent problems.

MO 75
Distribution of Athericidae (Diptera) in Czech part of Labe (Elbe) River basin with ecological notes

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In the Czech Republic the Athericidae family contains three species: Atherix ibis, Atrichops crassipes and Ibisia marginata. Larves of all the three species live in running waters. Atherix ibis and Atrichops crassipes are included in The Red List of the Czech Republic. Between the years 2004 - 2009 Atherix ibis species was discovered in 104 localities, Atrichops crassipes in 40 localities and Ibisia marginata in 65 localities. Generally we can talk about constant and numerous occurence in all the localities. Altitude in which these species appear is 120 – 604 m for Atherix ibis, 180 – 360 m for Atrichops crassipes and 230 – 800 m for Ibisia marginata. In several cases they were all found together. It is interesting that Atrichops crassipes species which is considered to be rare in the Czech Republic occurs mainly in the anthropogenic heavily modified streams, modified both by technical alterations as well as by the quality of water. Atrichops crassipes prefers alfa - meosaprobic and beta - mesosaprobic waters. The size of the stream does not determine its appearance. Atherix ibis prefers running reaches of medium-sized and large-sized streams with gravel and stone substrate. Beta - mesosaprobic waters are characteristic for Atherix ibis. Ibisia marginata prefers small-sized and medium-sized submontane streams with small amount of anthropic adaptations, preferring oligosaprobic to beta - mesosaprobity waters.

MO 76
Check list of aquatic insects in Krkonose (Giant Mts.)

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Krkonose is the highest mountain range in the Czech Republic. The very first enquiry of the natural resources is dated back to the year 1563, when an italian doctor P. O. Mattioli (1500 - 1577) carried out his botanical research. The initial research of insects was done in 1846 by E.A.H. von Kiesenwetter and J.C.F. Markel. J. Gerhard (1868, 1896) did research on aquatic beetles of the spring areas and pools. Important entomologists active in the area of Krkonoše were for example F. Klapálek, J. Obenberger, K. Hůrka and others. However the systematic research started only at the end of the 20th century, in 1980s. A lot of specialists on different species of insects have been cooperating on the research of Krkonoše insects. A big variety of entomological methods are being used to gain the material and these methods have also been enriched by the hydrobiological principles. Species of insects living or evolving in the aquatic or semiaquatic environment have been inserted in the translated checklist. Until now 534 taxons of 9 orders have been discovered in the area of Krkonoše. Ephemeroptera 45 species, Odonata 26 species, Plecoptera 68 species, Heteroptera 15 species, Megaloptera 2 species, Neuroptera 1 species, Trichoptera 106 species, Diptera 218 taxons, Coleoptera 53 species. Considering the ongoing research these figures are definitely not final.

MO 77
The role of physiological tolerance in the colonization ability of two saline water beetles (Coleoptera: Hydrophilidae)

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Aquatic beetles colonize both running and standing waters. Several studies have demonstrated a relationship between species geographical range size and habitat type (lentic or lotic). This pattern can be explained by the contrasting long-term stability of both habitat types. Species adapted to living in more ephemeral lentic water bodies are selected for high colonization ability, resulting in larger and more dynamic geographical ranges than species restricted to more stable lotic habitats. Despite our understanding of this general pattern, the evolutionary and physiological mechanisms driving it are still poorly understood. Colonization ability equates to the ability of organisms to establish populations in different habitat patches, and can be viewed as an emergent property of both dispersal capacity and the physiological tolerance of individuals/populations. In this study, we explore whether differences in physiological tolerance account for the differing colonization abilities of two closely related species of aquatic beetle (*Enochrus bicolor* (Fabricius 1792) and *Enochrus falcarius* Hebauer 1991; Coleoptera: Hydrophilidae), which inhabit lentic and lotic saline habitats respectively, and have widely different geographical range sizes. For both species, we examined tolerance to the two main environmental factors in inland saline waters; temperature and salinity, through an experimental approach. Preliminary results demonstrate that thermal and ionic tolerances do not differ significantly between lotic and lentic species, suggesting instead a key role for differences in dispersal ability in driving colonization ability in this case.

MO 78

Seasonal changes in water beetle assemblages in a temporary pond of Lonjsko polje Nature Park

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The main objective of this study was to determine in details the seasonal dynamics of water beetles in a single semipermanent pond in the area of Lonjsko polje Nature Park over one year period. Furthermore, we wanted to investigate the relation between the changes in assemblage composition with respect to fluctuations of pond dimensions and physicochemical properties of the pond and finally to test if the two microhabitats within the pond (deepwater vs. shoreline) significantly differ. Field survey was conducted from May to December 2004 and aquatic coleoptera were collected using semiquantitative method of sweeping D-frame pond net. Altogether, 1458 specimens of water beetles were collected.

Results show seasonal differences in water beetle assemblages and indicate a significant positive correlation of Hydradephagan fauna with pond dimensions and negative correlation with conductivity and dissolved $CaCO_3$ in water. T-test showed that Hydradephagan abundance is significantly different in the two microhabitat types.

MO 79

Genus *Aphelocheirus* Westwood, 1833 (Hemiptera: Aphelocheiridae) in the Iberian Peninsula

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In this work, the study of the genus *Aphelocheirus* in the Iberian Peninsula was carried out. *Aphelocheirus* species inhabit the upper and middle sections of well-preserved streams and rivers. The presence of *A. murcius* and *A. occidentalis* were confirmed. However, *A. aestivalis* does not seem to occur in the Iberian Peninsula, and previous records of the species may correspond to either *A. occidentalis* or *A. murcius*. *A. occidentalis* has clear external differences, like colour pattern and very long conexives, which permit it be distinguished easily from other *Aphelocheirus*. Conversely, *A. murcius* and *A. aestivalis* are quite similar, and it is more difficult to separate them. A detailed morphological study of the specimens confirmed the taxonomic identity of the individuals of *A. murcius*. The shape of the left paramere is the only valid characteristic to differentiate them from *A. aestivalis*.

MO 80

Variation in emergence dynamics of riverine dragonflies (Odonata: Gomphidae) on the river-system Tisza (Hungary)

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The changes in gomphid assemblages of the river-system Tisza have been followed with attention since 2000. With this purpose comparative analysis on emergence characteristics of riverine dragonflies took place on four river-reaches, under different habitat conditions (two of them at the Upper-Tisza, one at the Middle-Tisza and one at the River Szamos). Our examinations were based on the quantitative collection of exuviae. In addition analyses were also made on the effects of changes in water temperature and water level on emergence. According to our results the species composition on population level and also the abundance of the gomphids differ fundamentally on the examined Tisza-reaches. While on the reach of the Upper-Tisza at Jánd assemblage of four species were found, below the firth of River Szamos at Vásárosnamény three species occurred. On the dammed reach of the Middle-Tisza only two species were found, but in number eight times more than at Jánd, and four times more than at Vásárosnamény. The species-composition and the abundance of the Szamos-reach was nearly the same as that of the Tisza-reach at Vásárosnamény. Important differences were also obtained among the river-reaches in the beginning just as in the pattern of emergence, which were definitely affected by water temperature and hydrological features as well. Our results – representing on typical Central European conditions – can be well compared with similar data of other European regions.

MO 81

Diversity of aquatic insects (Heteroptera: Nepomorpha, Gerromorpha and Coleoptera: Hydradephaga, Hydrophilidae) in kras area of Gorski Kotar (Croatia)

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The aims of this study were to determine aquatic insects (Heteroptera: Nepomorpha, Gerromorpha and Coleoptera: Hydradephaga, Hydrophilidae) fauna in two temporary and two permanent ponds and to relate assemblage structure, abundance and diversity with respect to hydroperiod, habitat size, shading of ponds and altitude. Field work was conducted in two temporary and two permanent ponds in the municipality of Mrkopalj (Gorski kotar) from June to September 2005. Altogether, 360 specimens belonging to 24 species of water bugs and beetles were collected. A large number of species (17) was recorded in the Sungerski lug pond (S1) and the great species diversity in relation to abundance was recorded for the Sunger pond (S2). The occurrence of *Anacena limbata* and *Anacena lutescens* from family Hydrophilidae and *Hydroporus melanarius* from family Dytiscidae is an important faunistic result, because they are new to the fauna of Croatia. According to the results of our study, water bugs and beetles prefer large, permanent, open ponds at lower altitude, although greater diversity was found in small pond.

MO 82

Morphology and ecology of larvae and distribution of *Drusus plicatus* Radovanović, 1942 (Insecta: Trichoptera)

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Within the order Trichoptera, one of the most interesting genera regarding ecology, distribution and evolutionary history is the genus *Drusus.* A total of 28 species were

recorded in the Balkan Peninsula, 90 % of which are endemic. The *Drusus* species usually inhabit springs and crenal sections of mountain streams and rivers, with low annual water temperature. This important life history trait determines their patchy distribution, especially the isolation of mountain populations, and therefore high species diversity.

Drusus plicatus was described by Radovanović (1942) based on specimens collected in Macedonia. According to morphology of adults, particularly of male genitalia, this species belongs to the *bosnicus* group. Within the Balkan Peninsula, eight taxa were described and placed into the *bosnicus* group: *Drusus bosnicus*, *D. klapaleki*, *D. medianus*, *D. plicatus*, *D. ramae*, *D. vespertinus*, *D. radovanovici* and *D. septentrionis.* All species of the *bosnicus* group share some morphological features like the shape of male genitalia (large spinulated dorsal plate on 8th tergite), dark colouration of adults, etc. All these taxa are allopatrically distributed, what is most likely a result of speciation from a single original species (Marinković–Gospodnetić 1978).

In this study we present results on morphology and some ecological data of the last instar larvae of *Drusus plicatus* Radovanović, 1942. Also, we present the most important diagnostic features of the last instar larvae in order to distinguish them from larvae of the other species belonging to the *bosnicus* group and other European caddisflies. Additionally, distribution of this species in the Balkan Peninsula is shown and discussed.

MO 83
Morphological features of pupae of *Drusus croaticus* Marinković-Gospodnetić, 1971 and *Drusus septentrionis* Marinković-Gospodnetić, 1976 (Insecta: Trichoptera) from Balkan Peaninsula

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The major research on Trichoptera in Bosnia and Herzegovina and Croatia started at the turn of the 19th century. Altogether, approximately 35 species are described from Bosnia and Herzegovina and Croatia. Some of these species belong to the genus *Drusus* Stephens, 1837. *Drusus* species in Bosnia and Herzegovina and Croatia are distributed from the Dinarides, mountainous area spreading throughout Central Croatia and Bosnia and Herzegovina. Seven species in Bosnia & Herzegovina from the genus *Drusus* belong to the *bosnicus* group. All *Drusus* species in the *bosnicus* group occurring in Bosnia and Herzegovina are allopatric in distribution. Populations of this species could have been separated due to geological and climatic changes and new allopatric species could eventually evolve.

Drusus septentrionis Mar. is distributed in eastern part in Bosnia & Herzegovina in four springs, and *Drusus croaticus* Mar. is distributed in central mountain part of Croatia in numerous springs. Both species was described by Mara Marinković-Gospodnetić, Professor from the University in Sarajevo, in the second half of XX century. Larvae of these species were described before two years.

In this study we present results on morphological features of pupa of *Drusus croaticus* Mar., collected in spring of the Bijela Rijeka River (National Park "Plitvice Lakes", Croatia) and pupa of *Drusus radovanovici* Mar. collected according reared larvae to adults in the laboratory. The larvae of *Drusus radovanovici* were collected in the spring of the Bistrica River (Bosnia & Herzegovina), and transferred to the laboratory in Zagreb. It was the first described of pupae from any endemic species of genus *Drusus* from the Balkan Peninsula.

MO 84
A new electronic multiple entry key for the identification of aquatic invertebrates in Switzerland

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Macroinvertebrates are currently used by nature managers as bioindicators to carry out assessments of surface water quality. However, identification of these organisms is not always obvious and requires the use of identification keys. The majority of these keys are dichotomic and paper printed. Despite their broad use, these keys suffer from the difficulty to detect possible errors and the limited number illustrations. Moreover, there is no flexibility of use. Recent developments of electronic multiple entry keys allow to solve these problems and open new prospects for identification's assistance. We developed such a new tool to build multiple entry identification key for the identification of three aquatic macroinvertebrate groups (Ephemeroptera, Plecoptera and Mollusca) to both family and genus level. In order to fulfil requirements of future end users, this multiple entry identification key was developed with nature conservation managers, consultants, governmental organizations and taxonomic experts. This key, called CLEMACH, has major advantages in term of time spent to the identification and quality of identification results.

MO 85
Diversity, distribution and ecological features of caddisfiles (Insecta: Trichoptera) in a Mediterranean karst River Cetina and its tributaries, Croatia

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Karst region covers about 50% of the entire territory of Croatia, and is geomorphologically important part of its' central-highland and the Mediterranean region. It is characterized by different types of water habitats, with a high amount of running waters, interesting from faunal and ecological view. Cetina river is the longest Mediterranean river; with length more than 106 kilometres. Its source is located 50 kilometres from the coast, and it flows into the Adriatic Sea near the city of Omiš. So far, the fauna of Trichoptera in area of Cetina river and its tributaries was poorly investigated.

In 2004 and 2005, a systematic sampling of Trichoptera was conducted on the area of the Cetina River and its tributaries, and periodical in 2007 and 2008 on its tributaries. Sampling of material was conducted on 11 locations on the Cetina river and on 5 locations on its tributaries. This study included different types of habitats: spring, upper, middle and lower part of Cetina River and springs and upper reach of tributaries. Sampling was conducted on a monthly basis, including also the winter months. During the 20 on-site visits, about 7,000 adults were collected on the Cetina River, and about 3,000 adults on tributaries. The composition and

structure of fauna of Trichoptera was analysed from all locations (biodiversity, degree of similarity, constancy, dominance), and the seasonal dynamics and expansion for each determined species. Also we were analysed biogeographical features of caddisflies fauna established on the Cetina River and compared faunal characteristics of fauna between rivers Cetina and Krka.

MO 86
Effects of global change in aquatic insects of high mountain streams (Pyrenees): Stoneflies and Mayflies as indicators

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The MAYSTONS project aims to examine possible changes of benthic stream communities in height mountains, associate to community risk before future scenarios expected in the Global Change. As hydrological pattern changes (increase of long drought periods), water temperature increase, and dissolved oxygen concentration decrease in waters.

To achieve this goal overall have been selected the stoneflies, given the high number of cold stenotherm species that includes this order, and the mayflies, especially the species of the genus *Rhithrogena* that are the only species strictly reophilous and cold stenotherm between the mayflies in Pyrenean streams. The selected areas for this study are header catchments of the Aigüestortes National Park. The two principal basins different in their degree of regulation, the Escita river basin with the lakes in the sources regulated and the Sant Nicolau river basin only with a few degree of regulation. 27 sample points were study a long the summer of 2008-2009, between altitudes of 1535 and 2300 m.a.s.l.

40 species of stoneflies and 28 of mayflies have been identified at the moment, some of them Pyrenean endemics as *Pachyleuctra benllocchi, Pachyleuctra bertrandi, Isoperla acicularis acicularis*, or *Isoperla viridinervis*. A decrease in the geographical distribution of some cold stenotherm species as the relict species *Arcynopteryx compacta* was recorded, associated possibly to the air temperature increase in 3ºC of the annual means from the latter 70's to today. This temperature change has allowed the altitudinal distribution increase of *Alainites muticus* from its altitudinal limit of 1450 m.a.s.l. at 1979 (Puig 1980) to 2295 m.a.s.l in the actuality. Temperature increase and long drought periods occurred in the last decade can explain in part the changes in the distribution of *Rhithrogena loyolae*, and other *Rhithrogena* species.

The presence of hemocyanins in Plecoptera have studied in rare and endemic Pyrenean species as an added capacity to survive in front of the decrease of dissolved oxygen concentration in running waters. Hemocyanins were discovered only in some of them, as *Arcynopteryx compacta* or *Isoperla acicularis acicularis.* And the hemocyanin activity associated with DO decreases were tested in lab experiments.

MO 87
Macroinvertebrate drift in the lowland streams in Latvia

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Despite that the macroinvertebrate drift has been widely investigated in many patterns worldwide, the knowledge about invertebrate drift in Latvian streams is scarce.

The aim of the study was to characterize macroinvertebrate drift under diurnal and seasonal framework in relation to the dominating environmental factors.

The knowledge about the background drift is useful to estimate the impact of hydrological regime fluctuations and pesticide inflow on stream ecosystems and as well as in the studies of feeding ecology of salmonids.

Macroinvertebrate drift was studied in three medium sized lowland streams in 2007. Samples were collected by using 3 drift nets (frame size of 0.25 x 0.25 m2; mesh size of 0.5 mm) at two cross sections at each stream, 8 times over a 24-hour period, in spring, summer and autumn seasons. The nets were set every 3 hours from 9.00 a.m. till 6.30 a.m. with exposition period of 30 minutes.

At Korge stream and Tumsupe stream samples were collected downstream and upstream to the riffle, and at Strikupe stream – downstream to sand-macrophyte (Elodea canadensis) biotopes and sand-detritus biotopes.

As proposed, species composition was similar in Korge stream and Tumsupe stream, comparing to Strikupe stream. Results showed seasonal change in macroinvertebrate species composition. The diurnal drift pattern with significant increase in drift density in the dark time of the day was typical for mayfly Ephemeroptera, stonefly Plecoptera larvae and gammarids Gammarus pulex (behavioral drift). The highest drift density of the first instars of Trichoptera larvae was in daytime (dispersal drift).

MO 88
The role of cyanotoxins on macroinvertebrate communities in Mediterranean calcareous streams

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Human activity has significantly increased the inputs of nutrients, specially DIN. Different studies have reported that some cyanobacteria communities produce microcystins in Mediterranean streams. At the same time, the presence of dissolved microcystins in running waters was recorded, with maximum mean levels near 4 ppb (Puig et al, 2002). The increase of dissolved microcystins in running waters appear to be associated to the increases of nitrate loads in natural systems (Vassal'lo, 2003), and flow patterns. In this last case, flow act as a perturbation with changes between the erosion of benthic primary producer communities and the dilution effect of high flows. This situation permits the extension of their toxic effects to primary and secondary consumers in stream ecosystems (Ríos, 2000; Aboal *et al.*, 2002; Aboal & Puig, 2005, 2009).

This work studies the role of cyanobacteria as key group in the bottom-up control of the macroinvertebrate communities in calcareous basins where cyanobacteria were the dominant primary producers. From different perspectives: a) effects of the dissolve cyanotoxins on population decrease of some sensitive species, and life-cycle changes; b) the unpalatability of cyanobacteria as food resource to herbivorous species (primary consumers); c) the structure of food webs in these streams. The Muga and the Matarranya river basins were selected for this purpose (North-East of Spain); two different reaches were studied in each stream, one headwater and other downstream affected by nutrient inputs, at two different periods (2001-2002 and 2007-2009).

A release of species of *Baetis gr rhodani* by *Baetis gr lutheri* was observed, this change is associated with the concentration of dissolve microcystins in waters. The

situation is similar to the populations of *Ecdyonurus forcypula* respect *Electrogena lateralis*. In some cases, the extinction of stonefly populations as *Perla marginata* may bee associated with the depletion of dissolved oxygen and the increase of microcystins in waters.

Only one species of caddis-flies (*Psychomyia pusilla*) and chironomids appear as consumers of cyanobacteria, but not in all of the studied reaches. In general de primary consumers select diatoms, fungi, and/or detritus as food. The food webs are based in the detrital way in these streams.

This study is supported by the RETROCALMED and GRACCIE projects of the Spanish Research and Science Ministry.

MO 89

Are there any differences between the EPT and Coleoptera, Heteroptera assemblages in their response to environmental factors?

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It is well known that the autecology and fenology of Ephemeroptera, Plecoptera, Trichoptera (EPT) and the Coleoptera, Heteroptera (CH) assemblages are really different. Even so the aquatic macroinvertebrate taxa were not divided according to their ecological traits and they were investigated all together in almost all studies. Our aim was to explore the differences between EPT and CH assemblages as regards their spatio-temporal distributional variation and their response to environmental factors directly characterizing their habitats. Our studies were carried out in May, July and October of 2009. Samples were taken according to the AQEM protocol at 10 stream section (20 subsample at each site) in the Mecsek Mountains. Altogether 55 taxa (9 Ephemeroptera, 3 Plecoptera, 22 Coleoptera, 8 Heteroptera, 25 Trichoptera,) were captured and identified. Multivariate analyses (Canonical correspondence analysis) were used for evaluating datasets. Some remarkable differences were found between the environmental factors influencing the distribution of EPT and CH assemblages. The distribution of EPT fauna was highly affected by pH, type of sediments, the riparian vegetation and the coverage of forest. While in the cases of CH assemblages the main factors make effect on their distribution are pH, riparian vegetation and hidromorfological factors.

MO 90

The genus *Rhyacophila* Pictet, 1834 (Insecta: Trichoptera) in Kosovo

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The ongoing investigations on Kosovo caddisfly fauna reveal genus *Rhyacophila* to be the richest with species. Out of 84 Trichoptera species identified so far from more than 20 investigated stations all over Kosovo, 15 of them belong to genus *Rhyacophila*. *Rhyacophila fasciata* and *Rhyacophila polonica* are present in more than 50 % of investigated stations while *Rhyacophila balcanica, Rhyacophila trescavicensis* and *Rhyacophila bosnica* have very narrow distributional geography. Finding of *Rhyacophila palmeni* in Kosovo assists the clarification of the geographical distributional issues of this taxa in South Eastern Europe.

MO 91

Mayflies (Ephemeroptera) and stoneflies (Plecoptera) of Pantepui biogegraphical province (Guyana highlands, Venezuela)

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The Venezuelan part of the Guyana Shield is characteristic by the peculiar flat-topped table mountains, the tepuis, inhabited by highly endemic biota. The community of their summits is considered a discontinuous biogeographical province called Pantepui (Mayr & Phelps 1967). Some of the tepuis have been thoroughly explored by scientific expeditions, while the others are virtually unknown. Extremely oligotrophic and acid black water streams are common biotope at the summits. Nevertheless, even at the most explored tepuis fauna of these streams has been only poorly explored. The entire insect orders have been practically unknown, e.g. the first mayfly records were published only recently from Mt. Chimantá and Mt. Roraima summits (Derka et 2009). It is true also for stoneflies, which have been unknown in Pantepui province. *Macrogynoplax* and *Kempnyia* are two stonefly genera we have recorded. *Kempnyia* Klapálek, 1914 is recorded for the first time in Venezuela. An outstanding fact is the total absence of the most common and the most widely distributed Neotropical genus *Anacroneuria* from the streams at the tepuis summits. Mayfly nymphs are common component of aquatic communities at the tepuis summits. *Callibaetis* is the only genus inhabiting stagnant waters (pools in wetlands at the Churí tepui summit). Representatives of three genera from the Leptophlebiidae family have been recorded: *Massartella*, *Miroculis* and *Farrodes. Massartella* species, which are endemic for different summits, seems to be restricted to oligostenothermal streams. Baetidae, represented by three still unidentified genera, are more common and abundant then Leptophlebiidae, probably because they are more tolerant to water temperature fluctuations.

MO 92

Assessing the conservation status of lower course of Una river using records of Adephagan Coleoptera

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Carabid and Hydradephagan water beetles possess a range of characteristics needed for the evaluation of the conservation status of wetland habitats as they have a strong role as environmental indicators. The aim of the research was to estimate the conservation value of the lower course of Una where it forms the border between Croatia and Bosnia and Herzegovina. It is the part of the Croatian National Ecological Network and a potential NATURA 2000 site.

Sampling was conducted along the river and its narrow coastal area in 2009. We used a D-framed pond net and pitfall traps to collect beetles at six selected sites along the research area. We comprised a variety of microhabitats differing in vegetation density or disturbance caused by water flow: open fast-flowing and slow-flowing water (with or

without vegetation), stagnant water, side canal, fish pond, periodically flooded grasslands, agricultural land.

Here, we present the first results on adephagan diversity of this area. The highest richness of hygrophilic carabid species were found in wet grasslands and riparian willow forests, while the richest Hydradephagan community was found in densely vegetated stagnant water along the river shoreline.

The lower Una valley has undergone low human impact with well preserved riparian habitats, hence representing a highly valuable site for investigated group of Coleoptera. The maintenance of natural course enabling periodical flooding of surrounding grasslands, suitable agriculture practices as well as restricted vegetation removal management are necessary for effective conservation of such rare habitat types.

MO 93
Experimenatal research on concepts and methods of keeping and breeding *Dytiscus latissimus* Linnaeus, 1758 (Coleoptera; Dytiscidae)

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Our research direction is based on aspiration to study the biology of *D. latissimus* in natural habitat as well as in laboratory conditions and to identify the position of *D. latissimus* in biocenoses in order to further elaborate the concept of ecosystems protection as unified landscape complexes. We also target to study the ethology, breeding and development cycle of the species in laboratory environment in order to possibly introduce these species in zoo culture, with perspective to reintroduce these in natural habitat in the future.

Our environmental studies are being conducted on the territory of the former fish farm of Rugeli region, Daugavpils town, Republic of Latvia (Google-Earth coordinates 55°52'34.01"C 26°35'17.41"B), which already for several years has a dense population of this diving beetle. We have also identified typical reproduction locations and plants preferred by females for laying eggs, which are *Carex acuta, Carex rostrata, Caltha palustris*. We have determined food preferences of *D. latissimus* for forage objects, which appeared to be caddis larvae *Limnephilidae*. We have studied seasonal activity of D. latissimus and developed observation and gathering methods of these species in natural habitat.

As of today on the basis of Latgales zoo (Latgales zoodārzs, Daugavpils, Latvia) we have developed and constructed experimental working models of aqua-systems for keeping and breeding imago, as well as for keeping *D. latissimus* larvae. We have also traced the length of the full development stages of these species in laboratory conditions.

MO 94
Mayflies and Stoneflies of the Wutach River in the Black Forest, Germany (Insecta: Ephemeroptera, Plecoptera)

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The Wutach River is a tributary of the Rhine River that flows through the southern Black Forest. It is famous for its savage gorge, which cuts geological layers of about 500 milli-on years – beginning from the Paleozoic granites of the Black Forest to the Jurassic limestones of the Swabian Alb - at an air line of only 20 km. Especially for its geological uniqueness the Wutach Gorge attained the status of a nature reserve already in 1939. The ecological conditions of the Wutach River reflect a cold mountain stream with high concentration of oxygen and a fast and turbulent current. The riverbed is composed of rocks, stones, or gravel with only occasional sandy and silty patches. In the study area the river belongs to the epi-, meta- and upper hyporhithron with good water qualities ranging from oligo- to β-mesosaprobic conditions. During April 2007 - February 2009, monthly collections of mayflies and stoneflies were undertaken at defined collection points by kick-sampling, net-sweeping and light trap-ping. Due to the mountaneous character of the stream, rheophilic species predominate at Wutach R., but also few lentophilic species do occur. The study area with its diverse habitats also serves as a refuge for species that are considered rare in Germany, such as *Baetis melanonyx, Procloeon bifidum, P. pennulatum, Ecdyonurus submontanus, Habrophlebia lauta* (Ephemeroptera), and Leuctra geniculata, Perla abdominalis, and *Taeniopteryx auberti* (Plecoptera). A total of about 3500 specimens were collected during this period. 26 species of Ephemeroptera in 13 genera and 7 families and 32 species of Plecoptera in 13 genera and 6 families were collected.

MO 95
Population dynamics of *Gmelinoides fasciatus* in the Volga River at Tver

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The small Baikalian amphipod *Gmelinoides fasciatus* Stebb. was endemic in the region of Lake Baikal (Lake Baikal, Angara River) and to the Yenisei River Basin**.** During the 1960's and 1970's it was introduced in the European part of Russia and in Siberia in order to enhance fish production. Soon after these planned introductions, the quick spread of this exotic species and its negative impact on native species were realized. Especially in lakes and reservoirs the species displaced indigenous taxa and dominates the community in terms of abundance as well as biomass. In the Volga Basin, the species was introduced in 1965 into the Gorkovskoe reservoir and it appeared in 1977 already about 400 km downstream in the Kuibyshevskoe reservoir. The upstream movement took longer, and the species was recorded in 1986 from Rybinsk reservoir and only in 2006 at Tver. The record at Tver is discussed, data from three summer seasons were compared and an extensive sampling programme in 2008 revealed that the location Tver is characterised by three generations per year. The monthly dataset (March – November) from 2008 revealed population dynamics, abundance and biomass. Understanding the effects on benthic communities caused by the invasive amphipod *Gmelinoides fasciatus* is crucial in order to predict further developments in European inland waters.

MO 96
Habitat and diets of mayflies in an Andean stream (Colombia)

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The diets of 490 mayflies corresponding to six ephemeroptera species: *Thraulodes* sp, *Tricorythodes* sp, *Leptohyphes* sp, *Americobaetis* sp, *Camelobaetidius* sp and *Paracloeodes* sp, were analysed in rock, leaf litter, sediments and macrophytes habitats in an Andean stream. The examined species were preferable consumers of Fine Organic

Matter (20,62%) following by the diatom consumption (3,28%). There are no significant differences between the habitats and the species diets. However, *Camelobaetidius* sp showed preferences for diatoms in rock habitat, whereas *Tricorythodes* sp has higher values of Fine Organic Matter and Vegetal Material in its stomach contents.

MO 97

Seven decades long monitoring of the aquatic bug (Heteroptera: Nepomorpha) fauna in the Lake Balaton

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Four detailed faunistic lists of aquatic Heteroptera (Nepomorpha), originating between the years 1928 and 2002 from Lake Balaton, the largest shallow lake of Central Europe, are available. A comparative analysis confirmed that the aquatic bug fauna of this great lake can be established with suitable accuracy if it is sampled by different but devoted collectors. 24 species of aquatic bugs have been reported from here. The fauna changed considerably in the last decades. Species lists of the four basins of the lake established during the four sampling periods show characteristic differences. Not only the frequency of 6 species (*Micronecta griseola, M. pusilla, M. scholzi, M. minutissima* as well as *Sigara striata, S. falleni*,) changed characteristically but there has been a distinct change in the ratio of rare species too. Rare species were present in significantly higher proportion in the period 1928-30 than later, in any of the samplings between 1984 and 2002. All these changes run parallel with the direction of anthropogenic influences.

MO 98

Morphological features of larvae of *Drusus plicatus* Radovanović, 1942 and pupae of *Drusus croaticus* Marinković-Gospodnetić, 1971 and *Drusus septentrionis* Marinković-Gospodnetić, 1976 (Insecta: Trichoptera) with ecological and distributional notes

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Within the order Trichoptera, one of the most interesting genera regarding ecology, distribution and evolutionary history is the genus *Drusus.* A total of 28 species were recorded in the Balkan Peninsula, 90 % of which are endemic. The *Drusus* species usually inhabit springs and crenal sections of mountain streams and rivers, with low annual water temperature.

In this study we present results on morphological features of larvae of *Drusus plicatus* Rad. collected in Macedonia and pupae of *Drusus croaticus* Mar. and *Drusus septentrionis* Mar. The pupae of *D. croaticus* were collected in the spring of the Bijela rijeka River (National Park "Plitvice Lakes", Croatia), whereas pupae of *D. septentrionis* were obtained through the rearing of larvae to adults in the laboratory. The larvae of *D. septentrionis* were collected in the spring of the Bistrica River (Bosnia & Herzegovina), and transferred to the laboratory. Hereby we give the first descriptions of pupae of any endemic species of the genus *Drusus* from the Balkan Peninsula. Additionally, ecological features and distribution of studied species in the Balkan Peninsula are shown and discussed.

MO 99-101: SE Asian – European Forum

MO 99

Tick bite that occurs with the Isolated Facial Paralysis

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Tick-borne diseases can be seen all over the world and their importance rise increasingly. It is noticeably important that the disease and death rates due to tick-bites in our country in different area increased in 2008. In Turkey, the numbers of diseases which are transmitted by ticks are considerably large and all of them are not observed. Isolated facial paralysis cases due to tick infestation in ear are infrequent in literature. The development of isolated facial paralysis due to ticks can be explained by several theories. In this article, there is a case report of a 3 year- old girl who applied to our clinic with severe left ear pain, paresthesia on left half of her face, not be able to close her left eye and lisping, and who experienced a tick removing operation from her external auditory canal.

MO 100

A case reports: Entamofobia and Domestic Delusional Parasitosis

Nihal Doğan

Turkey

Delusional parasitosis is a form of psychosis whose victims acquire a strong delusional belief that they are infested with parasites, whereas in reality no such parasites are present. It is usually mono-symptomatic, where the patient is convinced of being infested with animal parasites while no objective evidence exists to support this belief. Very often the imaginary parasites are reported as being "bugs" crawling on or under the skin; in these cases the experience of the sensation known as formication may provide the basis for this belief. The patients can bring numerous samples for examination from their skin, clothes and environment. Practically all patients refuse psychiatric help in delusional parasitosis. One or more members of the same family often suffer from the same psychosis, and the characteristic delusional state is identical. The secondary victims are often family members, who are dominated by their spouses, show filial devotion or are trying to keep the family in harmony. Patients whose delusion of parasitosis is not severe can be helped without psychopharmacological intervention. They can be relieved of their symptoms by giving them sympathetic counseling, and gaining their confidence.

In our case we reported a family complained about the persistent belief that they were infested by parasites. One of the patients was a 58 year-old woman who complained about cutaneous sensation of bugs on her head for 5 years and the other patient was the daughter of her who was 22 years old. She was diagnosed as entamofobia. Our patients used to visit all health institutions and science faculty about their complaints. In addition to use the plant and agricultural drugs, the mother forced all family members to have their hair cut frequently.

People with delusional parasitosis are likely to ask for help not from psychiatrists but from dermatologists, veterinarians, pest control specialists, or entomologists. Because delusional parasitosis is not at all well known to non-specialists, under those circumstances the condition often goes undiagnosed, or may be incorrectly diagnosed.

MO 101

A review of the weevils of the genus *Cionus* Clairville & Schellenberg (Coleoptera: Curculionidae) of the Latvian fauna

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The weevils of genus *Cionus* Clairville & Schellenberg easily differ from other representatives of a subfamily Curculioninae by anterior margin of prosternum with deep emargination reaching to procoxa, and by one or two spots on suture of elytra. About 60 known species of genus *Cionus* inhabit mainly the Palaearctic and afrotropical regions. For Latvian fauna 6 species are reported. In adjacent territories the number of the registered species from this genus differs a little: Byelarus - 5 species, Estonia - 6 species, Lithuania – 5 species.

The first data on weevils of genus *Cionus* Clairville & Schellenberg in Latvia were published in the beginning of the 19th century (Precht 1818). Subsequently, more than 10 works were published where information on genus *Cionus* can also be found.

In the Latvian fauna 6 species of the genus *Cionus* Clairville & Schellenberg are known. *C. tuberculosus*, *C. scrophulariae, C. hortulanus* in Latvia are common and widely distributed. *C. longicollis, C.nigritarsis, C.olivieri* are rare and insufficiently known species (known no more than 4 localities).

Shape and structure of male genitalia and internal sacs of Latvian species were studied. Illustrated key to these species is prepared.

Because of unsufficient knowledge of the weevils of genus *Cionus* Clairville & Schellenberg and subfamily Curculioninae our researches will be continued.

S16: Biorational control of arthropod pests: mechanism and application IV.

Room Copenhagen

Comparative aspects of Cry toxin usages in insect control

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Crystalline (Cry) endotoxins from *Bacillus thuringiensis* (*Bt*) and related toxins are currently being used in plant protection as insecticides and in genetically modified plants. While both take advantage of the specificity of Cry lectins against various insect orders, there occur characteristic differences in (*i*) form of application; (*ii*) compatibility with agrotechnologies; (*iii*) the exact active ingredient; and (*iv*) its environmental fate. The clear advantage of insect resistant *Bt*-plants is that they eliminate labor- and energy-demanding field application. In turn, however, *Bt*-plants continuously produce truncated Cry toxin during vegetation. As a result, these *Bt*-plants do not comply with the principle of integrated pest management, as Cry toxin administration cannot be limited to insect pest occurrence. *Bt*-insecticides and *Bt*-plants also differ in their active ingredients: while the former contain protoxins that require metabolic activation in the insect gut, the latter mostly produce preactivated toxin. In case of Cry1Ab, DIPEL® contains a 131 kDa Cry1Ab protoxin, along with further Cry1 and Cry2 protoxins. In contrast, *Bt*-plants of genetic event *MON 810* express a single truncated Cry1Ab toxin of 91 kDa. In addition to pesticide registration issues, this difference has pronounced effects on the easy development of insect resistance against Cry1Ab. Finally, Cry1Ab lectin protected from rapid decomposition in the plant tissue show environmental persistence in stubble.

Organic nanofibers as dispensers for insect pheromones: an entirely novel technical approach to mating disruption in IPM programs

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Conventional pheromone dispensers have a long history of development. In spite of nearly fourty years of improvements they still fall short of the ideal in mechanical and UV stability, predictability of release rate, long lasting efficacy, cost, and environmental concerns over limited biodegradability of remaining polymer material, to name a few obstacles. With modern requirements such as sustainability as well as mechanical pheromone distribution in mind, we searched for practical ways of overcoming most of past shortcomings. We now have first results which prove successful dispensing of sex pheromones with the aim of IPM by behavioral, nontoxic intervention against mating activities of the European grape vine moth *Lobesia botrana* (Lepidoptera:Tortricidae), a severe pest in vineyards. At Freiburg, Germany, electrospun, biocompatible fibers of organic nanomaterial served as dispensers during the growing season of 2009.-According to Greiner & Wendorff (2007), such electrospun nanofibers offer new territory of numerous applications and in our hands are a viable alternative to currently available dispensers. A fine layer of Ecoflex® nanofibers loaded with (*E,Z*)-7,9-dodecadien-l-ol acetate have been used. This layer was deposited in a vineyard. According to the standard procedure of Doye (2006), field cages with reared male and female *L. botrana* moths served as test sites for quantifying the disruption success over time. Three consecutive replications were run during spring and summer of 2009 with segments of electrospun nanofibers, followed by one experiment with a continuous sheets of nanofibers exposed on a mechanical carrier. No treatment (blank) and commercial Isonet® dispensers served as negative and positive controls, resp. Disruption effects observed were statistically significant for 3 weeks, a time period that leaves room for being experimentally optimized and considerably extended over the entire growing season.-Application of this novel approach to other commercially important pest insects is imminent, as are steps taken toward mechanization of the procedure.

Compatibility of the very sensitive parasitoid *Psyttalia concolor* (Szèpl.) with some modern pesticides with different mode of action. Influence of the exposure route and persistence

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Psyttalia concolor is a parasitoid species as sensitive to pesticides as the 2 indicators species used in assays for pesticide registration under the directive 91/414/EEC.

In this work, laboratory studies were conducted to determine the influence of the exposure route (residual contact, ingestion and topical application) on the susceptibility of the most expose life stage (adults) to several modern

insecticides with different mode of action, included in annex I of the directive 91/414/EEC. Mortality at 72 hours as well as the beneficial capacity (% attacked hosts and progeny size) was recorded and insecticides classified according to IOBC toxicity ratings.

Deltamethrin (neurotoxic pyrethroid) and Spinosad (neurotoxic naturalyte) were toxic (4) irrespective the way of exposure and Methoxyfenozide (moulting accelerator), harmless (1). Effects of Spiromesifen (lipid synthesis inhibitor), Abamectin and Emamectin benzoate (chloride channel agonists), were dependent on the way of application. Via residual contact, Emamectin was harmless (1) and Spiromesifen and Abamectin moderately harmful (3) for mainly reducing progeny size.

Extended lab persistence studies were also performed and effects of residues of different ages were studied (3-d, 7-d, 14-d and 21-d-old). Deltamethrin residues were very toxic irrespective of the age, but 14-d and 21-d-old Spinosad and Spiromesifen residues were only slightly toxic to the parasitoid and 3-d-old Abamectin residues were harmless.

Unexplained premature mortality in Argentine stem weevil populations: from field observation to causal mechanism

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The braconid endoparasitoid *Microctonus hyperodae* was successfully introduced into New Zealand in 1991 to control the serious exotic pastoral pest, Argentine stem weevil (ASW). The wasp parasitises the adult stage of the ASW and normally the weevil dies only when the fifth-instar parasitoid larva emerges. However, an unexplained source of premature mortality of ASW has also been observed during parasitoid biocontrol research over the last 15 years. Although this is an extra mortality factor that has an additional suppressive effect on ASW populations for better pest management, it does not make any adaptive sense. This phenomenon may well occur in other host-parasitoid systems resulting from maladaptation to the New Zealand ecosystem arising from extreme population fluctuation. Therefore, it might have implications for the introduction of future biocontrol agents, as well as for understanding insect invasive processes in novel ecosystems.

We hypothesise that under field conditions *M. hyperodae* kill some ASW without parasitising them through injection of venom without eggs. Taking a combined molecular biology / biochemical approach, the presence of parasitoid eggs was detected only in parasitised weevils and in keeping with the hypothesis, venom proteins in the absence of an egg were typical of prematurely dead weevils only. However, this is not typical of what is understood to be pseudoparasitism because of the rapid onset of mortality.

The finding raises implications for biocontrol theory, where parasitisation rates themselves may underestimate impact. Also, if venom injection is shown to be the causal mechanism, a new class of biopesticides could arise as another outcome for this research.

Neem based pesticide for the management of major pests of rice, cotton, banana and vegetables

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Laboratory and field studies were conducted to evaluate bioefficacy of NeemAzal (Neem based pesticide) for the control of major pests of rice, cotton, banana and vegetables. In rice, investigations were carried out for the control of leaf folder, *Cnaphalocrocis medinalis*; stem borer, *Scirpophaga incertulas*; and earhead bug, *Leptocorisa acuta*. Combination spray of NeemAzal T/S 1% @ 2 ml/lit + Monocrotophos 36 SL @ 2.5 ml/lit recorded the highest feeding and ovipositional deterrency against leaf folder and earhead bug. It also significantly reduced the stemborer damage. NeemAzal 1% is proved to be highly safer to natural enemies in rice ecosystem. In cotton, neem oil play a major role for the control of stem weevil. Application of neem oil 3% was highly effective against stem weevil infestation and incremental cost benefit ratio was also recorded. In banana, NeemAzal 1.2% EC is highly effective against Pseudostem borer, *Odoiporus longicollis* infestation. Stem injection of NeemAzal @ 4:4 ratio recorded 75.99 % reduction in infestation over control, which is more effective than by swabbing. NeemAzal significantly reduced oviposition of the weevil. In tomato, highest ovipositional deterrency and population reduction (30.00 to 66.00 %) from 1 to 15 days after treatment were recorded in combination treatment (NeemAzal T/S 1% @ 1ml/lit and Acephate 0.75g/lit) against *Helicoverpa armigera* and *Bemisia tabaci.* In Cabbage and Cauliflower, 72.27 % reduction in egg laying was observed due to NeemAzal 2 ml/lit against *Plutella xylostella* and 88.75% against *Spodoptera litura*. These studies indicated NeemAzal is a better alternative to synthetic pesticides in the management of major insect pests of rice, cotton, banana and vegetables.

S17: Forest entomology IV.

Room Brussels

Genetic differences among Central European Cockchafer (Melolontha spp.) species

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Cockchafers are widespread pest species throughout Central Europe. Economically important species comprise the European cockchafer (Melolontha melolontha Linnaeus), the Large cockchafer (Melolontha pectoralis Germar) and the Forest cockchafer (Melolontha hippocastani Fabricius).

In the present work we have investigated the genetic differences among these three species. A 1188 bp fragment of the cytochrome oxidase (COI) gene of the mitochondrial DNA (mtDNA) from 44 M. melolontha, 6 M. hippocastani and 11 M. pectoralis individuals from Hungary and Austria were compared. A sequence divergence of 12,3% was found between M. melolontha and M. hippocastani, 13,0% between M. hippocastani and M. pectoralis and 5,1% between M. melolontha and M. pectoralis. The sequence divergence within the M. melolontha populations was 0,25%.

Web-spinning sawflies of the genus *Cephalcia* Panzer (Hymenoptera, Pamphiliidae) in the *Picea abies* forests of Slovenia

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The first noted local outbreak of web-spinning sawflies (*Cephalcia* spp.) appeared in 2009 in the northern part of Slovenia. The infested area of a 60-90-year old Norway spruce (*Picea abies* (L.) Karst.) stand was 600-800 m above sea level, on a northern slope with an inclination of 20% and covered 62 ha. The growing stock was 300 m^3, and the stand was in good condition (managed), with more than 70% *P. abies*; the other tree species were *Fagus sylvatica*, *Larix decidua* and *Pinus sylvestris*. The most infested area covered 4 ha, the medium area 18 ha and the low damaged area was 40 ha. Within most infected area, we set 32 sample plots for measuring stand attributes (DBH, social status, size and length of the crown, defoliation, vitality, and other visible damage). Within this area, we also set six plots for temperature and humidity measures of the soil at a 15 cm depth. The density of *Cephalcia* spp. population in August 2009 was high (we collected 1770 specimens of the prepupal stage on 1m^2 of soil). In 2009, observations in the outbreak area focused on the following problems: investigation of characteristics of the affected stand, identifying the spectrum of spruce web-spinning sawfly species involved in the infestation, life activities of the epidemic population and questions connected with the importance of the outbreak to Slovene forestry and control efforts.

ForestryImages (www.forestryimages.org): Images as tools to support forestry and natural resource education

G. Keith Douce

Center for Invasive Species & Ecosystem Health, University of Georgia

ForestryImages www.forestryimages.org is a searchable, taxonomically-based, web-accessible image archive that enables users to locate, down-load and use images in educational programs and materials in forestry, forest health and natural resource management. Forestry Images makes more than 119,000 images on subjects and topics that include: species of regulatory concern, invasive species, entomology, pathology, silviculture, understory and overstory plants, and management practices available for no-cost educational uses. Although ForestryImages was initially focused on North America, it is now global in scope and provides access to images taken in more than 100 countries by over 1650 photographers. ForestryImages contains more than 12,000 images of European organisms.

Forestry Images is one of four interfaces to the Bugwood Image Archive System operated by The Center for Invasive Species & Ecosystem Health (www.bugwood.org) based at The University of Georgia, USA.

This presentation will provide a background on the ForestryImages system, provide the audience with examples of the types of images available through the system, and how images can be accessed and used to support education.

A new release mechanism of cis-verbenol, a constituent of the aggregation pheromone of the European spruce bark beetle *Ips typographus*

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It is well known that cis-verbenol, a constituent of the aggregation pheromone of the spruce bark beetle *Ips typographus*, is liberated as frass pheromone. After oral uptake of the host terpene (-)-α-pinene and following oxidation of the precursor the beetle releases cis-verbenol via the frass. This procedure to synthesize and release the aggregation pheromone implies a high risk for the individual beetle. When attacking vigorous trees pioneer beetles are endangered to stick in the resin and if not, they may be killed in their bore holes by high concentrations of volatile host terpenes. A high attack density within a short time period will minimize these risks. We postulate that it could be an advantage to synthesize and release aggregation pheromones outside the host leading to a precolonisation aggregation which will enhance the chance to overcome host defense mechanisms. Therefore one possibility could be a tracheal uptake of (-)-α-pinene and release of cis-verbenol. Recent studies show that (-)-α-pinene has access to the beetles via the tracheal system and is oxidized to cis-verbenol. In the present study we could show that *I. typographus* has the ability to exhale cis-verbenol. In laboratory studies starved beetles were incubated in an artificial (-)-α-pinene atmosphere and their volatile products were collected in a closed loop system and analyzed via GCMS. (-)-α-pinene treated beetles exhaled significant higher amounts of cis-verbenol compared to untreated controls.

Role of the European Food Safety Authority in pest risk assessment and risk communication with reference to insect species potentially harmful to trees

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The European Food Safety Authority provides independent scientific advice and transparent communication on risks relating to the safety and security of the food chain in the European Community. The EFSA Scientific Panel on Plant Health addresses the increasing demand of EU risk managers for scientific advice on risks posed by organisms harmful to plants and plant products. Advice is published as scientific opinions which provide a basis for consideration of phytosanitary measures to protect against the introduction and spread of harmful or invasive species in the European Community, under Council Directive 2000/29/EC. Since its inception in 2006, the Panel has delivered forty scientific opinions on the risks posed by species of invasive plants, invertebrate pests and pathogens, and pathways for pest movement and guidance on the process and methodology for the evaluation of risk.

The process and methodology for the evaluation of risk is discussed with particular reference to *Thaumetopoea processionea* and *Dryocosmus kuriphilus*.

S19: Urban entomology, urban pest

Room Maastricht

Effect of hazelnut oil and castor oil on adults of *Callosobruchus phaseoli* F. under laboratory conditions

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The development of resistance of many insect species, the demand for pesticide free products, the increased concerns about worker safety and the gradual withdrawal of several commonly used insecticides, has led researchers to evaluate the potential use of other materials to reduce risk control methods. Vegetable oils can play an important role for control of stored product pests, where these materials are readily available and the insecticides are in high costs. In this study, the insecticidal effects of castor and hazelnut oil were investigated against *Callosubruchus phaseoli* (F). The castor oil at 5, 6, 7, 8 and 9 ml/kg and hazelnut oil at 2.8, 4.4, 6, 7.6 and 9.2 ml/kg were tested against *Callosubruchus phaseoli* in cowpea. All bioassays were conducted at 27±1°C and 65±5% RH. The experiments carried out with 4 replications and 30 insects (adult or larva) were used for each replication. Mortality was counted after 24, 48 and 72 h of exposure and after the 72 h mortality count, all insects (dead or alive) were removed and the vials were left at the same conditions for further 35 d for *C. phaseoli* to assess progeny production. The increase of dose and exposure interval increased mortality. After 72 h of exposure, mortality of *C. phaseoli* received to 80.83 % on hazelnut oil at high rate (9.2 ml/kg). In contrast, mortality for castor oil was higher than hazelnut oil and received to 86.66% at 9 ml/kg. For *C. phaseoli*, the lowest LC_{50} value on 72 h was observed in the hazelnut (6.57 ml/kg). The application of oils significantly reduced progeny production. In both oil and in all rates, the percentage of reduction in progeny production was up to 80%, even in low rate. These results show that the oil of some plant species may be exploited for insect control in stored products.

A novel semi-field technique for assessing insecticide activity against bedbugs

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During the past decade, reports of a rapid growth in the number of bed bug infestations have become very common. There are a number of potential explanations of the increase, however despite our knowledge and understanding, the real explanation is still unclear. A number of new bedbug control products and methods have been introduced, but it is likely that until we have a novel insecticide molecule to which the bedbugs are fully susceptible, combinations of existing insecticides and methods will remain the main tools in this battle.

The authors introduce the short and long-term effects of combinations of S-methoprene insect growth regulator, natural pyrethrum and PBO developed for use by householders and pest control operators. The combinations are active against resistant strains, with the S-methoprene insect growth regulator interrupting the bedbug's development and reproduction. Following a series of individual laboratory trials, the authors have designed a novel semi-field trial assessment technique. The presentation introduces this new technique, and describes the benefits, results and conclusions. This laboratory technique significantly improves our understanding of the way that insecticides work against this important pest species.

Prevalence of flea infestation in dogs from Belgrade area

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Flea infestation is the most common ectoparasitic condition of dogs with worldwide distribution. This wide distribution and the fact that fleas are major nuisance pests a matter of public health and the source of flea allergic dermatitis (FAD), one of the most common causes for the presentation of dogs to the veterinarian, make control definitely necessary.

A survey was conducted in order to gain current information on flea species (Siphonaptera: Pulicidae) infesting dogs in Belgrade area along with data on the factors that affect the presence, distribution and seasonality of infestation.

Fleas were collected from 332 dogs presenting to private veterinary practices in Belgrade during 2009. The fleas were preserved in 95% ethanol and identified using morphological criteria.

Three flea species were found parasitizing dogs. *Ctenocephalides felis* was the most abundant (79.21 % of fleas identified), followed by *Ctenocephalides canis* (19.29.%) and *Pulex irritans* (1.50 %). *Ct. felis* was more abundant on dogs living in houses than in apartments, but the reverse was found for *P. irritans*. Overall flea abundance and *Ct. canis* abundance were highest in rural areas, whereas the presence of other pets sharing the abode was associated with higher overall flea abundance and *Ct. felis* abundance. Only *P. irritans* abundance was positively related to the activity of dogs. *Ct. canis* and *P. irritans* abundances were higher during the warm period of the year. Mean annual temperature was negatively correlated with overall, *Ct. canis* and *P. irritans* abundances, but positively related to *Ct. felis* abundance. The highest prevalence (28.61%) of infestation on dogs occurred in August and the lowest (5.12%) in April.

Tuesday, 24 August

Plenary lecture 3

Room Copenhagen

The great carrier of an insect: the Drosophila genetic model system

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The genetic „dissection", i.e. isolation of mutants and their analysis, is the strategy which gives the highest „resolution" in the analysis of gene function and interaction. Drosophila with the knowledge of 100 years' classical genetics, the whole armory of molecular biology and its full annotated genome sequence offers unique advantages for such studies in the postgenomic era. As a Holometabolous insect, it is especially suitable for studying the regulation of insect development and physiology.

The fruitfly system offers a unique collection of genetic techniques and resources: genetic transformation of any DNA sequence into the germline, manipulation of gene expression using the binary Gal4 system, disruption of nearly all the genes by transposon insertions, gene silencing (RNAi) by double-stranded (ds) RNA for the whole genome, targeted mutations by homologous recombination, mosaic techniques, etc.

The availability of the complete sequence of the Drosophila genome opened up a new dimension for research on gene networks and interactions. Lately, the genome sequences of 12 other Drosophila species have become available which offers further advantages for evolutionary studies.

In addition to many basic biological problems, the fruitfly system has given important contributions as well to the knowledge of insect hormones, especially ecdysone, the determination and development of the segmented body plan and the central nervous system. The talk brings up specific achievements in these fields connected to Drosophila.

S21: Taxonomy of lepidoptera I.

Room Brussels

The Noctuidae Europaeae series – a twenty-years challenge

Michael Fibiger

The Australian scribbly gum moths (*Ogmograptis* Meyrick, Bucculatricidae) and their unique insect/plant interaction

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Ogmograptis scribula Meyrick was described in 1935, but the biology of the genus producing the iconic scribbles on certain smooth-barked *Eucalyptus* remained enigmatic. Based on the ribbed cocoon, Nielsen and Common assigned *Ogmograptis* to the Bucculatricidae in 1991. Details of the biology now reveal a complex and unique interaction between the larva of *Ogmograptis* and its host, with two morphologically different larval forms. The entire mine is located at the level of the cork cambium. The very slender legless larva of the earlier instars makes a narrow, widely spaced and irregularly looped track followed by a vertical set of shorter, tighter loops with a turning loop at the end. The larva then either returns in the same or a closely parallel track to end with a second turning loop, presumably when the cork cambium starts growing in preparation to shed the outer layer of the bark. At this point the larva moults into the final instar with legs, feeding exclusively on the callus tissue now filling the track, before boring to the surface and pupating at the foot of the tree. Biology and morphology have confirmed *Ogmograptis* to be an overall rather plesiomorphic bucculatricid. Recent studies by Lauri Kaila helped resolve the identity of another group of lepidopteran larvae producing very similar tracks at the level of the vascular cambium in *Eucalyptus*, revealing yet another bucculatricid genus, closely related to the South African *Leucoedemia* Scoble & Scholtz.

New genetic lineages in the West Palaearctic *Hyles euphorbiae* complex (Lepidoptera: Sphingidae, Macroglossinae)

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Previous molecular studies of the *Hyles euphorbiae* complex (HEC) in the Western Palaearctic have revealed a clear geographical pattern of genetic differentiation into two main lineages, the European *H. euphorbiae* and the North African *H. tithymali*. Based on morphology, East European populations from Turkey, and those from Armenia, Azerbaijan, northern Iraq and western Iran have been regarded as subspecies *H. e. conspicua*, whereas populations from even further East, i.e. from central Iran to Afghanistan and neighbouring parts of Turkmenistan and Pakistan, are generally treated as another, *H. robertsi*, but genetic differentiation of these two taxa from *H. e. euphorbiae* had not yet been detected. The results of the genetic analysis presented here confirm *H. robertsi* as a distinct lineage, but also show several additional lineages, demonstrating unexpected genetic variability. The divergence becomes especially apparent when sequences of closely related taxa, unambiguously accepted as separate species, are included in the analysis. However, the genetic network appears incongruent with the distributions of both pattern elements of larvae and the wing patterns of the moths.

Morphological evolution in Lepidoptera: some potential consequences of recent molecular findings

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Few morphological characters support most of the inferences which have so far appeared at all feasible about superfamily interrelationships within the Lepidoptera-Ditrysia, and considerable changes in these inferences have therefore been foreseen. The first major findings on high-rank ditrysian interrelationships emerging from ongoing large-scale molecular analyses indeed do support a number of noticeable changes of current concepts, albeit partly still in a non-robust way. Re-examination/re-interpretation of some morphological characters prompted by these findings will be presented, and special attention is paid to suggested consequences concerning the number of independent evolution of complex hearing organs

Butterflies of Indian Agricultural Research Institute campus (New Delhi, India) and their conservation

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The Institute was established in 1905 as Imperial Agricultural Research Institute located at Pusa, Bihar, it moved to New Delhi in 1936. The institute occupies 1200 acre (4.9 km^2) agriculture land in New Delhi, India. The National Pusa Collection, one of the largest collections of insects in the world. This collection houses more than half a million specimens of which 0.1 million comprising about 17,500 species authentically identified, in which lepidotperan identified insects are 4110 in number.

Butterflies are the most beautiful creature in the world and most attractive than other insects. These are valuable pollinators when they move from plant to plant gathering nectar. They are also good indicators of environmental quality as they use sensitive to changes in the environment.

The collections were made during years 2005 to 2009 from IARI campus. The butterfly's photographs were taken in the field.

In the current study, a total of 76 species of butterflies recorded under five families. The collection specimens were identified from the identified collection in National Pusa Collection (Insects). The lycaenid and nymphalid butterflies were found dominant with 24 and 20 species, respectively, followed by Pieridae (18), Hesperiidae (8) and Papilionidae (6). Three rare [*Leptosia nina* (rare in New Delhi)*, Salatura genutia* and female specimen *Hypolimnas misippus*] butterfly were seen in the study. *Hypolimnas misippus*, which is listed in Wild Life Protection Act-1972 in schedule I and II. Two new butterfly was found in IARI campus, New Delhi *i.e. Graphium doson axion* on tree *Polyalthia* sp. and *Talicada nyseus delhiensis* on *Bryophyllum calycinum*.

On the conservation point of view, the larvae were collected from field and reared in lab condition at room temperature and after rearing released back to the natural environment.

S22: Phytoplasma vectors I.

Room Strasbourg

Why are leafhoppers, planthoppers and psyllids vectors?

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DI.VA.P.R.A. – Entomologia e Zoologia applicate all'Ambiente "Carlo Vidano", Università degli Studi di Torino, Italy

Phytoplasmas are transmitted by insects of a few families of Homoptera. Transmission specificity defines the fact that only selected species can act as vectors of a pathogen. Phloem-feeding behaviour is a pre-requisite for transmission of phloem-restricted pathogens like phytoplasmas. But we know that many heteropterans and most of homopterans are phloem feeders, yet only few are vectors. Insect–phytoplasma recognition and adherence, notably at the midgut and salivary gland levels, is another pre-requisite for phytoplasma entrance and colonisation of the vector. Attachment of phytoplasmas to insect cells is apparently not very specific in in vitro assays, while a specific interaction between the major phytoplasma antigenic membrane protein (Amp) and the insect microfilament complex (actin and myosin) has been observed. Similarly, ATP synthase of selected vector species specifically interacts with Amp from vector species. Once the phytoplasmas have colonised the midgut epithelium they must cross the basal lamina to spread in the haemolymph. It has been proposed that the grid-like structure of the basal lamina of Heteroptera is not permeable to mollicutes. Once in the haemocoel, phytoplasmas must evade insect immune system and multiply. Finally, the resistance of the salivary glands to phytoplasma infection may explain the fact that some species acquire phytoplasmas but are not vectors. We can speculate that, among phloem feeders, heteropterans are not vectors because of their basal lamina structure, while whiteflies, aphids, mealybugs and scale insects either lack receptors at the midgut or salivary gland levels or they do not sustain phytoplasma multiplication.

Taxonomic affinities of world phytoplasma vectors

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Phytoplasma disease vectors are found largely within the leafhoppers and planthoppers (Hemiptera: Auchenorrhyncha) but also among the psyllids (jumping plant lice) (Hemiptera; Psylloidea). Around 200 vectors of phytoplasma are already known but many more are likely to be recognized because there are already many more phytoplasma diseases characterised than there are known vectors of the diseases. Most of the disease vectors are likely to be found among leafhoppers and delphacid planthoppers. But where are the vectors currently found within the phylogenetic relationships of the Auchenorrhyncha? Are vector species over-represented in some leafhopper tribes or subfamilies. Is there a reason for this? This presentation will discuss the taxonomic affinities of the known vectors.

A phytoplasma secreted protein that improves insect vector fitness

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Phytoplasmas induce morphological changes in their plant hosts and affect plant-insect interactions. We studied transmission of Aster Yellows phytoplasma strain Witches' Broom (AY-WB) by the aster leafhopper *Macrosteles quadrilineatus*. We found that infection of AY-WB within the insect, plant or both hosts increases the fecundity of *M. quadrilineatus* by 60 to 70%. In order to identify proteins responsible for these changes in these interactions with insects, the fully sequenced AY-WB genome was mined for genes encoding secreted proteins. These proteins are candidate virulence factors (effectors) that may manipulate the plant or insect hosts. Fifty-six secreted AY-WB proteins (SAPs) were identified (Bai *et al.*, MPMI, 22, 18-30. 2009). One candidate effector is SAP11, which carries a nuclear localization signal and accumulates in the plant cell nuclei. In this study, we found that stable over-expression of *SAP11* in Arabidopsis increased the fecundity of *M. quadrilineatus* by on average 25%. More recent data suggests that SAP11 may interact with plant proteins that regulate plant defense responses to pathogens and pests. This may affect *M. quadrilineatus* nymph production. Thus, the SAP11 effector function extends beyond its direct interaction with the plant host; it stimulates the generation of more insect vectors that subsequently can disseminate the phytoplasmas to other plant hosts**.**

Microbial symbiosis in phytoplasma vectors

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Phytoplasma-borne diseases, transmitted to plants by phloem-feeding insects, cause heavy losses in several important crops. The disease containment currently relies on vector control. A novel approach to limit phytoplasma spread is symbiotic control (SC), based on the use of antagonistic activity of insect-symbiotic microorganisms against the pathogen. To develop SC strategies, the knowledge on the microbiota associated to the vectors is required, in order to define the potentialities of different symbionts.

The first microbiota screenings were carried out on Auchenorrhyncha vectors of the Grape Yellows (GY) agents, a group of phytoplasmas with high impact on European viticulture. Among the bacterial symbionts of the leafhopper *Scaphoideus titanus* Ball, vector of the Flavescence dorée phytoplasma, the acetic acid bacterium *Asaia* sp. showed particular potentialities for SC. Moreover, the microbial community of the planthopper *Hyalesthes obsoletus* Signoret, vector of the phytoplasma agent of Bois noir, was investigated. Several stably associated symbionts were observed, characterized by high prevalence and wide distribution, with possible interesting implications for SC.

Rivalry behaviour and mating disruption in the Hemiptera Scaphoideus titanus Ball (Cicadellidae) and Hyalesthes obsoletus Signoret (Cixiidae)

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The leafhopper Scaphoideus titanus Ball and the planthopper Hyalesthes obsoletus Signoret are vectors of phytoplasmas that cause economically important grapevine diseases, Flavescence dorée and Bois noir, respectively. In both insects the intraspecific communication is via substrate-borne vibrational signals. The mating process is mediated by vibrational duets that drive a male to a stationary female. On the other hand, when more males occur on a same substrate a sexual competition can arise. In S. titanus, the presence of a mature and responding female is necessary to trigger male rivalry that can be manifested by satellite behaviour and signal masking. In H. obsoletus, the male competition is not dependent on the presence of a female, and is manifested by the emission either of specific rivalry signals or choruses. However, the presence of a receptive female can result in a remarkable increase in intensity and duration of rivalry signals. In this way, the rivalry strategies of the two species vary substantially: in S. titanus it is strictly correlated to the mating communication, with the aim to displace the rival from the contact with the female, whereas in H. obsoletus it looks related to spacing between individuals and territoriality. In H. obsoletus a similar behaviour was found in females, that are also able to emit spontaneous calls and to establish vibrational choruses. The knowledge of the intraspecific communication is a pre-requisite to set up a novel control strategy, based on artificial disruptive vibrational signals. Trials conducted with pairs of S. titanus on a grapevine leaf showed that the use of playback of male disturbance signal is able to definitely interrupt the mating duet.

S23: Role of biodiversity in pest management I.

Room Copenhagen

Optimizing biodiversity benefits: supporting biocontrol through informed landscape management

Felix Wäckers
Lancaster University; Biobest

Insect predators and parasitoids are crucial in controlling population dynamics of herbivorous arthropods. As biological pest control agents they provide a valuable ecosystem service that can help secure the production of safe and healthy food. However, in agro-ecosystems the effectiveness of predators and parasitoids can be severely constrained by a range of factors including the lack of alternative prey, floral resources, and suitable overwintering sites.

In Conservation Biological Control programs we seek to identify such bottlenecks and subsequently develop strategies to remove or minimize these impediments (Olson and Wäckers 2007). Recently developed tools allow us to better investigate energetic reserves, feeding history, reproductive success and age structure of field collected predators and parasitoids (Steppuhn and Wäckers 2004). On the basis of this information we can develop landscape management tools that are effective in supporting biocontrol efficacy.

In my presentation I will touch upon the mechanistic studies that have provided the basis of our landscape management projects in the Netherlands and the UK. Subsequently, results from the large-scale field studies with commercial growers will be presented. While these field studies demonstrate that it is possible to support predators and parasitoids through targeted use of non-crop vegetation, possible pitfalls are addressed as well. Finally, I will argue that it is possible to jointly combine and optimize biocontrol, pollination and conservation benefits through an informed selection of floral resources and a rational design of agro-ecosystems and landscape structure.

Diversity in agricultural landscapes and wild bees

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Wild bees as pollinators account for major ecosystem services. In a structurally diverse agricultural landscape at the Southern slope of the Alps we counted as many as 300 different species. In other agricultural areas, defragmentation is suggested to safeguard survival of endangered species. It holds potential to reduce the distance between the key resources for wild bees, i.e. nest and flowering host plants. Our findings indicate that landscape structures such as forests or roads are not insurmountable barriers for the bee species tested. To evaluate the effect of small vs. large distances between the key resources on wild bees and their reproduction, we used a new, experimental approach in which patches of host plants were moved progressively further away from the nest over time. The number of female bees were recorded that were able to forage at each patch at each distance. Maximum foraging distance recorded amounted even for the smallest species tested to more than 1 km. However, 50% of the individuals were not able to forage more than few hundred meters. From a conservation perspective, these results show that the maximum foraging distance should be considered in conjunction with a second value, which quantifies distances that can be covered by a sizable proportion of the population. Smaller foraging distances lead also to a higher reproduction. Our studies indicate that nesting and foraging habitats should be separated only by few hundred meters to preserve populations of bees. Our country reimburses farmers that

leave a small proportion of their land non-cropped or covered with sown flowering plants, and we conclude that the spatial arrangement of these areas will provide important opportunities for maintaining biodiversity.

Increasing orchard biodiversity for sustainable pest management

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Companion plants (*Fagopyrum esculentum*, *Tagetes patula*, *Anethum graveolens* and *Phacelia tanacetifolia*) and interplanted peach trees were used to increase biodiversity in an effort to enhance biological control in apple orchards of West Virginia, USA. Flowers were planted to provide nectar and pollen and the peach trees provided nectar from extrafloral nectar glands on leaves. Rates of biological control, pest population density, natural enemy population density, arthropod biodiversity, insect damage to fruit and fruit yield were measured from 1997 to 2001. There were no detectable changes in aphid predation, leaf roller (Tortricidae) parasitism or arthropod biodiversity as a result of the experimental treatments. However, population levels of *Dysaphis plantaginea*, *Phyllonorycter blancardella* and leafhoppers (Cicadellidae) were altered by increases in plant biodiversity. Diversifying the orchard also reduced fruit damage from Pentatomid feeding and *Quadraspidiotus perniciosus*. The results of this experiment point to the need to measure response variables other than rates of biological control to evaluate the effects of conservation biological control experiments on the agroecosystem. Suppression of pest damage can be achieved through other mechanisms rather than direct predator-prey or parasitoid-host interactions. The ecosystem service of pest regulation can be achieved indirectly through subtle changes in ecosystem processes such as diverse natural enemy guilds, changes in host quality, competitive interactions, and other mechanisms.

Does vegetation management enhance natural enemy impact on pest populations in apple orchards?

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In our six-year study, effects of different groundcover management (bare-ground, periodically mowed natural grasses, flowering herbs) on the pests and some natural enemies were investigated in an experimental apple orchard in Hungary.

The orchard under integrated pest management (IPM) was divided into three parts each of 1 ha:

- bare ground in the alleys (BAREgr)
- mowed grass vegetation in the alleys (GRASS)
- flowering herbs in the alleys (FLOWER)

The flowering herbs in the alleys of the plot FLOWER in 2002–2004 were: Fagopyrum esculentum, Sinapis alba, Calendula officinalis, Phacelia tanacetifolia, Salvia officinalis, Foeniculum vulgare, Lupinus albus, Lotus corniculatus, Hyssopus officinalis and Trifolium pretense. Instead of mixture of flowering herbs, only one plant species per alley was sown in 2005–2007: F. esculentum, P. tanacetifolia, L. albus, spring oat (Avena sativa), Panicum miliaceum, Trifolium repens, T. pretense, perennial rye (Secale cereanu) and Medicago sativa.

Ground cover management alters spider mites, their mite predators and tydeids on apple trees. As an effect of flowering herbs, the abundance of phytoseiids increased in the plot FLOWER, although this happened only in the second part of the study. FLOWER was characterized by higher *Leucoptera malifoliella* parasitation, greater abundance of *Chrysoperla carnea* and more abundant spider assemblages. In contrast, we found no difference between the treatments in case of *Aphis pomi, Leucoptera malifoliella*, fruit injuries caused by summer fruit tortrix moth (*Adoxophyes orana*) and codling moth (*Cydia pomonella*). Furthermore, significantly higher woolly aphid infestation was found in FLOWER compared to BAREgr and GRASS in one year.

Effects of exclusion or supplementary honey feeding of the ant *Lasius niger* (L.) on aphid populations and aphidophagous predators on apple

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Two replicated experiments were conducted in an unsprayed apple orchard (cv Discovery) at East Malling Research (UK) in 2006, and an unsprayed apple orchard (cv Topáz M9) at Research and Extension Center for Fruit Growing, Újfehértó (Hungary) in 2007 to evaluate the effects of the common black ant, *Lasius niger* (L.), on populations of rosy apple aphid, *Dysaphis plantaginea* (Passerini), and green apple aphid, *Aphis pomi* DeGeer. Ants were either excluded from trees by a sticky barrier band round the base of the trunk (UK, Hungary) or provided with honey baits at the base of the trunk or in the canopy (UK) or only at the base of the trunk (Hungary). Trees where ants had free access and trees without artificial baits were used as experimental controls.

Exclusion of ants resulted in increased populations of some predator groups and rapid decreases in the populations of both aphid species. In comparison, populations of both aphids increased rapidly on control trees where ants had not been excluded and where predator populations were lower. Provision of artificial baits, either at the base or in the canopy of the trees, also caused reductions in *D. plantaginea* numbers and their tending ants, but the effects were weaker. The influence of honey feeding on *A. pomi* and their tending ants was more complicated. Feeding on the trunk caused some reductions in *A. pomi* numbers and their tending ants, but the effect of honey feeding in the canopy was not remarkable on *A. pomi* numbers and their tending ants.

The implications of these results for management of aphids in apple orchards are discussed.

S24: RNA interference, a novel tool in analysing hormone function (General genetics) I.

Room Maastricht

Genetic variability of *Ixodes ricinus*

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The application of molecular markers to the study of ticks has provided new insights into their population structures, taxonomic relationships and the epidemiology and evolutionary dynamics of the disease and the vector. Several molecular markers have been used in investigation of *I. ricinus* complex. Protein electrophoresis has been an effective technique for the detection of genetic polymorphism for over three decades. The mitochondrial genes such as cytb, 12S rDNA, 16S rDNA, COI and COII have been used as molecular markers for phylogenetic studies in ticks, but little is known about the population genetic structure of the *I. ricinus*. Some studies of genetic structure of *I. ricinus* using molecular markers conducted in Europe showed low genetic variability

and no genetic differentiation within small samples size originating from different regions. Results of the study did not provide any evidence of a correlation between the identified haplotypes and their geographic origin. The genetic variability of 319 individuals of *I. ricinus* collected from Baltic country and Norway show high levels of diversity within the populations by using RAPD analyses. Only a small proportion of overall genetic variation in *I. ricinus* was apportioned regionally. The highest part of genetic variation in *I. ricinus* ticks depends on variation within populations situated on the main birds migratory rout.

Identification of genes involved in CpGV-resistance of the codling moth, *Cydia pomonella*

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The codling moth, *Cydia pomonella,* is a worldwide pest in apple growing regions and is regarded as one of the most severe insect pests in apple orchards. The larvae can also damage quinces, cherries, plums, apricots, peaches, walnuts, and pears. The *C. pomonella* granulovirus (CpGV-M) is one of the most powerful methods for reducing C*. pomonella* populations*,* especially in organic farming. Since 2003 less sensitive codling moth populations against this virus emerged in Germany and in other European countries e.g. France, Italy and the Netherlands, during the following years. The respective populations showed a sensitivity that was reduced up to 1000-fold. Single cross experiments showed that the putative CpGV-M resistance gene is located on the Z-chromosome (sex chromosome) (Asser-Kaiser et al., Science 317: 1916-1918 (2007)).

For identifying genes potentially involved in the development of CpGV resistance, a gene expression profiling approach was chosen. CpGV-M resistant codling moth larvae (4th instar) were reared on virus-contaminated and virus-free diet via "droplet feeding". Two different CpGV strains were involved in this assay: CpGV-M, where resistance is know to exist in the field, and CpGV-I12, a new isolate, with apparent resistance breaking capacities. A virus-free diet was used as a control. Complementary DNA-amplified fragment length polymorphism (cDNA-AFLP) analysis and subsequently quantitative Real Time-PCR (qRT-PCR) were applied to identify and to compare the expression levels of different genes putatively involved in the resistance process between the different samples. The identified genes could also help to understand the evolution of virus-host interactions.

Genetic variation among Iranian populations of leafhopper *Hishimonus phycitis* (Hemiptera: Cicadellidae) vector of Witches' Broom Disease of Lime Phytoplasma, based on mitochondrial DNA sequences

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Witches' Broom Disease of Lime (WBDL) is a lethal disease of acid (Mexican) limes, Citrus aurantifolia (L) in southern Iran, Oman and UAE killing lime trees in less than ten years. It is caused by 'Candidatus Phytoplasma aurantifolia', transmitted by a leafhopper vector Hishimonus phycitis Distant (Hemiptera: Cicadellidae). For a better understanding of the vector's intraspecific genetic variation, 400 individuals of H.phycitis were collected from geographical populations of 4 southern provinces in Iran (e.g. Hormozgan, Sistan-Baluchestan, Kerman and Fars) besides a single population from Oman. Maximum parsimony, neighbour-joining and UPGMA search criteria offered congruent, well supported phylogenies based on 658-base pairs of DNA sequence using standard barcode fragment from the 5'-end of the mitochondrial gene Cytochrome Oxydase I (COI). F-statistic analysis under pairwise genetic distance indicated no significant variation among Iranian and Oman populations ($P>0.01$) and positioned the geographic populations in a monophyletic cluster. Our mitochondrial DNA sequence data based on informative regions suggest that H. phycitis forms a homogeneous group of haplotypes across its distribution. An analysis of molecular variance within populations showed 125 polymorphic loci; specifically high number of nucleotide transversions in Fars and Sistan-Baluchestan. The finding of inter-population gene flow in this study, may support the role of homogenous climatic factors contributed to shaping the present genetic structure of H.phycitis. Our total analysis emphasises the need to consider work on monitoring of Fars and Sistan-Baluchestan populations when building pest management strategies.

First insights into the genetic diversity of *Otiorhynchus sulcatus* and the bacterial endosymbiontic community of divers *Otiorhynchus* species

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The black vine weevil *Otiorhynchus sulcatus* Fabricius (Coleoptera: Curculionidae) is a serious pest in a wide variety of horticultural crops worldwide. Aside from *O. sulcatus* numerous other weevils like *O. rugosostriatus*, *O. raucus* or *O. salicicola* are becoming increasingly important in horticulture, possibly as a result of climatic change and/or intensified global trade of plant material. Several members of the weevil genus *Otiorhynchus* are extremely polyphagous with adults causing damage by feeding on the foliage of their host plant, while soil-borne larvae feed on the roots. Although host plant preferences were detected for some *Otiorhynchus* species, currently little information concerning adaptation to new host plants is available. Since adaptation to different host plants might result in the formation of insect host races, we analysed the genetic variation among populations of the black wine weevil by RAPD analysis of ~50 individuals from three German and two US (Oregon) populations. Genetic differentiation between the *O. sulcatus* populations was evident. These results can now serve as a molecular tool which can be used in the future for analysing potential sympatric host race formation in *O. sulcatus*. In addition, bacterial endosymbionts can play a role during an insect's adaptation to new host plants. Except for the presence of *Wolbachia* in several *Otiorhynchus* species, nothing is known so far on the presence of other endosymbiotic bacteria in this weevil genus. Here, we present first results on a metagenomics approach of the bacterial endosymbiotic community based on the 16S rRNA gene of freshly emerged *Otiorhynchus* larvae.

S25: Vector-borne diseases - biology and control

Room Rome

Recent developments in the control of onchocerciasis

Rory Post
The Natural History Museum, London and London School of Hygiene & Tropical Medicine

Modern onchocerciasis control is by Community Directed Treatment with Ivermectin (CDTI). Annual treatment confers tremendous clinical benefits, preventing blindness and skin disease. However, it remains uncertain whether CDTI can interrupt transmission under all circumstances, and the investigation of complementary approaches continues. Recent vector-based approaches will be described, including recent successes in vector elimination sponsored by the WHO African Programme for Onchocerciasis Control in Equatorial Guinea, and the opportunities presented by the recent discovery of *Wolbachia* bacterial endosymbionts in *Simulium damnosum* s.l.

Mosquitocidal toxicity of plant *Ocimum sanctum* and Fungus toxin *Beauveria bassiana* on the malarial vector, *Anopheles stephensi*

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Laboratory and field investigations have been made to evaluate the combined effect of *Ocimum sanctum* and Fungus toxin *Beauveria bassiana* on malarial vector, *Anopheles stephensi.* Different concentrations of *O. sanctum* have been tested on the various stages of Anopheles *stephensi.* Mortality of the larva has been increased at the increased dose of plant extract. Lethal concentrations (LC50 and LC90) were also worked for the different larval stages of mosquitoes. Significant increased mortality was evident after the combined treatment of plant and Fungus toxins. The lethal effect on mosquito larvae may be due to the active plant compounds and beauveiria toxins of fungal insecticides on the gut lining of the mosquito larvae. The larval density was decreased after the treatment of plant extracts and *B. bassiana* toxins at the breeding sites (drinking water), and hence, these plant extracts and fungal toxins are the suitable alternatives of synthetic insecticides for the mosquito vector management.

Coexistence of Borrelia burgdorferi with Anaplasma phagocytophilum in Ixodes ricinus and Ixodes persulcatus ticks from Latvia

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Ticks are well-known as vectors of various human and animal pathogens and responsible for maintaining the circulation of these pathogens in nature. Several species of *Ixodidae* family have been found in Latvia, however epidemiological significance has been established only for two of them: *Ixodes ricinus* and *Ixodes persulcatus. Borrelia burgdorferi* are known as the causative agent of Lyme disease in human and are regularly registered tick–borne disease in Latvia. *Anaplasma phagocytophilum* are causative agent of human granulocytic ehrlichiosis disease and the first case in Latvia was diagnosed in 2001. People with multiple tick-borne pathogens infection may have unclear clinical picture of the disease, which complicates the diagnosis and appropriate treatment choices. The goal of study was to clarify the prevalence of simulataneously infection of *Borrelia burgdorferi* with *Anaplasma phagocytophilum* in field-collected ticks in Latvia.

A total of 472 individual ticks (342 *I.persulcatus* and 130 *I.ricinus*) collected by flagging methods from various regions of Latvia were examined. For the detection of *B.burgdorferi* and *A.phagocytophilum,* DNA from 23S ribosomal RNA and *msp2* (major surface protein) genes, respectively, was amplified and detected by TaqMan real –time polymerase chain reaction.

In 0,8 % (4/472) cases were mixed infection with *B.burgdorferi* and *A.phagocytophilum* (3 cases in *I.ricinus* and 1 - in *I.persulcatus*).

This study confirms the occurrence of simultaneously infection of *B.burgdorferi* with *A.phagocytophilum* in Latvian ticks and stimulates further studies including TBE virus (tick-borne encephalitis) and other human tick-borne pathogens in order to get the full picture of coinfection in regional ticks.

Behavioural insensitivity to DEET in *Aedes aegypti*: a genetically determined trait residing in changes in sensillum function

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N-N-Diethyl-*m*-toluamide (DEET) is one of the most effective and commonly used mosquito repellents. However, during laboratory trials a small proportion of mosquitoes are still attracted by human odours despite the presence of DEET. In this study behavioural assays identified *Aedes aegypti* females that were insensitive to DEET and the selection of either sensitive or insensitive groups of females with males of unknown sensitivity over several generations resulted in two populations with different proportions of insensitive females. Crossing experiments showed the 'insensitivity' trait to be dominant. Electroantennography showed a reduced response to DEET in the selected insensitive line compared with the selected sensitive line, and single sensillum recordings identified DEET-sensitive sensilla that were non-responders in the insensitive line. This shows, for the first time, that behavioural insensitivity to DEET in *Ae. aegypti* is a genetically determined dominant trait and resides in changes in sensillum function.

S26: Taxonomy of lepidoptera II.

Room Brussels

Systematic studies on Gelechiid Moth Fauna (Microlepidoptera) from North-Western Himalaya in India

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Lepidoptera (moths, butterflies and skippers) is the second largest order after Coleoptera in the class Insecta whose number is roughly equivalent to that of known flowering plant species. This order has about 2, 00,000 species world over, out of which 15,000 species are butterflies and remaining moths (Holloway *et al.,* 1992). Under Superfamily Gelechioidea one of the family Gelechiidae is represented by 4000 species worldwide, out of these, 729 species are present in India (Roonwal *et al.*, 1964). The main characters of the family are vertex and frons covered with smooth scales, antenna smaller than 3/4th length of forewing, labial palpus upturned, second segment long, acute, hindwing with veins R_1 and Sc united from base of wing or R_1 running into

Sc beyond base of wing, discocellular perpendicular to long axis of wing or directed at 45° angle toward base of wing from M_2, termen excavated. The author has undertaken survey-cum-collection tours from one hundred and sixty-five localities belonged to five states i.e., Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana and Uttarakhand during pre-monsoon, monsoon and post-monsoon periods from January, 2008 to December, 2009. The adults of Gelechiid were collected during the night time (nocturnal habit) with the help of portable light traps and by hanging the source of light (125-Watt mercury vapors lamp) on a white sheet or white washed wall. The collected moths were killed by using tetrachloro ethane or ethyl acetate.

In all, forty-four species belonging to nineteen genera such as *Anarsia* Zeller, *Brachmia* Hubner, *Brachyacma* Meyrick, *Chelaria* Haworth, *Dichomeris* Hubner, *Gaesa* Walker, *Gnorimoschema* Busck, *Helcystogramma* Zeller, *Hypatima* Hubner, *Hypelictis* Meyrick, *Pectinophora* Busck, *Phthorimaea* Meyrick, *Polyhymno* Chambers, *Sitotroga* Heinemann, *Stegasta* Meyrick, *Stomopteryx* Heinemann, *Symmoca* Hubner, *Telphusa* Chambers and *Thiotricha* Meyrick of the family Gelechiidae were collected and identified. The result of these investigation shows that ten species i.e., *Anarsia ephippias* (Meyrick), *Anarsia idioptila* Meyrick, *Anarsia triglypta* Meyrick, *Dichomeris rasilella* (Herrich-Schäffer), *Helcystogramma hibisci* (Stainton), *Hypatima tephroptila* (Meyrick), *Sitotroga cerealella* (Olivier), *Pectinophora gossypiella* (Saunders), *Phthorimaea operculella* (Zeller) and *Stegasta variana* Meyrick which is represented by more than twenty specimens are common in these areas. The major pests species are *Pectinophora gossypiella* (Saunders) and *Helcystogramma hibisci* (Stainton) which are serious pest of cotton and okra, *Anarsia ephippias (*Meyrick) of french beans, *Pthormaea operculella* (Zeller) of potato and *Sitotroga cerealella* (Olivier) of stored grains were studied from biosystematic point of view. The detailed aspects on their distribution, host plants, keys, morphological and genitalic characters alongwith colored photographs of the adults will be highlighted in the Congress.

The Taxonomic Atlas – lessons and perspectives

László Ronkay
Hungarian Natural History Museum

Diversity, host specificity, and community phylogenetics of New Guinean metalmark moths (Lepidoptera: Choreutidae)

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The vast majority of herbivorous insect species are known only from the adult stage. Even for those for which biological and life history information is available, features such as host specificity are poorly known. A large-scale ecological project focused on the community ecology of herbivorous insects in Papua New Guinea was designed to yield data that enable the examination of biological attributes and species richness in a new light. Sampling of all caterpillars found on a set of trees representing about twenty plant families resulted in host records for thousands of specimens of Lepidoptera. We examined a small subset of the data - the microlepidopteran family Choreutidae. Using morphological characters in conjunction with DNA barcodes (658 base pairs of cytochrome c oxidase I), we recognized species belonging to four genera (*Brenthia*, *Choreutis*, *Litobrenthia*, and *Saptha*) and examined their host specificity and patterns of host utilization in a phylogenetic context at both interspecific and intergeneric levels. We found that most species are less host specific than was previously believed, i.e., rather than being strictly monophagous, most species are so-called clade specialists, feeding on multiple members of one or several closely related plant genera. In addition, we examined community phylogenies of hosts and herbivores, focusing on the plant genus *Ficus* and choreutid genus *Choreutis*.

A web-based taxonomy of the Hawkmoths (Lepidoptera: Sphingidae)

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The last world-level taxonomic revision of the Sphingidae was published by Rothschild & Jordan in 1903. Many works on these moths have been published subsequently, but given their conspicuous and popular nature, it is telling that a world monograph has not been written for over 100 years. We discuss a web-based model for descriptive taxonomy using Sphingidae as the target group of organisms (see www.cate-sphingidae.org). There are several advantages to putting taxonomy on the web. In addition to providing wider access to the information, such a platform allows continuous updating by the taxonomic community so that we do not have to wait for another 100 years before the next monograph. The workflow also includes a means of implementing peer-review. We discuss some of the challenges of this approach and argue that one way or another taxonomy is destined to become web-based.

Phylogeny of the Plusiinae (Lepidoptera: Noctuidae): exploring the conflict between larvae and adults

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The higher-level classification of the lepidopteran family Noctuidae has been largely based on characters of the adults. However, the immature stages and DNA sequence data have become increasingly important as sources of phylogenetic information. This study revisits the Plusiinae, the first noctuid subfamily for which an objective phylogenetic hypothesis had been derived by cladistic analysis of character data. This hypothesis, proposed by Kitching (1987), used only characters from the adults. An alternative phylogenetic hypothesis, proposed by Beck (1999), based on larval data and derived using non-explicit methodology, differed marked in the position of tribe Abrostolina and genus *Diachrysia*. Here, we reassessed Kitching's adult characters, coded a larval data set and added DNA barcodes. We found no significant conflict between any of the data subsets and so analysed them together in a total evidence, maximum parsimony framework. The results corroborated Kitching's phylogeny in placing tribe Abrostolina as sister to the remaining plusiine tribes and resolving the position of *Diachrysia* as within tribe Plusiina. We found no support for Beck's hypothesis of a close and derived relationship between Abrostolina and *Diachrysia*. In addition, tribe Autoplusiina was found to be paraphyletic, with the New World and Old World genera forming separate clades. We also found no evidence for a separate tribe Exyrina, the genus *Exyra* falling within tribe Plusiina as sister to *Plusia*.

S27: Phytoplasma vectors II.

Room Strasbourg

Incidence and insect vectors of phytoplasma diseases in canola and cereal crops in Saskatchewan, Canada

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Since 2001, leafhopper populations were sampled in canola, barley and wheat crops at different locations in Saskatchewan, Canada. Aster yellows (AY) disease incidence was determined by visual observations and plants were randomly sampled at the same locations for canola in 2001–2008 and for cereals in 2005–2008. Leafhoppers and plants were tested for the presence of phytoplasma DNA using nested PCR tests. Over 20 leafhopper species tested positive for the presence of AY phytoplasma, mostly for the strains 16SrI-A and –B, and occasionally the strain 16SrI-C. DNA of AY phytoplasma, strains 16SrI-A and -B was detected in leaf, stem, root and seeds of canola, wheat and barley plants and AY strains 16SrI-A, -B, and -C were detected in oat tissues. On average, 10-30% of the infected canola plants and 100% of the infected cereal plants did not exhibit symptoms, confirming that AY disease incidence is underestimated in canola and cereal crops in Saskatchewan. Leafhopper biodiversity and tentative establishment of an economic threshold is discussed.

Phytoplasma diseases: trends in Canadian vineyards

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Leafhoppers are pests that can affect grapevines, notably by transmitting phytoplasmas. Some species have been reported as phytoplasma vectors in vineyards worldwide. A survey of phytoplasma diseases in Canadian vineyards found Aster Yellow phytoplasmas in grapevines from Ontario and Quebec. More than 15 000 leafhoppers were sampled between 2006 and 2008 and 135 species were identified.

DNA extraction from individuals and phytoplasma detection by polymerase chain reaction (PCR), using universal primer sequences of phytoplasmas were performed to detect the presence of the pathogens in insects. Strains were determined thanks to genbank databases.

Phytoplasmas from the Aster Yellow group were detected in almost 40 cicadellid species. We described for the first time the ability of some species to carry phytoplasmas.

Our next objective will be to distinguish "carrier leafhoppers" (*i.e.* insects that are demonstrated phytoplasma-positives), and "vector leafhoppers" (*i.e*. insects that successfully transmit phytoplasmas to grapevine).

Maize redness disease – a host shift by *Reptalus panzeri*?

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Maize redness (MR), a serious and newly characterized disease of maize in Europe, is induced by stolbur phytoplasma and characterized by midrib, leaf, and stalk reddening and abnormal ear development. Presence of symptoms has been reported from Serbia, Romania, and Bulgaria for the past 50 years, and recent epiphytotics have reduced yields by 40 to 90% in South Banat District, Serbia.

High density populations of the ciixid planthopper *Reptalus panzeri* (Löw) were found in the MR affected maize fields and approximately 20% of these insects were positive for the presence of stolbur phytoplasma. Under controlled conditions, naturally infected *R. panzeri* transmitted the phytoplasma to healthy maize, producing midrib and leaf reddening. In these experiments, *R. panzeri* was proven to be a vector of MR and stolbur phytoplasma to be the causal agent of MR.

Further research focused on the planthopper's life cycle indicated obvious feeding preference for, and aggregation of, both *R. panzeri* adults and early instar nymphs on maize. The prevailing maize-wheat crop rotation was found to be favorable for successful larval development and overwintering - leading to the emergence of high numbers of *R. panzeri* adults. The time of adult emergence corresponds with the wheat harvest so already infected adults transmit stolbur phytoplasma to nearby maize.

Even though *R. panzeri* is widely distributed in Europe, there has been no reported association between maize and this insect prior to the discovery that it transmitted stolbur phytoplasma to maize. The few earlier studies available indicated that *R. panzeri* is primarily an arborous species that inhabits scattered shrubs and woody plant hosts. Results of our research indicate substantially different behavior for the *R. panzeri* populations that inhabit maize fields in South Banat. The high populations of both *R. panzeri* adults and nymphs found on maize in this region suggest that a host shift for this cixiid has occurred. This event is in contrast to previous studies suggesting that planthoppers do not easily adapt to novel host species, and requires further research of all underlying factors.

Psyllid vectors of fruit tree phytoplasmas

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The fruit tree phytoplasmas spread in Europe are 'Candidatus Phytoplasma mali', 'Ca. Phytoplasma prunorum' and 'Ca. Phytoplasma pyri', all members of the 16SrX-group. They are transmitted by phloem-feeding psyllids (Hemiptera, Sternorrhyncha), all belonging to the genus Cacopsylla.

These species accomplish one or more generations per year on wild and cultivated rosaceous plants and usually overwinter as adults. Some species like Cacopsylla pyri, the main vector of 'Ca. Phytoplasma pyri', are monophagous while others, like C. melanoneura and C. pruni, the vectors of 'Ca. Phytoplasma mali' and 'Ca. Phytoplasma prunorum', respectively, are oligophagous and require an aestivation and overwintering period on conifers. These particular aspects are crucial points for the epidemiology of the diseases and for the control strategies against the vectors. Recent studies pointed out the role of wild plants in the biology of these psyllids and as inoculum source of the phytoplasmas. Moreover the finding and localization of the aestivation/overwintering sites, allows to follow all the life cycles of these insects and to better understand the transmission features. Discrepancies in transmission efficiency were recorded within the same species and in different geographic areas indicating the presence of different populations.

S28: Role of biodiversity in pest management II.

Room Copenhagen

Efficiency of earwigs as biocontrol agents in fruit orchards: ecology of two sibling species

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Earwigs, *Forficula auricularia* (L.) are beneficial predators in pipfruit orchards. Numbers of earwigs show large interannual variations in densities in both organic and IPM orchards, this limits their practical use. Molecular studies identified the European earwig as a complex of two sibling species, A and B. In Belgium, species A has a single reproductive cycle a year with a prolonged brood care, and lays eggs before winter, while species B has two reproductive cycles, and lays eggs in early spring. More ecological information was needed to increase their efficiency as biocontrol agents.

Several experiments were carried out: 1) Quantitative information on dispersion should be taken into consideration for making efficient pest management decisions. For this, marked earwigs were released at a single point and recaptured after one month. The data was analyzed with a diffusion model. 2) A density dependent population decrease occurs during the last moult into adults. One possible hypothesis, cannibalism, was tested in a controlled lab experiment. 3) Winter survival was tested with artificial nests in field conditions.

Dispersion distances were four times lower in species B compared to species A and were overall very low (<30m). Therefore, mass releases of earwigs in pest infected areas will only be effective in a small area around the release point. Cannibalism tested significant for species B, in contrast to species A. The more synchronized life-cycle of the latter could explain this difference. During winter, more earwigs of species B survived. In regard of these results we suggest that species A invests in offspring survival, while species B invests in adult survival, producing more broods. Both have consequences for using earwigs for biocontrol.

Alien vs natives: will *Harmonia axyridis* have an impact on native aphid natural enemies?

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Harmonia axyridis is a polyphagous ladybird species which has recently become established in Britain and is predicted to have a negative impact on biodiversity. *Harmonia axyridis* is an intraguild predator of aphid natural enemies in simple laboratory arenas. However, variables affecting intraguild prey survival under natural conditions, including plant structure and escape behaviour, cannot be incorporated into simple laboratory arenas. Here we present experiments which investigate variables affecting intraguild predation of the green lacewing *Chrysoperla carnea* by *H. axyridis* at a larger and more complex spatial scale than in previous studies. Aphid density does not appear to affect the predation of *C. carnea* by *H. axyridis* nor does lacewing density. In contrast, aphid species (*Acyrthosiphon pisum*, *Megoura viciae* and *Aphis fabae*) and plant species (stinging nettle, cabbage, barley and bean) may affect intraguild predation. The effect of *H. axyridis* on guilds of aphid enemies and the subsequent effect on aphid suppression is also under investigation.

Ecological relevance of test species in soil ecotoxicology – Is biodiversity protected?

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Risk assessment of plant protection products aims at avoiding undesired harmful effects of pesticides on non-target organisms in in-crop and off-crop habitats. Results from (laboratory/semi-field) ecotoxicological testing are extrapolated to the field situation. Species involved in ecotoxicological testing should represent non-targets in the field due to their sensitivity on the test items impact. There is no doubt, that selection criteria for test organisms do not match primarily the criterion "representativness for non-targets". Actually in soil ecotoxicology studies test organisms have been selected mainly for reasons of easy cultivation and high reproduction.

On the other hand there is a lack of knowledge which species representative non-targets are. In case of the collembolan community numerous field studies in arable fields explored effects of agricultural practises on the soil community. But until know there is no concept specifying the characteristic elements of the collembolan coenosis in arable fields. For off-crop habitats like grassy field margins or hedgerows such information lacks at all.

The aim of our study was to identify typical structural components of the Collembola coenoses in in-crop and off-crop habitats. As a result we classify different coenoses and present species which show a high significance for each habitat and species which are sensitive to specific site conditions. Due to these findings it is possible to come to a more realistic assessment of the ecological relevance of collembolan species involved in exotoxicological test procedures.

Chemodiversity in insect control

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All insects are not pests. The chemical diversity in a field, meadow, stream, or salt marsh is vastly larger than its biological diversity. There are many situations where more than one species, even belonging to different phyla need to be controlled. In many cases more than one insecticide or several different classes of pesticides may be present in a field. It is virtually unknown what the interferences between different compounds are on the controlling ability (toxicity to a target organism) of a selected compound.

The target insect that needs to be controlled in this study is the salt marsh mosquito *Aedes sollicitans*. Larvicides (compounds that kill mosquito larvae) are preferentially applied to control the mosquito populations before they reach the dispersive adult stage. Yet, adulticides (compounds that kill adult mosquitoes) are frequently used.

Also other, often much more broad spectrum, insecticides than those used for mosquito control are used to control insects in orchards, vineyards, or truck crop fields. This produces unintended blends of insecticides in the salt marshes that may affect the larval survival. Also herbicides are used in sometimes very large quantities in virtually all residential areas (front and back yards around people's houses) and on golf courses adjacent to or nearby to salt marshes. Malathion and piperonyl-butoxide-synergized pyrethroids are the most widely used mosquito adulticides. Some of the most heavily used broad spectrum insecticides in these situations include imidacloprid, carbaryl, and trichlorfon. Among herbicides, 2,4-D, dithiopyr, glyphosate (Roundup®), and MPCA ((4-chloro-2-methylphenoxy) acetic acid) and mecoprop are the most heavily used in New Jersey, and among fungicides, chlorothalonil, thiophanate, mancozeb, and Al-fosethyl top the list.

Simple *in vivo* toxicity bioassays with mosquito larvae in glass beakers show that many of the incidental compounds can quite drastically change the toxicity of the intended insecticide. Temephos was used as one of these because it is a mosquito larvicide widely used since the 1960s and is still effective in most situations; it is mostly detoxified by the *Ae. sollicitans* larvae by esterase enzymes. The other compound used in the *in vivo* bioassays was carbaryl, a compound that is not a mosquito larvicide but a useful model compound for being detoxified exclusively by mosquito cytochrome P450s. The results, so far indicate that we still have much to learn in order to use chemical control agents effectively and prudently.

Variation in genetics and performance of Dutch western flower thrips populations

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Genetic variation for host plant adaptation can lead to more aggressive populations breaking down plant resistance. Western flower thrips (Frankliniella occidentalis) is one of the key insect pests in agriculture and horticulture worldwide.

In this study we compared variation in genetics and performance of Dutch western flower thrips populations collected on leek, lettuce, chrysanthemum and a thrips rearing on chrysanthemum as a reference. Genetic differences among thrips populations were established by AFLP. Population performances were measured using whole plant-, choice- and leaf bioassays. Leek, lettuce, chrysanthemum, the resistant wild tomato (L. pennellii) and the susceptible cultivated tomato (moneymaker) were used as host plants.

In every case when the populations, regardless of their origin, interacted with the tomatoes, we noticed greater damage in the susceptible tomato in comparison to the more resistant tomato. The susceptible host was clearly preferred over the resistant one by all populations. Significant differences in aggressiveness between populations showed the reference thrips population to be the most aggressive. Chrysanthemum sustained the highest reproduction while there was no reproduction at all on the resistant wild tomato. Reproduction showed a significant interaction between host plant and population. Both biotypes from chrysanthemum produced the most offspring on chrysanthemum as a host. Such a strong host preference indicates host-associated adaptation of F. occidentalis.

So different thrips populations adapted to certain host plants exist. Knowledge about host plant preference should be used to slow the development of F. occidentalis by careful selection of plants and cultivars.

Host plant resistance to thrips in chrysanthemum: Appraisal of germplasm evaluation

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Chrysanthemum (*Dendranthema grandiflora* Tz.,) is one of the commercially viable flower crops of India and is popular among small and medium farmers. Thrips (*Microcephalothrips abdominalis*) are the most serious and economically important pests of chrysanthemum. Nymphs and adults lacerate the tissues of flower buds and flowers and suck the sap causing scorching marks and deformation. Severe incidence of thrips adversely affects the marketable flower yield thus making the frequent use of insecticides inevitable. In order to minimize the insecticide usage, a sustainable and ecologically viable pest management strategy like host plant resistance is very much needed. In our study, 80 germplasm collections of chrysanthemum were evaluated for resistance to thrips, at Indian Institute of Horticultural Research, Bangalore, India during 2006-09 and found significant variations among accessions in their susceptibility to thrips. We identified a few least susceptible genotypes which could be further explored as resistance sources. *viz.,* Swetha Sringar, Varthur, Lemon, Co-2, Mother Teresa and Kargil. Significant variations were also observed among three colour groups of flowers in attracting thrips *viz.,*. yellow, red and white. Varieties of yellow coloured flowers attracted highest number of thrips (12.24/flower) followed by red (5.12) and white (6.82) which were on par with each other. Comparative assessment of variability among indigenous and exotic collections revealed that the former were more promising as resistance sources than exotic accessions indicating the priority the native germplasm deserves in screening for resistance. In the light of these findings, nature and scope of host plant resistance against thrips in relation to flower colour and origin of chrysanthemum accessions are discussed.

S29: RNA interference, a novel tool in analysing hormone function II.

Room Maastricht

iBeetle – genome wide identification of gene functions in a coleopteran model organism

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The red flour beetle *Tribolium castaneum* has developed into a major insect model system suited for basic research in insect development, evolution, physiology, and pest control. The powerful reverse genetics and the now available full genomic sequence open for the first time the possibility to conduct an unbiased genome-wide RNA interference screen targeting diverse biological questions:

(1) We aim to open additional fields of insect research to genetic analysis, fields that are currently neglected either because the *Drosophila* situation is too derived (e.g. involuted larval head), because the organs of interest are not present in *Drosophila* (e.g. defensive glands), or because they require selective inactivation of genes at postembryonic stages (e.g. metamorphosis) – which in *Tribolium* is readily achieved through systemic RNAi.

(2) We aim to identify genes essential for insect biology which have no (or different) functions in *Drosophila*. Past work in *Tribolium* has revealed that crucial components of intensely studied processes such as segmentation, leg development, and axis formation have escaped detection because they are not involved in these processes in *Drosophila*.

RNA interference based approaches in insect biotechnology

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RNA interference (RNAi) caused by exogenous double-stranded RNA (dsRNA) has emerged as a powerful technique for down-regulating gene expression in insects and other organisms. Injection of dsRNA to suppress expression of the corresponding gene has become a widely used tool in analysing gene functions. We used method to explore the functions of proteins, such as metalloproteinases, metalloproteinase inhibitors and heat shock proteins, in development and immunity of the model beetle *Tribolium castaneum* which is amendable to systemic and persistent RNAi. Injection of dsRNAs results in a variety of phenotypes among which some are lethal when they interfere with essential developmental processes or metabolism. The discovery that also feeding of dsRNA produces RNAi effects in insects has opened the door for novel approaches in insect biotechnology. RNAi mediated silencing of specific gene(s) in pest insects through plant delivered RNA, offers the possibility to target genes necessary for their development, reproduction, or feeding success. Recent literature provides evidence that expression of dsRNAs directed against insect genes in transgenic plants causes RNAi effects which can confer protection against insect herbivores. Principally, this technology enables engineering of a new generation of pest-resistant GM crops. However, efficacy of protection and the range of species affected are dependent on the RNAi targets selected. Hormone receptors present in insects, but absent from vertebrates, represent favourite target genes since analogues of insect growth regulators such as ecdysone or juvenile hormone have been introduced as environmentally save insecticides in plant protection.

Gene silencing of neuropeptide genes in *Gryllus bimaculatus* and *Spodoptera frugiperda*

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RNA interference (RNAi) is a novel tool to elucidate *in vivo* functions of proteins and peptides. Long dsRNA can be constructed *in vitro* to target mRNA sequences specifically and to silence the gene expression in insects. In the cricket *Gryllus bimaculatus* (Ensifera; Gryllidae) and the moth *Spodoptera frugiperda* (Lepidoptera; Noctuidae) the RNAi has been used to suppress the transcript levels of allatoregulating neuropeptides and of the sulfakinins (SK) as quantified by real-time RT-PCR. The dsRNA sequences were derived from the known cDNA structures and were either injected into the abdomen of the animals or ingested by the insects. Both treatments led to a systemic gene suppression lasting for up to 7 days.

In the case of the allatoregulating neuropeptides, the juvenile hormone (JH) titers in the hemolymph of the crickets and moths were affected. Silencing of the allatostatin (AS) A-type enhanced the JH titer going ahead with a reduced JH-esterase activity, at least in *Spodoptera*. The egg laying of adult females was strongly reduced in spite of high JH levels.

In *Spodoptera* gene silencing of the AS C-type or allatotropin 2 (AT 2) either led to a JH-titer enhancement or a depression depending on the developmental stage. Treatment of *Spodoptera* males with AS C-type or AT dsRNA affected the transfer of JH from males to females during copulation and this reduced fecundity.

AS as well as SK were shown to act as food intake inhibitors and the AS affected the release of digestive enzymes in the midgut of *G. bimaculatus*.

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Silencing of corpora allata affecting neuropeptides in the pupa of *Tribolium castaneum* causes pupal-adult intermediates and reduces adult fecundity

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Juvenile hormones (JH) are unique agents that control the metamorphosis and reproduction in insects. The JH biosynthesis is regulated by either stimulatory or inhibitory neuropeptides termed allatotropin (AT) or allatostatin (AS). The genome of *T. castaneum* encodes two AS and one AT precursors. In this study, we cloned the cDNAs of the precursors, studied their expression pattern during the developmental stages and established *in vivo* their role in the metamorphosis and reproduction of the beetle. The cDNA of *Tc-AT* is expressed in three mRNA isoforms. Real-time RT-PCR data demonstrate a time- and tissue-specific expression of the precursor mRNAs in eggs, lavae, pupae and adults of *Tribolium*. RNA interference-mediated knockdown (dsRNAi) of the *Tc-AT* in the early pupa resulted in adult loss-of-function phenotypes, where the P1 phenotype adults looked normal, but the females laid only low number of eggs, whereas the P2 phenotype exhibited strong developmental defects. Injection of dsRNA for *Tc-AS B* and *Tc-AS C* into young pupae also resulted in two adult phenotypes, P1 and P2. The P1 phenotype adults had more or less normal adult characters, but the females deposited low numbers of eggs. The P2 adults showed abnormal phenotype characters and the eclosed adults died within eight days of imaginal life without laying eggs. Phenotypes obtained from isoform-specific knockdown of *Tc-AT* demonstrated a comparatively weak

effect for *Tc-AT1*, whereas the *Tc-AT3* treated animals showed the most severe moulting defects and died within one week of adult life. Our findings support the role of neuropeptides AT and AS as JH biosynthesis regulators in the pupa and the authentic role of JH as regulator for the pupal/adult development and for oogenesis and egg maturation in the young adult female.

RNA interference in the tobacco hornworm, *Manduca sexta*

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RNAi has been widely observed in insects and has proved extremely useful as a reverse genetics tool to elucidate the function of newly identified genes. We have experienced difficulties achieving repeatable RNAi in the larvae of the model lepidopteran *Manduca sexta* and others have reported similar problems in Lepidoptera. A survey of published results shows that the injected dose of dsRNA required for successful RNAi in lepidopterans is similar to that required in other Orders. We investigated experimentally the factors that may limit the sensitivity of *Manduca* to RNAi. The survival of dsRNA in the insect hemolymph, the uptake of dsRNA into cells, as well as the presence of key RNAi machinery components were all considered.

S30: Vector-borne diseases - biology and and population biology (incl. Myiasis)

Room Rome

Molecular genetic analysis of populations of *Wohlfahrtia magnifica* (Diptera: Sarcophagidae) in Europe and Asia

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Wohlfahrt's wound myiasis fly, *Wohlfahrtia magnifica* (Diptera: Sarcophagidae), causes a serious traumatic myiasis of livestock in southern and central regions of Europe and the Mediterranean region of North Africa. Its distribution and impact extends into central Asia. Populations of *W. magnifica* in Europe have previously been shown to comprise two distinct mitochondrial lineages, western and eastern. New collections from the previously unsurveyed Peloponnese region of Southern Greece identified two new haplotypes from that region. However, they did not include a haplotype so far unique to an outbreak population in Crete, established in 1999. The uniqueness of this haplotype to Crete probably results from under sampling in Greece and elsewhere. In addition, samples from cases of myiasis in Afghanistan were identified as comprising two further new haplotypes of the eastern lineage of *W. magnifica*. Their close similarity to haplotypes in the eastern Mediterranean suggests that human assistance could have been responsible for their spread in the region, possibly along the so-called Eurasian Ruminant Street. Future collections of *W. magnifica* will concentrate on Eurasia, especially countries along the Eurasian Ruminant Street, to examine in more detail the possibility of human assisted dispersal of this species.

Malaria vectors, *Anopheles* Hyrcanus Group (Culicidae, Diptera): Taxonomic status, habitats, parasitism and distribution

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Anopheles Hyrcanus Group comprises several species which are vectors of malaria and other mosquito borne diseases in the Oriental and Palearctic Regions. The group includes 30 known species world-wide, or about 42% of the species that comprised the Myzorhynchus Series of genus *Anopheles* Meigen subgenus *Anopheles* Meigen. Twenty eight of these species are found in the Oriental and Eastern Palearctic Regions and three in the Western Palearctic Region. In Asian countries (e.g. Korea, China and Japan), the known or potential vectors of human malaria include *Anopheles sinensis* Wiedemann, *An. kleini* Rueda, *An. pullus* M. Yamada, *An. lesteri* Baisas, *An. sineroides* S.Yamada and *An. belenrae* Rueda. Members of the Hyrcanus Group breed in various habitats, such as rice paddies, irrigation ditches, drainage ditches, ground pools, swamps, stream margins, inlets and pools, uncultivated fields, and artificial containers. Surveys from various Asian countries showed that *An. sinensis* is the most dominant species from rice paddies, irrigation ditches and other habitats. The taxonomic status, distribution records, and parasite rates of several species in selected countries are noted and discussed.

Emergence of sandflies and leishmaniasis in Europe

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The risks of the emergence of leishmaniasis in Europe have been assessed (Ready, P.D. 2010. Leishmaniasis emergence in Europe. Eurosurveillance 15 (10): pii=19505), and one of the threats comes from the natural spread of the sandfly vectors of Leishmania infantum northwards from the Mediterranean region. This presentation will review recent research on the use of molecular ecology to identify the habitats, landscapes and climates that form barriers to the spread of the principal sandfly vectors, namely Phlebotomus species in the subgenus Larroussius. Essential components of the research are standardized sampling methods and population genetics based on variation not only in mitochondrial DNA but also in nuclear genes displaying different levels of polymorphism.

Some of the research was supported by EDEN funding, EU grant GOCE-2003-010284 EDEN.

Impact of the global warming on species composition, distribution area and preferences of Moroccan leishmaniasis vectors (sand flies)

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Leishmaniasis is a serious increasing public health problem in Morocco and Phlebotomine sand flies are the only vectors of this disease. Entomological investigations must be done and a vector control strategy must be established, for a good understanding and better control of this infectious disease,

The Impact of the global changes on biodiversity must be evaluated, especially for vector populations. In many phlebotomine sand flies, modifications in distribution and behavior were noted.

In the aim to study the effect of global changes and warming on vectors distribution, on their longevity and density, specimens were collected, using sticky paper, and identified. Our data were compared to anterior results to actualize the species composition, their distribution areas, to find out emerging or re-emerging foci and to prevent an adapted control strategy.

Our results showed the important effect of global changes and global warming on sand fly species. The vector

distribution area becomes wider and sand flies colonize new areas. In addition, the global warming has a positive effect on the incubation periods of pathogenic agents which means the appearance of a mass of new pathogenic foci.

In this way, the international scientific community and health organizations must be aware of the importance of the problematic, scientific collaborations and hard work is waiting to be done.

Malaria vectors in the Guinea savanna zone of Central Nigeria

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The composition of anopheline mosquitoes in the guinea savanna zone of Nigeria and their infection with the malaria *Plasmodium* parasite has been investigated. Adult Indoor resting anophelines were caught using mechanical aspirator from human habitations. Three species of *Anopheles* were morphologically identified as *An. funestus, An. rufipes,* and *An. gambiae* s.l. PCR diagnostic assays delineated *An. gambiae* s.s. and An. *arabiensis* from the *gambiae* complex and further delineated the M and S molecular forms of *gambiae s.s.* All the 1058 individuals collected were tested for *Plasmodium* sporozoites by ELISA. *Anopheles gambiae* s.s. was the most dorminant species (66.64%; n=705) followed by *An. arabiensis* (19.00%; n=201), *An. rufipes (*10.68%; n= 113) while *An. funestus was the* least (3.69%; n= 39). The composition of the S form was dorminant (60.39%; n=407) over the M form (39.07%; n=261). 23 (2.17%) of the 1058 anopheline tested were positive to *Plasmodium* circumsporozoite antigen; 19 (1.80%) were positive for *Plasmodium falciparum* and 4 (0.38%) for *P. malariae*. Species wise, 19 *An. gambiae* s.s were infected with *Plasmodium* circumsporozoite antigen; 2.27% (n=16) and 0.43% (n=3) tested positive for *P. falciparum* and *P. malariae* respectively. For *An. arabiensis* 4 were positive for circumsporozoite antigen with a 1.49% (n=3) and 0.50% (n=1) for *P. falciparum* and *P. malariae,* respectively. Seven (2.68%) of the 261 M form tested positive to *P.falciparum* only while 9 (2.23%) and 3 (0.74%) of the 407.S form tested positive to *P. falciparum* and *P. malariae,* respectively. This study shows that *An. gambiae* s.s. (the S form in particular) and *An. arabiensis* have been iincriminated as the principal vectors of malaria in the guinea savanna vegetation zone of central Nigeria.

S31: Taxonomy of lepidoptera III.

Room Brussels

The Asian species of the genus *Naarda* Walker, 1866: review and taxonomy (Lepidoptera: Noctuidae, Hypeninae)

Balázs Tóth

The genus *Naarda* Walker, 1866 has a tropical-subtropical distribution in the Old World, containing 41 species. Its systematic position has been doubtful – despite the obvious monophyly and the unique appearance of the group – authors have placed it in various subfamilies like Ophiderinae, Hypeninae or Herminiinae.

The goal of this work is to give the morpho-taxonomic description of the genus and prepare the revision of all Asian taxa for clarifying their infrageneric classification.

My research is based on the specimens of the Hungarian Natural History Museum, photos on the type specimens of each Oriental species, and some material from other collections. External morphology and the genital structures were examined; by photographing the most intact specimens of each species and all genitalia slides. I prepared the general characterization of the genus *Naarda* Walker, 1866, revealing the synonymy of the genera *Gynaephila* Staudinger, 1892 with *Naarda* Walker, 1866. My results prompted me to treat the genus as a member of the subfamily Hypeninae.

The examined species were placed in nine main clades which are treated provisorically as species groups. The rate of the new species is surprisingly high, I found withing the available material altogether 54 undescribed species, this portion is considerably larger than the formerly known *Naarda* fauna of Asia. Thus, the entire stock of the Palaearctic and Oriental species counts 83 species. New distributional data are also given.

Revision of the genus *Xenophysa* Boursin, 1969 (Lepidoptera: Noctuidae, Noctuinae)

Zoltán Varga

The genus *Xenophysa* was erected by Boursin (1969, Entomops, Nice 2:221) for four species. *Agrotis junctimacula* Christoph, 1887 (Mém. Rom. 111:67, pl.3) was designated as type species of the new genus. *Agrotis cacumena* Brandt, 1938 and two newly described species *X. xenogramma* and *X. monastica* were also associated to the genus. *Xenophysa* species seem to be generally rather uniform both in external characters and male genitalia. They can mostly compared with some smaller *Xestia*-related genera as *Estimata* Kozhantschikow, 1928, *Erebophasma* Boursin, 1963 and *Spinipalpa* Alpheraky, 1892. *Xenophysa* imagines are medium sized noctuid moths (expansion: 25-39 mm), with elongate fore wings and acute apex. Antennae are strikingly long, in males finely bipectinated and ciliated, in females filiform and finely ciliated. Legs are also remarkably long. Colouration is mostly simple, maculation is generally whitish-ochreus or ivory, orbicular spot narrow, quadrangular, often connected with the reniform. Male genitalia show some peculiar, mostly autapomorphic characters. Tegumen is broad triangular, often with cross-shaped transversal extensions and bilateral lobes with finely dentated surface. Female genitalia also show several remarkable characters. Antrum has a U- or V-shaped incision which corresponds with the thicker or slender shape of the aedeagus. The new subgenus *Epixenophysa* and a new species *Xenophysa pseudopoecila* are described, with re-description of 2 species and revised status of 4 species. The distribution and phylogeny of the genus is considered. *Xenophysa* species are subdivided into a western and a central Asiatic xeromontane lineage with the highest diversity of species in the western Tien-Shan, Pamirs and Hindukush mountain systems with some overlap of the main phylogenetic branches. A stenochorous monophyletic "triplet" of species (*X. agnostica*-group) is restricted to these mountains. A very peculiar stenochorous species is restricted to the Hindukush range (*X. poecilogramma*) and also to western Mongolia (*X. sharhoo*). Key of identification based on male and female genitalia and map of distribution of all known taxa are given.

Morphometric study on *Melitaea phoebe* species group (Lepidoptera, Nymphalidae)

János P. Tóth, Nigel Spring, Zoltán Varga

The "*phoebe* group" (subg. *Cinclidia* Higgins, 1981) is taxonomically one of the most problematical groups in the tribe Melitaeini. The well-known *Melitaea phoebe* ([Denis & Schiffermüller], 1775) (TL: Wien, Austria) is a polytypic species with several described subspecies. The species rank of *Melitaea telona* Fruhstorfer, 1908 was only recently recognised. It has a disjunct area from the Levant across Asia Minor and Balkans to southern Italy and Sicily and to the Carpathian basin. These results were also confirmed by genetic studies based on the analysis of one mitochondrial and two nuclear genes in several species of the *M. phoebe* group and also by enzyme electrophoresis in the case of *M.*

phoebe and *M. telona kovacsi.* The differences in genital structures, however, mostly remained unconsidered.

In this study, the morphology of genital structures was analysed partly by traditional methods but also by landmark-based geometric morphometric methods. 221 male and 128 female individuals were analysed from the Hungarian Natural History Museum, the Zoological State Collection, Munich and the collection of the University of Debrecen. We surveyed five species from the "*phoebe* group", mostly *M. phoebe* (106♂, 62♀) and *M. telona* (81♂, 55♀) specimens but also some *M. scotosia* (7♂, 4♀), *M. sibina* (5♂) and *M. punica* (6♂, 3♀). *Melitaea aetherie* Hübner,[1826] (15♂, 4♀) was used as an outgroup, because although this species is closely related, its separation and species rank are not questionable. Our specimens originated from many locations from the Palaearctic. In the case of *M. phoebe* and *M. telona* the specimens covered almost the whole distribution.

Our results suggest *Melitaea phoebe*, *M. telona*, *M. punica* and *M. scotosia* are closely related but different species. *M. scotosia* based on genital structures seems to be well separated from the other species in both sexes while *M. sibina* seems to be a subspecies of *M. phoebe*. The most discriminative traits between species from the measured characters are: in males, the inner process of the processus posterior and the curvation of the harpe; and in females, the shape of the posterior lamella and the length of the furca branch. In the case of *M. punica, M. sibina* and *M. telona,* our results agree with the conclusions of the DNA analysis. We cannot find any differences between the females of *M. phoebe* and *punica;* this finding also supports the close relationship with *M. phoebe*. Since the females' genitalia do not significantly differ in *M. phoebe* and *M. punica*, they seem to be more closely related than *M. phoebe* and *M. telona*. In case of *M. scotosia* our results suggest an ancient separation from the above mentioned three species. Contrary to the DNA results, on our MDA plots *M. scotosia* can be clearly separated from the other species in both sexes.

Dispersing the mist: molecular phylogenetics of Noctuoidea (Insecta: Lepidoptera)

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To examine the higher-level phylogeny and evolutionary affinities of the megadiverse superfamily Noctuoidea, an extensive molecular systematic study was undertaken with special emphasis on Noctuidae, the most controversial group in Noctuoidea and arguably the entire Lepidoptera. DNA sequence data for one mitochondrial gene (*COI*) and 7 nuclear genes (*EF-1α, wingless, RpS5, IDH, MDH, GAPDH, CAD*) were analyzed for a total of 151 taxa of principally type genera/species for family-group taxa. Data matrices (6407 bp total) were analyzed by parsimony with equal weighting and model-based evolutionary methods (Maximum Likelihood), which revealed a well-resolved skeleton phylogenetic hypothesis with six major lineages. We thus present a new phylogenetic hypothesis for Noctuoidea that consists of six clear, strongly supported families: Oenosandridae, Notodontidae, Erebidae, Nolidae, Euteliidae and Noctuidae.

S32: Phytoplasma vectors III.

Room Strasbourg

Sampling methods of phytoplasma vectors

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Sampling of vectors represent a crucial stage when dealing with phytoplasma diseases. Direct methods (e.g. counts on plants, sweep-net, D-Vac) permit to obtain specimens more suitable for molecular analyses and to sample non-flying insects, but they are more time-consuming. Indirect methods (Malaise traps, coloured sticky cards etc.) generally catch only flying insects, but they provide an estimate of the population during a certain time window, and are less time-consuming. The attractiveness of sticky traps depend on the colour and on the position within the canopy. The sex ratio of vectors is often biased by the sampling method used. The flight activity of vectors can be studied with mark-capture techniques, using fluorescent powders or proteins. The spatial distribution can be estimated with crowding indexes (Taylor Power Law, Moran I index, etc.), that permit to develop sampling plans. The spatial correlation, determined with geostatistic, permit an estimate at non sampled locations: interpolation can be performed by means of many functions (IDW, Kriging, etc.). The artificial neural networks (ANN) are a novel method of estimation at non sampled locations, capable of self-learning and estimating from a given data set containing different input (e.g. environmental) factors and one or more output factors (vector's populations).

Novel emerging plant pathogens in phytoplasma vectors

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The yield of several crops is damaged by the spread of diseases attributable to phytoplasma. These non-cultivable prokaryotes are considered disease agents based on their presence in symptomatic plants, and on the symptom outbreak in healthy plants grafted with infected plant portions, or exposed to infective insect vectors. However, Koch postulates cannot completely be verified.

It has been recently demonstrated that some plant diseases, considered caused by phytoplasmas, are characterised by the presence of other microorganisms, often vectored by the same insect. Furthermore, phytoplasma vectors, beside transmitting the known pathogens, may also be the vehicle for the spread of other emerging diseases due to microorganisms co-existing with the phytoplasmas.

These findings underline the complexity of epidemiology and aetiology of several important plant diseases. Studies on the role, in plant diseases, of emergent microorganisms transmitted by phytoplasma vectors are constantly required, to elucidate the mechanisms of pathogen virulence and transmission, and to develop suitable control strategies.

Disseminating information on leafhopper, planthopper and psyllid vectors of phytoplasma disease

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Over 200 vectors of phytoplasma disease have been recogised but few comprehensive identification keys are available and details of pest species are mostly widely scattered in the specialist literature. An account of the "Leafhopper vectors of phytopathogenic viruses" was published in 1968 (Nielson, *U.S.D.A. Tech. Bull*. 1382, 386pp 1968) but in the past 40 years there have been many taxonomic changes in the insect names and our understanding of the disease organisms. This project, funded by The Leverhulme Trust will provide a comprehensive and accessible web-based guide to the leafhopper and planthopper vectors of phytoplasma, bacteria and virus diseases. The starting point of the project has been to compile a database of known plant diseases and their vectors from the various sources available. Datasheets will be developed that will include high quality digital images of adult insects (and nymphs where available), taxonomic drawings of morphological features, and text on the biology and pest status of each species. Each species datasheet will include details of taxonomy, identification, similar species, biology, host plants, distribution, and diseases and bibliography. Datasheets will be aimed for both professional use, as well as by workers in developing countries seeking to find accurate information on identification. This presentation will describe the project and present the database structure.

Can phytoplasma vectors be controlled?

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Phytoplasmas are phloem-limited, insect-transmitted, plant pathogenic bacteria that are responsible for hundreds of diseases world-wide. Because transmission occurs quickly, plants become infected before insecticides can act on the vector, thus rendering their use to reducing population size but not effectively preventing transmission. The single most effective means of controlling the vector is to cover plants with insect exclusion netting; however, this is not practical for most commercial crops. Because of these limitations, researchers are turning to genetic manipulation of plants to affect vector populations and pathogen transmission. These novel control schemes include genetic manipulation of plants, introducing symbionts, plant lectins, and systemic acquired resistance. These various forms of control measure will be discussed.

S33: Chemical mimicry and defence mechanisms of arthropods I.

Room Maastricht

Diversity of chemically-based defence strategies in sawfly larvae

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Royal Belgian Institute of Natural Sciences

Larvae of sawflies (Hymenoptera, Symphyta) typically feed on plant leaves. They are fascinating study objects in chemical ecology, to approach topics such as plant-insect and predator-prey interactions, and the following taxa were studied in more details.

Nematinae (Tenthredinidae) species possess a series of eversible ventral glands. The glands, which show an interspecific variability in their size, emit a volatile secretion that is often a complex mixture of compounds. These can belong to several classes of chemicals (e.g. aliphatics, aromatics, terpenoids) and can be of taxonomical interest. The secretion repels predators such as ants. Some species may use antifungal properties of the secretion to better survive the overwintering stage in the soil. Nematine sawflies are often, either both cryptic and solitary, or on the contrary, both brightly coloured and gregarious. These traits are associated with the (non) occurrence of other defensive traits, such as developed ventral glands.

Some Tenthredinidae species are probably unique among insects by their capability of easy bleeding. This phenomenon is known from several tenthredinid subgroups where species feed on plants containing toxins such as glucosinolates, steroidal alkaloids, or saponins. Plant chemicals are sequestered in the larval haemolymph that is, thereby, feeding deterrent towards biting predators. Easy bleeding involves particular adaptations of the insect's physiology, morphology, and behaviour. It is likely that it appeared and was lost repeatedly during the evolution of this sawfly family.

When larvae of Pergidae or Argidae species are in outbreak, they can be ingested by ruminants, which can then be killed due to the occurrence in the larvae of toxic peptides. However, the reason d'être of these toxins would be a defence towards predators such as invertebrates and birds. An ongoing research aims to detect and quantify the toxins in Australian and European species.

Clearly, sawfly larvae deserve further chemo-ecological research. In this context, we are setting up an illustrated catalogue for the European species and that reveals the diversity in their life history and ecology.

Network of transport proteins involved in sequestration of plant glucosides within leaf beetles

Anja Strauß, Antje Burse, Wilhelm Boland
Max Planck Institute of Chemical Ecology

Leaf beetles (Chrysomelidae) produce an impressive variety of defensive compounds. In the subtribe Chrysomelina, all developmental stages are chemically protected. In particular, the larvae defend themselves against predatory attacks by secreting a defensive chemical cocktail from their dorsal glands. The secretion is enriched with their specific defensive substances, which has been either taken up as glucoside from the host plant or synthesized *de novo* in the fatbody. Each of these strategies relies on a sophisticated molecular transport system. We suppose that during the course of Chrysomelina evolution, changes in the transporter selectivity influenced the diversity of defensive compounds.

As a first step, we isolated putative transporter candidates from cDNA libraries of *Phaedon cochleariae* and *Chrysomela populi* by sequence analysis. Feeding experiments have indicated the importance of the precursor sugar moiety as well as the existence of a rather unspecific uptake in the gut compared to a highly specific transport into the glands. Hence, we have glucose transporters and ATP-binding cassette (ABC) transporters in focus. Possible candidates have been heterologously expressed in *Xenopus laevis* oocytes as well as in insect and mammalian cells and localized *in vivo* using GFP-fusion proteins. One ABC transporter seems to be a promissing active transporter candidate, because of its high expression level in the glandular tissue. Furthermore, we expect RNAi studies to complement the search for relevant transporters. The overall goal is using phylogenetic analysis to gain insights into the development of the diversity of defensive compounds and, consequently, into the coevolution of leaf beetles and their host plants.

Discovery of a novel secondary endosymbiont of the pea aphid: prevalence in natural populations, microbiological characterization, and phenotypic effect on the host insect

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Aphids exclusively feed on plant phloem sap. Their survival on the nutritionally unbalanced food is mainly attributed to the essential endosymbiotic bacterium *Buchnera aphidicola*. In addition to *Buchnera*, aphids often harbor different types of endosymbionts, whose microbiological characteristics and biological significance have not yet been fully understood. Such endosymbionts are collectively referred to as secondary endosymbionts. Thus far, six types of secondary endosymbiotic bacteria have been described from the pea aphid. Some of the secondary endosymbionts are known to benefit the host conditionally via conferring tolerance to heat stress, resistance to parasitoid wasps, immunity to fungal pathogens, and broadening of food plant range. Such biological functions exerted by the secondary endosymbionts must have affected the host physiology and biology in a variety of ways. Recently, we identified a unique bacterial 16S ribosomal RNA gene sequence from some field-collected individuals of the pea aphid. Phylogenetic analyses showed that the sequence is distinct from the previously-known aphid secondary endosymbionts. Diagnostic PCR surveys detected 7.9% (28/353) infection of the symbiont in pea aphids collected from Western Europe. Whole-mount fluorescent in situ hybridization of the aphid embryos demonstrated that the bacterium infects blastoderm-staged embryos, and finally populates secondary bacteriocytes, sheath cells and other tissues surrounding the bacteriome. These histological traits are similar to the previously-known aphid secondary endosymbionts. We also report its remarkable phenotypic effects on the host aphid.

Salicyl alcohol oxidase in *Chrysomela lapponica* (Coleoptera, Chrysomelidae): a key enzyme in larval chemical defense and its functional and evolutionary dynamics in two ecological races

Roy Kirsch, Heiko Vogel, Antje Burse, Wilhelm Boland
Max Planck Institute for Chemical Ecology

Several leaf beetle species belonging to the subfamily Chrysomelinae use a chemical defense strategy to overcome predatory attack and microbial invasion. The larvae possess a defensive system consisting of defensive glands in the thorax and abdomen. In case of danger, the glands release small droplets of the defensive secretion. It has been shown that larvae of the genus *Chrysomela* feeding on *Salicaceae* not only survive the general insect repellent salicin of their host plants, but also benefit from this plant secondary compound by sequestration and further modification to employ the resulting salicyl aldehyde for their own chemical defense. After transport of salicin through the gut into the defensive glandular reservoir, chemical modifications occur in two steps: deglucosilation by a glucosidase and oxidation of the aglucon salicyl alcohol to the bioactive principle salicyl aldehyde by a salicyl alcohol oxidase.

Within the genus *Chrysomela* some species synthesize a variety of esters as defensive compounds with a mixed-host plant and beetle-origin. These species represent a monophyletic group and their defense is seen as more derived compared to the obligate salicyl aldehyde producers. Some of them shifted from *Salicaceae* to *Betulacea* as host plants independently. The willow feeding species retain salicyl aldehyde in addition to ester biosynthesis whereas the birch specialists have lost salicyl aldehyde production. This leads to a couple of questions related to the fate of salicyl alcohol oxidase (SAO) in birch feeders, where this key enzyme in *Chrysomela* larval chemical defense is not needed anymore. Is the SAO still expressed? If so, is the enzyme functionally active? What happens to the *sao* gene, when there is no selection pressure on it anymore?

We compared two ecological races of *Chrysomela lapponica*, one feeding on birch and the other on willow. We got SAO candidates in the willow race by comparing MS/MS generated peptide sequences from proteins present in the glandular secretion with a cDNA library created from the glandular RNA pool. By heterologous expression and subsequent enzyme assays the SAO was identified. Then we elucidated the SAO of the birch race and compared expression level, enzyme abundance in the defensive glandular system, enzymatic activity and gene architecture of SAO in the birch and willow race. It was no SAO activity or enzyme detectable in the defensive system of the birch race. But in both races we found a defensive gland specific transcription even with a 1000 fold decrease in the birch compared to the willow race. Heterologous expression and subsequent enzyme assays showed a loss of function of birch SAO which is most probably due to a truncation at the proteins N terminus. This truncation is reflected by deletion on second exon/intron boarder leading to an alternative splice mode in the birch race. In addition we were able to identify four genes in the willow and two in the birch race showing more than 70% identity in predicted coding region compared to SAO. This indicates a sub-functionalization of an oxidoreductase after several gene duplication events.

S34: Biocontrol in crops and storage I.

Room Copenhagen

Biological control of the South American tomato pinworm, *Tuta absoluta* (Lep.: Gelechiidae) with releases of *Trichogramma achaeae* (Hym.: Trichogrammatidae) on different tomato crop cycles in Spain

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The South American tomato pinworm, *Tuta absoluta*, is the main pest on tomato crops in Spain, and is becoming a problem in other European countries. The egg parasitoid *Trichogramma achaeae* was identified as a candidate for biocontrol of the pest, and is currently introduced in IPM programs in Spain, Morocco and France. Successful control is achieved with inoculative releases of the parasitoid combined with release and/or conservation strategies of the mirid bug predators *Nesidiocoris tenuis* or *Macrolophus pygmaeus*. However, control strategies may vary according to crop cycle and local conditions. In this work, the efficacy of different biocontrol strategies was assessed on 5 commercial greenhouses in several areas of the southeast of Spain, both under spring-summer and autumn-spring cycles. Economical costs of IPM and conventional chemical control were also evaluated. Up to 86.1% of *T. absoluta* eggs were parasitized in spring and almost 100 % in autumn, when pest pressure was lower. Releases varied between 25 and 50 individuals of *T. achaeae* per hectare every week or fortnightly. Results were validated in other 15 commercial crops (greenhouses and field). According to the results, IPM strategies to control this and other pests are proposed for each tomato crop cycle.

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Biological studies with an egg-larval parasitoid *Chelonus oculator*: advances, successes, and potential of use

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Chelonus oculator Panzer (Hymenoptera: Braconidae) is an egg-larval parasitoid of several important lepidopterous pests. Laboratory studies on the parasitoid have concentrated on host spectrum, host-parasitoid relations, behaviour, mass rearing and side effect of some insecticides. Several contributions to use of *C. oculator* for biological control of lepidopterous pests have been made in the past 12 years. Host spectrum studies indicated that *C. oculator* was able to parasitize a number of new lepidopteran pests and completed its development successfully. *Spodoptera littoralis* and *Phthorimaea operculella* were defined as natural hosts of the parasitoid, and *Ephestia kuehniella*, *E. cautella*, *Plodia interpunctella* and *Galleria mellonella* were defined as laboratory hosts of the parasitoid. The eggs were laid on the host eggs singly. The eggs of the parasitoid hatched in the host eggs, and first and second instar of the parasitoid fed internally. The reproduction of the parasitoid was arrhenotoky, in which only male progeny developed from unfertilized eggs. Superparasitism was observed in the case of insufficient host. However, only one parasitoid completed its development. It seems that *E. kuehniella* is the most suitable laboratory host for mass rearing of the parasitoid. Effects of some insecticides (*teflubenzuron*, *cyfluthrin*, *chlorpyriphos-ethyl* and Spinosad) on the development of *C. oculator* were also tested. Studies indicated that *C. oculator* can be candidate for future research as a biological control agent against important lepidopteran pests.

Biological control of mediterranean flour moth, *Ephestia kuehniella*, using egg and larval parasitoids

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The Mediterranean flour moth (MFM), *Ephestia kuehniella* (Lepidoptera: Pyralidae), is a serious pest of flour and feed mills, and management of this pest can be difficult if an infestation has become severe to cause serious problems. Biological control using hymenopteran parasitoids presents an attractive alternative to insecticides for reducing infestations and damage from *E. kuehniella* in flour and feed mills. We tested the potential for using combinations of the egg parasitoid *Trichogramma turkestanica* Meyer (Hymenoptera: Trichogrammatidae) and the larval parasitoid *Bracon hebetor* (Say) (Hymenoptera: Braconidae) to control *E. kuehniella* in grain flour. Freshly laid *E. kuehniella* eggs were evenly sprinkled on the grain flour in plastic boxes, and then *T. turkestanica* females were released in the boxes. After 40 days (last stage larvae of *E. kuehnilla*) *B. hebetor* females were added. Our findings suggest that the combined release of both *T. turkestanica* and *B. hebetor* results in a greatest impact on the flour moth population.

Aphid parasitoids in a dry lowland of Khuzestan, Iran (Hymenoptera, Braconidae, Aphidiinae)

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Parasitoid-aphid-plant associations were examined and identified in 375 samples collected from 105 species belonging to 36 host plant families in part of Khuzestan province, southwest, Iran during 1976-78 and in 2008. Altogether 14 parasitoid species (3 genera and one subfamily) of hyperparasitoids were collected and identified from 32 host aphid species as follow: *Aphidius colemani* Viereck, *A. matricariae* Haliday, *A. persicus* Rakhshani and Stary, *A. rhopalosiphi* De Stefani-Perez, *A. rosae* Haliday, *A. transcaspicus* Telenga, *A. near transcaspicus* Telenga, *A. hieraciorum* Stary, *Binodoxys acalephae* Marshall, *B. angelicae* Haliday, *Diaeretiella rapae* (M'Intosh), *Ephedrus persicae* Froggatt, *Lysiphlebus fabarum* Marshall, *Lysiphlebus* sp. ,,A", *Lysiphlebus* sp. ,,B" and *Praon ? necans* Mackauer. *A. matricariae*, *B. angelicae*, *D. rapae* and *Lysiphlebus* sp. „A" are clearly dominant, they are broadly oligophagous and this phenomenon seems to contribute positively to their occurrence in an extreme dryland environment. *L. fabarum* and *Lysiphlebus* sp. ,,B" are less common, being more widely distributed in Khuzestan. Populations of some parasitoid species adapted in the plane of Khuzestan might become potentially useful biocontrol agents for exportation. A comparison of species richness in 1976-78 and 2008 agreed in the same species composition patterns in general as well as in the individual aphid-parasitoid species. Patterns can thus be classified as stable for the area studied.

Fumigant toxicity of essential oils from two *Eucalyptus* species against stored date pests

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In south Tunisia, dates and its second rate products present a resource of oasis and have a major role in shoring the agriculture and developing regional economy. Nevertheless, dates are prone to many insect pests that cause major economic losses and decrease their quality. The Mediterranean flour moth *Ephestia kuchniella* Zeller and the fruit dry moth *Ephestia cautella* are among the most important and destructive insect attacking dates in storage in Tunisia. *Methyl bromide* is used for the control of these insects in storage systems. However, due to the increasing environmental and human health concerns on the harmful effects of insecticides, the implementation of alternatives which are more effective and friendly to the environment is required. These technologies mainly include the use of plant essential oils. Therefore, this study was undertaken to assess fumigant toxicity of essential oils from *Eucalyptus camadulensus* and *Eucalyptus leucoxylon* against adults of *E. kuehniella* and *E. cautella*.

Results showed that fumigant toxicity varied with the oil concentration and the exposure time. For *E. kuehniella*, the LC_{50} and LC_{95} values of *Eucalyptus camadulensus* essential oil were respectively 0.72 and 1.66µl/l air. 100% mortality was obtained for the concentrations of 13.15 and 105.26µl/l air respectively after 30 and 3 hours of exposure. For *E. cautella*, *Eucalyptus leucoxylon* essential oil had LC_{50} and LC_{95} values of 0,429 and 1,336µl/l air. 100% mortality was achieved with the concentrations of 13.15 and 131.57 µl/lair respectively after 30 and 2 hours of exposure.

S35: Evolution, ecology and behaviour of parasitic arthropods

Room Rome

Searching for general rules in the ecology of arthropod ectoparasites

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Any scientific study revealing some patterns or processes still should answer the question: how general are these patterns and processes? The findings of a particular study should invariably be validated by studies in other geographic locations or on other taxa. Here, we present comparison of several studies that examined various patterns of the relationships between small mammals and different taxa of their arthropod ectoparasites (fleas, gamasid mites and ixodid ticks) and carried out in different geographic regions (Middle East, Central Europe, South Africa, Western Siberia). We consider patterns revealed at two hierarchical ecological scales, namely ectoparasite populations and ectoparasite communities. We conclude that, although general laws apply to the population level of parasite ecological studies, most patterns observed at the parasite community level are highly contingent and far from universal.

Hytrosaviridae as a threat to the success of SIT eradication programs for tsetse flies

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Hytrosaviridae are viruses that cause salivary gland hypertrophy syndrome and reduce the fertility in their dipterans insect hosts. *Glossina pallidipes* salivary gland hypertrophy virus (GpSGHV) is a linear double stranded DNA virus with rod shaped particles, 50 nm in diameter and 700 – 1000 nm in length and are a member of the proposed family Hytrosaviridae. While the virus was reported more than thirty years ago, attention has focused on the virus recently for several reasons: i) the success of the tsetse eradication programs on the island of Unguja, United Republic of Tanzania has encouraged other countries to consider the sterile insect technique as one additional tsetse control tactic; ii) during attempts to colonize *G. pallidipes* in Austria and Ethiopia, difficulties in colony expansion were experienced and the virus was thought to be the probable cause as a high percent of flies showed symptoms of hypertrophied salivary glands. To study in detail the biology of the virus and to understand its mode of transmission, a PCR based detection method and qPCR were developed and the complete genome of the virus has been sequenced. The detection of the virus with PCR showed that the virus is widely distributed in several colonized tsetse species. Under field conditions, the virus is mainly transmitted vertically from female to progeny and in laboratory colonies where the *in vitro* membrane feeding system is used the virus mainly is transmitted horizontally through feeding. Due to the negative impact of the virus on tsetse flies' productivity, a strategy to manage the virus infection in the colonies was required. The virus management strategy is based on four axes, i) blocking virus replication using commercial antiviral drugs, ii) inhibiting the virus infection by silencing virus specific genes using RNAi technology, iii) neutralizing of the virus infection using virus specific antibodies, and iv) reducing the virus horizontal transmission using a strategy of clean feeding (each fly receives clean blood with each feeding opportunity).

Clever birds are lousy – comparative analysis of bird innovation and louse genera richness

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The taxonomic richness of avian lice varies appreciably across different hosts. Some extensively studied bird family carry only 1 genus of lice, while other families harbour 20 genera. Here we set on to test whether or not the innovative capabilities of avian families relate their louse genera richness. The innovation data for bird families were gathered from the literature and controlled for research effort. We used genera richness to quantify the diversity of louse burdens because of the disagreement on the species concept of lice. We controlled for differences in louse research effort rates across bird families. We constructed two alternative phylogenetic trees of bird families with some difference in the taxonomy of passerine families. We controlled our data-set for host phylogenetic effects statistically by using these trees. In a comparison across avian families we show that host innovative capabilities co-vary positively with Amblyceran louse taxonomic richness, while no similar relationship appears with Ischnocerans. We discuss some alternative hypotheses explaining this surprising relationship.

Application of predictive degree day model for field development of sandfly vectors of visceral leishmaniasis in northwest of Iran

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Temperature plays a significant role in insect's development where a rise in temperature, accelerates the insect's metabolic rates, increases egg production, makes blood feeding more frequent, and shortens the time period required for the pathogens development in insects. Visceral leishmaniasis (VL) is one of the most important diseases transmitted by sandfly. A phenological model was used to estimate the number of generations, peak activity and temporal variability of sandflies in the main VL foci in northwest Iran. Development requirements of different life stages of a *Phlebotomus papatasi* lab colony were measured and were subjected to the formula for calculation of accumulated degree day (ADD) for field sandflies using the online software (UC IPM), horizontal cut-off and single triangle model. Sandflies population dynamics was monitored during the seasonal activity and its association with the ADD was tested using SAS software. Sandflies populations accommodated well with the amount of ADD in the region. During the seasonal activity, a total of 639 ADD were produced which was enough to support one complete life cycle and growth of the next generation up to late larval instar. Larvae of the 2nd generation hibernate through winter and the first adult population appears in the mid to late June of the next year when they receive at least 182 ADD from

the beginning of the spring. The highest population density of sandflies was observed in early August, followed by a rapid decline in early September, with the adult population disappearing completely in late September. This is the first degree day model related to sandflies in the most important VL foci of Iran. These data could be used in proper implementation of effective vector control programmes.

Predatory efficiency of the tadpole of Cricket Frog *Fejervarya Limnocharis* (Anura: Dicroglossidae) on the larvae *Culex Quinquefasciatus* say mosquito (Diptera: Culicidae)

Kabirul Bashar, Nita Debnath, A. J. Howlader, K. M. Z. Rahman

An experiment was conducted to evaluate the predatory efficiency of Cricket Frog *Fejervarya limnocharis (Anura: Dicroglossidae)* tadpole on the different larval and pupal stages of *Culex quinquefasciatus* Say (Diptera: Culicidae) mosquito under laboratory conditions during March 2008 to March 2009. Pond water and tap water were used for the comparative study. After 48 hours exposure the highest mean of predation by *F. limnocharis* tadpole were found in 2nd instar larvae (7.50± 0.514) followed by 3rd (7.25± 0.25), 1st (3.58± 0.398), 4th (2.25±0 .179) larval instars and pupae (0.58± 0.193) in pond water. In case of tap water predation rate was also highest in 2nd instar larvae (4.92± 0.259) followed by 3rd (4.42± 0.193), 1st (2.17± 0.321), 4th (1.33± 0.256) larval instars and pupae (0.50± 0.23). The tadpoles also fed on dead larvae and pupae when exposed in tap water. The predation rate was higher in pond water than tap water. So the present experiment showed that the tadpole of *Fejervariya limnocharis* has predatory potential on the larvae and pupae of *Culex quinquefasciatus*.

Tuesday poster session

TU 1: Chemical mimicry and defence mechanisms of arthropods

TU 1
Fitness costs of cotton aphid's (*Aphis gossypii*) cornicle secretion, as a defense mechanism

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The cornicle secretion is used in many aphid species as a defense mechanism specially to warn related individuals of predation by natural enemies. Many researches in this area have largely focused on the benefits of cornicle droplet and alarm pheromone but the cost of this phenomenon is not well known. In this study we tried to answer to this question that does cornicle droplet production of cotton aphid, *Aphis gossypii* has direct fitness cost to immature as well as mature aphids? Aphids were artificially induced to produce cornicle droplet at different stages of development (second, third and fourth instars as well as adult) by lightly stroked on the anterior portion of the thorax with a fine brush, resulting in the secretion of visible cornicle droplets. After this manipulation, life-history patterns of aphids were followed until the death of the last adult individual. The results show that the secretion of cornicle droplet by second and third-instar of cotton aphids did not effect on the survivorship and number of offspring produced by their adult stage. In contrast, fourth instars as well as adults that emitted cornicle droplet had lower and significant survivorship and offspring production than non-secretors. Thus, in this paper we address the direct, physiological costs of cornicle-droplet in *A. gossypii* and the hypothesis that cornicle droplets entails a fitness cost for aphids is supported only for late-instar and adult of cotton aphids.

TU 2-23: Biocontrol in crops and storage

TU 2
Reproduction parameters of the dubas bug, *Ommatissus lybicus* (Homoptera: Tropiduchidae) at three constant temperatures

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Reproduction parameters of *Ommatissus lybicus* de Bergevin were studied under controlled conditions at three constant temperatures (25±1, 30±1 and 35±1°C), 60±5% RH and a photoperiod of 16L:8D hours. Forty eggs (*O. lybicus* 24 hours old) were used for each temperature treatment. At 30°C, gross fecundity rate (168.3), net fecundity rate (123.1), gross fertility rate (151.5) and net fertility rate (110.7) were significantly different with other temperatures. In this research, with changing gross to net at 25, 30 and 35°C, the decrease of fecundity was 33.4, 26.9 and 69.1, respectively and the decrease of fertility was 33.4, 26.9 and 63.2, respectively. The egg/female/fertile day was 4.13 and 5.19 at 25 and 30°C; however, it extremely decreased at 35°C (1.45) indicating that most females do not get older and reproduced. The results indicated that 30°C was the optimum temperature for reproduction of *O. lybicus.*

TU 3
Preliminary observations on factors responsible for population growth of Chickpea plume moth, *Marasmarcha ehrenbergiana* Zeller in the Northern West of Iran

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Chickpea, the world's third most important food legume, is currently grown on about 11 m ha, with 96% cultivation in the developing countries. Few numbers of insect pests are known to attack chickpea including chickpea plume moth, *Marasmarcha ehrenbergiana* Zeller The insect is distributed in Iran (adldoost,1992), Turkey(Tamer *et.al.,*1998), and Syria (Sithanantham *et. al.*, 1984) and can potentially cause damage on rain-fed chickpea. During 2002-2009, population density and damages of the pest were studied in field conditions in Northern West of Iran. Result revealed that *M. ehrenbergiana* is a monophagous and monovoltine insect pest and the volunteer chickpea plants grown in cereal fields were vulnerable to the post-diapause overwintered neonate larvae in early season. Population density exceeded 45 larvae per plant. These volunteer chickpeas favor the persistence and population growth of the pest in cereal fields during rotation period. However survey on insecticides free fields, revealed that 47% of the spring chickpeas and all winter chickpeas were infected in 2002. Mean total larvae recorded

on 50 plants in winter and spring chickpea was 15.4 ±5.25 and 23.18±2.60 respectively, while two decades ago, *M .ehrenbergiana* was not considered as a minor pest due to very low population. However, in 2009, the population density exceeded 3 larvae per plant in some spring chickpea fields. Certain factors favor the development and population growth of the pest. Some of these are physical (climate, temperature, moisture, wind, etc.); others are biological (Interspecies competition, relative aggressiveness of the insect, natural enemies, quality and abundance of food supply, etc.); others still may contain both physical and biological properties that affect the insect populations growth (change in cultivation system, rotation and pesticide applications). Factors that may be responsible for the insect population growth will be discussed**.**

TU 4
Demography of *Trissolcus grandis* (Hymenoptera: Scelionidae) at five constant temperatures

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Trissolcus grandis Thomson is the most important egg parasitoid of the common sunn pest, *Eurygaster integriceps* Puton (Heteroptera: Scutelleridae), in Iran. Demographic characteristics may be used for preliminary screening of parasitoid species or populations as well as for predicting their efficiency under different physical conditions in field. In this study, the demography of two northwestern populations of *T. grandis* was studied under five constant temperatures, 20, 23, 26, 29 and 32 ± 1 °C, 50 ± 5% RH, 16L:8D photoperiod. The two populations responded differently to the temperatures, thus many life history parameters were significantly affected not only by temperature itself, but also in interaction with population. The highest value of intrinsic rate of increase for the Marand population was 0.344 ± 0.057 female/day that occurred at 26 °C. The value of this parameter declined although non-identically both below and over that temperature. The same rate for the Tabriz population increased regularly from 20 °C to reach a maximum of 0.368 ± 0.063 at 29 °C. Further increase in temperature did lead to a negligible change in value of that parameter. As a whole the Marand population seems adapted to colder conditions compared to the Tabriz population.

TU 5
Fumigant toxicity of essential oil from *Satureja hortensis* (Lamiaceae) against three Stored-Product Insect Species

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Human health problems and environmental hazards caused by the indiscriminate use of chemical pesticides during past three decades have lead scientists to look for less persistent and biodegradable alternatives. Essential oils from aromatic plants are recognized as proper alternatives to fumigants. In this experiment, fumigant toxicity of *Satureja hortensis* essential oil that was isolated *via* hydrodistillation, was studied against 1-7 day-old adults of the red flour beetle, *Tribolium castaneum* (Herbst) and 12-14 day-old larvae of the Mediterranean flour moth, *Ephestia kuehniella* (Zell.) and Indianmeal moth, *Plodia interpunctella* (Hübner) in fumigation chamber. The adult beetles were exposed to the concentrations ranging from 250 to 1000 µL/L air and exposure time from 9 to 24 h. The moth larvae exposed to the different concentrations ranging from 25 to 400 µL/L air, and mortality counted after 6, 9 and 12 h. At concentrations higher than 750 µL/L air, beetle adults mortality was recorded more than 70% after 24 h, whereas there was no significant difference between mortality of this concentration and mortality of higher rate. After 24 h of exposure, the LC_{50} value for *T. castaneum* was 462 µL/L. At 400 µL/L air, maximum mortality was obtained as 96% and 87% for *E. kuehniella* and *P. interpunctella* larvae, respectively. Data probit analysis demonstrated that *E. kuehniella* (LC_{50}= 81 µL/L air) was more susceptible than *Plodia interpunctella* (LC_{50}= 140 µL/L air). Relationships between exposure time and oil concentration on mortality of all species indicated that by increasing in oil concentration and exposure time mortality increased.

TU 6
Occurrence of *Wolbachia* in European weevils (Coleoptera: Curculionoidea)

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The occurrence of *Wolbachia* in relation to the systematic ecology and some biological factors of 40 weevil species from central Europe were examined based on *16S rDNA*, *ftsZ*, *wsp*, and *hcpA* gene sequences and phylogeny reconstruction. *Wolbachia* were detected in 16 species (40% of all studied species), 6 species carry only supergroup A (15%), and 4 species supergroup B (10%). Other 6 species were infected by both supergroups A and B (15%). No differences between *Wolbachia* supergroup frequencies were detected. There was almost no correlation between *Wolbachia* phylogeny and host systematic and phylogeny at the level of subfamily and tribe. *Wolbachia* strains were probably inherited from a common ancestor only in the case of the genus *Strophosoma*. There was also only limited congruence between phylogenies obtained from the studied genes. These results suggest horizontal transmission of *Wolbachia* between species and recombination events between different strains. A significant correlation was detected between infected and uninfected species in relation to mobility (flying species were 2× more frequently infected than non-flying species), foraging (polyphagous species were 2.5× less frequently infected than mono- or oligophagous species), and reproductive mode (parthenogenetic species were infected nearly 2× as often as bisexual species). No differences were detected between mesophilous and xerothermophilous species, nor between those inhabiting open areas vs. arboreal species.

TU 7

Comparative demography of olive psyllid, *Euphyllura pakistanica* (Hemiptera: Psyllidae) and its parasitoid *Psyllaephagus zdeneki* (Hymenoptera: Encyrtidae) on yellow olive cultivar under laboratory conditions

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Life history and demographic parameters of the most important olive pest in Iran, *Euphyllura pakistanica* Loginova (Hemiptera: Psyllidae) and its newly described parasitoid species, *Psyllaephagus zdeneki* Noyes and Fallahzadeh, 2005 (Hymenoptera: Encyrtidae) was studied under controlled conditions in order to develop a biological control program. The experiments were conducted in growth chamber at temperature of 20±1°C, relative humidity of 60±5% and a photoperiod of 16:8 (L:D) hours on yellow olive cultivar. Results indicated that the developmental period was significantly longer on *P. zdeneki* than *E. pakistanica* ($P<0.01$). The pre-imaginal developmental period and adult female longevity was 25.3±0.90 and 13.2±0.59 days on *P. zdeneki* even if it was 20.3±0.25 and 31.4±1.18 days on *E. pakistanica*, respectively. The adult longevity of females was significantly longer than of males in *E. pakistanica* and its parasitoid. Survival rates (l_x) in newly emerged females of psyllid and its parasitoid were determined 63.7% and 82.3% on yellow olive cultivar. The mean number of eggs laid per female was 138.4±4.22 and 397.9±18.4 in *P. zdeneki* and *E. pakistanica*, respectively. The values of intrinsic rate of increases of *P. zdeneki* was significantly higher than this value in *E. pakistanica* ($P<0.01$), which was obtained 0.260±0.002 and 0.167±0.001; also mean generation time was gained 15.7±0.15 day in *P. zdeneki* and 26.4±0.35 day in *E. pakistanica*, respectively. The present research revealed that population growth characteristics, are important in investigating parasitoid efficacy, e. g. the intrinsic rate of increase of *P. zdeneki* is higher than that of its host, *E. pakistanica*, and that *P. zdeneki* has a potential in the biological control of *E. pakistanica.*

TU 8

Study on the effects of some Iranian isolates of the fungus *Beauveria bassiana* (Deuteromycotina: Hyphomycetes) (Bals.-Criv.) Vuill. on the bird cherry-oat aphid, *Rhopalosiphum padi* (Hom: Aphididae), under laboratory conditions

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According to the importance of non-chemical controlling methods based on integrated pest management, *Beauveria bassiana* was considered as a bird cherry-oat aphid, *Rhopalosiphum padi,* pathogen. In this study, the pathogenicity effects of some Iranian isolates of *Beauveria bassiana* against adult aphids were evaluated using the spray bioassay method. Seven isolates, including DEBI 001, DEBI 002, DEBI 003, DEBI 010, DEBI 015, DEBI 008 and DEBI 006 were cultured on the SDA medium and incubated under dark conditions at 25°C for 15 days. The minimum and maximum dosages of each strain were determined and then 5 different conidial concentrations were prepared based on the logarithmic distances. Experiments were carried out based on RCD and repeated 4 times and for each replicate 20 adult aphids were treated. The control aphids were treated with distilled water – Tween 80. Treated aphids put in plexiglass cups in an incubator at 25±2°C and mortality was recorded daily for 5 days. Data were analyzed using SAS (6.2) and Curve Expert 1.4 to determine LC_{50} and LT_{50}. The lowest and highest LC_{50} were recorded 0.06 and 119.3 spore/ml, and the lowest and highest LT_{50} were recorded 2.08 and 4.57 days, both respectively using DEBI 008 and DEBI 001 isolates.

TU 9

Influence of temperature on functional response of *Hemiptarsenus zilahisebessi* (Hym: Eulophidae) on *Liriomyza sativae* (Diptera: Agromyzidae)

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Environmental variables, such as temperature, are important in determining the efficiency of biological control in different crops. In this research the functional response of *Hemiptarsenus zilahisebessi* (Erdos), a parasitoid of leafminers, was examined under laboratory conditions on *Liriomyza sativae* Blanchard reared on cucumber (*Cucumis sativus* L.). Five constant temperatures (15, 20, 25, 30, and 35°C) and six host densities (2, 4, 8, 16, 32, and 64) were used during a 24-h period. At each temperature, 2–64 third-instars of *L. sativae* were exposed to individual mated female wasp. A type II functional response model was fitted to each temperature regime. The minimum and maximum rate of parasitization was 3.80 and 15.38 larvae/24 h at 15°C and 30°C, respectively. Handling time (T_h) changed under different temperature regimes and was lowest at 30°C and highest at 15°C. Instantaneous search rate (a) also changed with temperature. It was lowest at 15°C and highest at 30°C. These parameters can be used in providing population prediction models and efficiency assessment of *H. zilahisebessi* for biological control of *L. sativae*. Furthermore the ability of *H. zilahisebessi* to find and parasitize *L. sativae* over a broad range of temperatures makes it a good candidate for control of this pest.

TU 10

Temperature-dependent development of *Eupeodes corollae* (Diptera: Syrphidae) as a predator of the cabbage aphid, *Brevicoryne brassicae* (Hemiptera: Aphididae)

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The influence of temperature on the development of the flower fly *Eupeodes corollae* Fabricus (Diptera: Syrphidae) from egg to adult stage was evaluated at six constant temperatures (15, 17, 20, 25, 30 and 35°C). The rate of development was significantly influenced by temperature. Total developmental time (egg to adult) ranged from 36.4±0.4 days at 15°C to 14.5±0.9 days at 30°C. No adult emergency was observed at 35°C. The lower developmental thresholds for the egg, larva and pupa were estimated 4.7,

6.9 and 6.4°C, respectively. Thermal constant values for the egg, larva and pupa were calculated 34.5, 111 and 125 DD. Lower developmental thresholds and thermal constant values for development from egg to adult stages were determined 7.3 °C and 333 DD, respectively. The results should be helpful in predicting development, the importation and establishment of *E. corollae* populations into new environments with diverse temperatures for the use of this native predator in biological control programs.

TU 11

Thermal requirements and effect of temperature on biological characteristics of two *Spodoptera frugiperda* egg parasitoid species

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Trichogramma pretiosum (Hymenoptera: Trichogrammatidae) and *Telenomus remus* (Hymenoptera: Scelionidae) have great potential for controlling *Spodoptera frugiperda* (Lepidoptera: Noctuidae) populations in Brazil. Biological characteristics and thermal requirements of these egg parasitoids were studied in order to define the better environmental conditions for rearing and using these species. Parasitoids were reared on eggs of *S. frugiperda* at 18–33°C temperature range. *Trichogramma pretiosum* and *T. remus* developmental time, from egg to adult, varied from 6.4 to 23.9 and 8.8 to 37.5 days, respectively. For both species the emergence rate was lower at 18°C and higher at 21-30°C range. At 18°C only 10.7% of *T. remus* adults were able to emerge, while at the same temperature, 42.8% of *T. pretiosum* have emerged. Most of non-emerged parasitoids, except *T. pretiosum* at 18°C, died in the egg or larval stage. Temperature did not affect *T. pretiosum* sex ratio, which ranged from 0.64 to 0.72. Conversely, for *T. remus*, at the extreme temperatures tested, significantly more females emerged, resulting in sex ratios of 0.94 and 0.83, respectively for 18 and 33°C. Between 21 and 30°C *T. remus* sex ratio ranged from 0.70 to 0.77. The temperature threshold (*Tt*) and thermal constant (*K*) were 12.2°C and 127 degree-days for the trichogrammatid and 13.5°C and 162.2 degree-days for the scelionid. Results have shown that *T. remus* is more sensitive to temperature than *T. pretiosum*.

TU 12

Effects of cold stored *Ephestia kuehniella* eggs at different periods on some biological properties of parasitoid *Trichogramma evanescens*

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Egg parasitoid species *Trichogramma* are commercially important organisms due to their host preference and high host finding capability. *T. evanescens* Westwood (Hymenoptera: Trichogrammatidae), a native species of Turkey, is mass reared on *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae). Decreasing the costs of parasitoid rearing can make use of parasitoids more common. In this study, eggs of *E. kuehniella*, cold stored at +4ºC for 1, 3, 6, 9, 12 and 15 days were given to the parasitoid, with 0-12 hours aged eggs applied similarly for comparison. Experiments were conducted in 10 replications for each storing period, in a climate controlled cabin (25±1^{O}C, 70±5% relative humidity, 16:8 h L:D). *E. kuehniella* eggs were fixed on 1x5 cm paper pieces using water with 20 eggs per glass vial (1.5x16 cm). Adults of parasitoid, 0-12 hours of age, were placed in vials (2 females + 1 male), adult feeding was achieved by applying honey into the vials as thin lines. Parasitized eggs and emerged adults were counted daily, and were examined and sexed under stereo binocular microscope.

Parasitism rates on 15, 12, 9, 6, 3 and 1 day stored eggs were determined as means, 87.5%, 83.5%, 68.5%, 83%, 82% and 81.5%, respectively. Parasitism rate on 0-12 hour aged eggs was 85.5%. Difference of parasitism rates on cold stored eggs with different periods was found to be statistically unimportant ($F=1.25$; $df= 6$; $P>0.005$). Emergence rates from 15, 12, 9, 6, 3 and 1 day stored eggs were determined as means, 75%, 84,7%, 85%, 82.5%, 93% and 93.2% respectively. Emergence rate from 0-12 hours aged eggs was 96.2%. Difference of emergence rates from 15 days cold stored eggs was found to be statistically important ($F=4.87$; $df=6$; $P<0.005$). Sex ratios (F/M) of adults emerged from 15, 12, 9, 6, 3 and 1 day stored eggs were determined as means, 2.04, 2.07, 2.05, 1.75, 2.20 and 2.54, respectively. Sex ratio of adults emerged from 0-12 hours aged eggs was 1.95. The difference between the effects of different storing periods on sex ratio of parasitoid was statistically unimportant. As a result, cold storage of *E. kuehniella* eggs for different periods did not affect the parasitism rate and sex ratio of the parasitoid, but emergence from 15 days stored eggs was low compared to other storing periods.

TU 13

Effect of temperature on food consumption coccinellid *Hippodamia variegata* (Col.; Coccinellidae) in laboratory condition

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Food consumption of different larva stages and adult coccinellid on pistachio psylla was investigated under condition i.e. 25°C and 30°C, relative humidity of 55±5 and photoperiod of 16:8 (L:D). Food consumption on the fourth nymphs of pistachio psylla for the 1st, 2nd, 3rd, 4th larval instars and female adult at 25°C was 26.72, 70.55, 170.75, 330.25 and 315.2 nymphs, respectively but at 30°C the number of consumed nymphs were 31.64, 86.63, 202.5, 378.86 and 341.79, respectively. Our results showed that increasing in temperature and larva stages is proportional to increase in rate of food consumption. Rate of food consumption of the 4th instar larvae was more than female adults.

TU 14

Synthesis of (Z)-14-methyl-8-hexadecenal – sex pheromone of khapra beetle *Trogoderma granarium* (Coleoptera: Dermestidae)

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The khapra beetle *Trogoderma granarium* (Coleoptera: Dermestidae) is an economically significant store pest in Asia, Europe and North America. The beetle gives 4 generations per year. The larvae damage grains of wheat, rice, corn, barley, groundnut and many other produce in storehouse. In Russia this pest is a quarantine species, but it can enter Russia with imported grain. Early detection of the khapra beetle is a most important problem for protection of stored grain in Russia, therefore, precise instruments, such as sex pheromone traps, are needed for monitoring of this pest.

The sex pheromone of *Trogoderma granarium* is known to be (Z)-14-methyl-8-hexadecenal. A method for the synthesis of this compound from available raw materials was worked out. The starting material for the synthesis of this pheromone was 4-chlorobutanol, obtained from tetrahydrofuran. After certain

transformations, two precursors, 1-tetrahydropyranyloxy-8-nonyn and 5-methylbromoheptane were obtained. The reaction between these substances in the presence of butyllithium and the removal of the tetrahydropyranyl protecting group yielded 14-methylhexadecyn-8-ol-1. Hydrogenation of the triple bond in the presence palladium on barium sulfate as a catalyst in pyridine leaded to 14-methyl-(Z)-8-hehadecenol, and oxidation of the alcohol with pyridiniumchlorochromate, yielded (Z)-14-methyl-8-hexadecenal. Thus, a simple method of the synthesis of the sex pheromone of the khapra beetle was elaborated from easily available raw materials.

TU 15

Effect of *Lecanicillium muscarium* and *L. lecanii* on the cottony camellia scale, *Pulvinaria floccifera* (Westwood) (Homoptera: Coccidae) on tea plant

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The cottony camellia scale, *Pulvinaria floccifera* (Westwood) (Homoptera: Coccidae) is one of the most important pest of tea gardens in the north of Iran. Because of using hazards of insecticides in tea plantation, application of natural enemies especially pathogens are more suitable alternative to control tea pests. In order to this aim, weekly sampling of pest specimens was carried out in tea gardens of Tonekabon region of Mazandaran province of Iran, and two isolates of *Lecanicillium lecanii* and *L. muscarium* were collected from infected scales. Concentration of 10^7 spores/ml for two isolates, with control treatment (water X-20 tween) was sprayed on *P. floccifera* on tea plants and were kept at 25±2°C, 85-90% RH and 16L:8D photoperiod. Mortality of treated individuals was counted after 14 days. This experiment was conducted in completely random design with 3 treatments and 4 replications. Significant differences between the means were compared using Duncan's Multiple Range test at 1% level of significance. The result showed that mortality of scale in treatments significantly differed from the control ($F=748.89$, $P<0.00001$, $df=2$). Mortality of scales treated with *L. lecanii* (86.6%) was lower than *L. muscarium* (89.4%). In conclusion, native isolates of *Lecanicillium* fungi collected from tea gardens showed high pathogenecity against *P. floccifera* and constitutes a very promising tool in the control of scale.

TU 16

An investigation on the efficacy of three egg parasitoid wasp species (*Trichogramma brassicae, T. embryophagum, T. pintoi*) on *Plutella xylostella* (L.) at 30 ºC temperature

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Diamondback moth, *P. xylostella* L. (Lepidoptera, Plutellidae) is one of the important pests on cruciferous plants throughout the world. If feeds on leaves, and as a result, it reduces yield quality and quantity. Efficiency of *T. brassicae, T. embryophagum* and *T. pintoi* (Hym.; Trichogrammatidae) were studied on *P. xylostella* eggs in cauliflower during 2008-2009. In order to a mated female from each species were put in glass vial (20*70 mm) with about 50 eggs (one old day egg) of *P. xylostella,* eggs were replaced daily for three days (total 150 eggs). For feeding wasps, a fine stripe of undiluted honey was put in each glass vial. These glass vial were put under controlled condition (30±1ºc, 65±5٪ RH and 16:8 L:D) for 72h. These tests were replicated 8 times for each wasp species. Data were analyzed and means were compared by using of Duncan test. Rate of parasitism for the first three days, adult emergence and mean sex ratio were measured for each trial. These results indicated that the rate of parasitism by *T. brassicae, T. embryophagum, T. pintoi* were 51.6, 54.6 and 67.6%, respectively. Mean sex ratios were 0.55, 0.58 and 0.36, and rates of adult emergence were 0.90, 0.90 and 0.88, respectively. In this study, rate of adult emergence of *T. brassicae* with other wasps showed significant difference ($P<0.05$), and the mean of sex ratio in *T. pintoi* (1:2 female:male) showed significant difference ($P<0.05$) in relation to other wasps. In contrast, rates of parasitism did not show significant differences for three wasps. Therefore, based on these results, the three wasps studied can be useful in parasitoid release programs for biological control on *P. xyllostella.*

TU 17

Species diversity of parasitoids in gallwasps (Hymenoptera: Cynipidae) communities on two oak species in the west of Iran

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The cynipid gallwasps (Hym., Cynipidae) are among the main insects associated with oaks (*Quercus* sp.) in Iran. The objective of this study was to determine species richness, diversity, evenness and frequency of parasitoids (Hymenoptera: Chalcidoidea) associated with gallwasps on two oak species in the oak forests of Kurdistan, Ilam and Kermanshah provinces in the west of Iran. The cynipid gallwasps were collected from buds and leaves of *Quercus infectoria* Olivier and *Q. brantii* Lindley during 2004-2005. The collected galls were maintained under laboratory conditions at room temperature (20-25 ºC) in transparent plastic boxes until the cynipids and their parasitoid adults were emerged. Eleven parasitoid oak gallwasp species were identified, and the results of this study showed that species richness of parasitoids increased from seven species to nine species from 2004 to 2005 in Kurdistan province, reflecting a species diversity increase in Kurdistan from 2004 to 2005, from 0.77 to 0.83. The highest evenness' index, 0.99 and 0.91, was found in Ilam in 2004 to 2005, respectively. *Brayscapus anasillus* was collected on five and four gallwasp species in 2004 and 2005, respectively. The most abundance of parasitoids was separated from gallwasps of *Neuroterus saliens* in Kermanshah province in 2004.

TU 18

Functional response of Trichogramma brassicae to Helicoverpa armigera and Sitotroga cerealella under laboratory conditions

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The functional response of *Trichogramma brassicae* Bezdenko, was examined on two insect pests *Helicoverpa armigera* Hubner and *Sitotroga cerealella* Zeller at 25±1 ºC, 65±10% RH and 16L: 8D photoperiod. Six egg densities of each host (5, 10, 20, 30, 50, and 100) were exposed in 10 replications to individual females of the parasitoid for a 24-h period. A type II functional response was observed on both host species. The instantaneous attack rate was 0.560±0.642 and 0.0869±0.0229 h^{-1} for *H. armigera* and *S. cerealella* respectively. One-way ANOVA revealed that parasitism rate of *S. cerealella* significantly preceded *H. armigera* at higher host densities 30, 50 and 100. Handling time (T_h) of the parasitoid was 1.976±0.138 and 0.723±0.078 h on *H. armigera* and *S. cerealella* respectively. The observed differences between the two host species may suggest that *H. armigera* has a group-defense, most probably biochemical, at higher densities of the host; although eggs are physically more attractive in lower densities. Thus we may concern with a characteristic type IV functional response in this host. Therefore, despite of its lower attack rate, *S. cerealella* may be considered as a preferable target pest for *T. brassicae* with a maximum attack rate of 33.2 vs. 12.2 eggs day^{-1} in the case of *H. armigera*.

TU 19

Age-dependent functional response of *Psyllaephagus zdeneki* (Hymenoptera: Encyrtidae), endoparasitoid of *Euphyllura pakistanica* (Hemiptera: Psyllidae)

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Psyllaephagus zdeneki Noyes and Fallahzadeh (Hymenoptera: Encyrtidae) is a koinobiont endoparasitoid of olive psyllid, *Euphyllura pakistanica* Loginova (Hemiptera: Psyllidae) in Iran. In this study, the influence of parasitoid adult female age on functional response was calculated at temperature of 25±1 ºC, 60±5% relative humidity and a photoperiod 16L:8D. The effect of host density on parasitism and host feeding was determined during adult life. For this purpose, females of *P. zdeneki* were individually placed in container with seven host density levels (2, 4, 8, 16, 32, 64, 120 hosts per arena) of third and fourth nymph instars. Each host density was replicated eight times. According to analysis of logistic regression, a type II functional response was fitted separately in parasitoid wasp life time for two conditions. The results showed that the highest estimated attack rate for parasitism and total parasitism and feeding was gained for the first five days of adult life. The handling time of *P. zdeneki* in two conditions increased as adult female age increased. The highest searching efficiency (*a´*) was gained on the fifth day for total hosts attacked (0.28±0.02 h^1) and the shortest handling time was gained (1.36±0.05 h^1) in the third day of adult life. The maximum number of hosts parasitized and attacked was determined to be 15.1 and 17.7 in the second and third day of parasitoid adult life, respectively. *P. zdeneki* showed high ability to feed and parasitize *E. pakistanica* over its life time. Therefore, this parasitoid may be a good candidate for biological control of olive psyllid in Iran and other parts of the world.

TU 20

Predation of *Rhizoglyphus robini* Claparede (Acari:Astigmata) on alfalfa stem nematode *Ditylenchus dipsaci* Kuhun under laboratory conditions

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The alfalfa stem nematode *Ditylenchus dipsaci* Kuhun is an important pest on alfalfa causing great alfalfa crop damage in Iran every year. *Rhizoglyphus robini* Claparede is a polyphagus pest of bulbs, corms and tubers, but could be benefical under special conditions. In this research the effect of *R. robini* feeding on *D. dipsaci* was tested. The experiment was conducted in pots containing a 500 g sterilized soil mixture with three treatments in four replications each in a completely randomized design. Treatments included determined quantity of Hamedan alfalfa coleoptiles in set quantity (1000 nematodes and 100 mites). Experiments were carried out at 27±3°C and 85±5% RH under greenhouse conditions. Results showed in pot experiments that percent mortality means of nematodes in first and second treatments were 99.7±0.07 and 61.5±1.55, respectively; the average of the fresh weights of alfalfa coleoptiles were 30.7±0.48; 12.8±3.69; 48.3±1.09 in the treatments, respectively; all results showed significant differences. These observations attribute an important role to the mite in regulating soil nematodes.

TU 21

Biological traits and fertility life table of *Bemisia tabaci* (Genn.) and *Bemisia argentifolii* Bellows and Perring (*B. tabaci* B-biotype) (Hemiptera: Aleyrodidae) on cotton and rapeseed in laboratory

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The aim of this work was to study the fertility life tables and development of two economically important pets in Iran on oil seed crops: sweet potato whitefly, *Bemisia tabaci* (Gen.) and silverleaf whitefly *B. argentifolii* Bellows and Perring (Hem.: Aleyrodidae) on rapeseed, (*Brassica napus* L.). The intrinsic rate of natural increase (r_m), net reproductive rate (R_0) and mean generation time (T) were 0.129, 30.7 and 26.8 days and 0.175, 40.8 and 21.3 days for *B. tabaci* and for *B. argentifolii*, respectively. The total survivorship of *B. tabaci* and *B. argentifolii* from egg to adult was 26.6 and 27.7 respectively. The results showed significant differences between the two species reared on either host plant for gross reproductive rate (GRR), net reproductive rate (R_0 or NRR) intrinsic rates of increase (r_m), finite rate of increase (λ), doubling time (DT) and mean generation time (T_c) in both species. Based upon these results, *B. argentifolii* showed a greater reproduction capacity on rapeseed. Thus, rapeseed is a suitable host for both species, constituting an important factor in host plant selection for optimizing control strategies of these major pests.

TU 22
Morphological and behavioral characters of *Bemisia* (Hom: Aleyrodidae) eggs and nymphs on cotton

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Morphological and behavioral characteristics of *Bemisia* Quaintance & Beker 1914 (Hom: Aleyrodidae) eggs and nymphs on cotton were studied. For this purpose, the infested leaves with nymphs and pupae of the pest were collected from cotton field and reared in culture room. Oviposotion was carried out 3 hrs after mating under leaf surface and in circle or semi-circle situation near the feeding place and in two rows. Depending upon age of leaves, individual eggs also were seen. Eggs immediately after deposition are whitish, but gradually their color changes to yellowish and finally brownish, and at 25ºC they hatch after 12-19 days. First instar nymphs, oval in shape and convex from upper surface with four-segmented legs, three-segmented antennae and small and green eyes, can move only for few centimeters. After wandering for a few hours and locating a suitable place, they become sessile by inserting the proboscis in the host plant tissue and starting feeding. Second instar nymphs, with one-segmented antennae and legs, and also sessile, appear after 3-2 days. The body of third instar nymphs is transparent, therefore, difficult to see on the stereomicroscope. Fourth instar stage consists of two separate phases: in the early part feeding is continuing and the body color is remains yellow, in the second part the the body color gradually converts to brownish and eyes are turning red. At this stage due to cessation of feeding, adult emergence occurs even if leaves dry up. Maximum parasitism occurred at this stage. In case of parasitism, pupal color changed to dark and parasite larvae were observable within the pupal body.

TU 23
Occurrence and composition of the *Chrysoperla carnea* species complex (Neuroptera: Chrysopidae) in Hungary

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Collection data of adults of the *Chrysoperla carnea* complex in Hungary during a 11 year period will be presented to provide basic information on its occurrence, distribution and species composition. Localities of Northern Hungary, Northern Great Plain and Western Transdanubia were sampled between 1996 and 2006. Two sites, Gödöllő and Debrecen were investigated regularly. Considering other areas, mostly single samples were taken.

The captured *Chrysoperla carnea* (Stephens, 1836) sensu lato individuals were identified according to the descriptions of Thierry et al. (1992, 1998), Duelli (1995), Canard and Thierry (2007) and also samples of various morphological types and song morphs were used. 5724 individuals were collected totally during the indicated period at the Hungarian localities. *Chrysoperla affinis* (Stephens, 1836) (Cc4, or "motorboat" sensu Henry) predominated with all of the "complex assemblages" (75%). The number and frequency of the occurrence of *Chrysoperla carnea* (Stephens, 1836) sensu stricto (Cc2 or "slow motorboat" sensu Henry) was much less than those of *Ch. affinis* (about 12%), and *Chrysoperla lucasina* (Lacroix, 1912) was found only rarely (5%). The proportion of unidentified individuals (*Ch. carnea sensu* lato) was quite high (8%) as a consequence of the many injured individuals of baited funnel trap catches. Some of the unidentified individuals seemed to belong to *Chrysoperla agilis* (Henry et al., 2003) distributed mainly in the Mediterranean area.

TU 24-72: Biorational control of arthropod pests: mechanism and application

TU 24
Effects of UV-absorbing nets on the flying capacity of pest and beneficial insects in a tomato greenhouse

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UV-absorbing nets can affect the in-flight behaviour of pests and natural enemies, affecting their processes for selection and testing of the host plants or arthropod hosts, respectively, by interfering in their vision orientation and moving. In this work, effects of these nets were studied on the tomato pests *Bemisia tabaci* and *Thrips tabaci,* the predators *Orius laevigatus; Nesidiocoris tenuis, Macrolophus caliginosus* and *Chrysoperla carnea,* and the parasitoids *Aphidius ervi, A. colemani, Eretmocerus mundus; Praon volucre* and *Psyttalia concolor*.

A tomato crop was grown under two semi-commercial tunnels (6.5 x 8 m) one covered by a 50 mesh UV-absorbing net (BioNet®), and the other by a 50 mesh standard net, each divided in 2 sealed compartments. When plants were 25 cm high, 8 yellow traps (20 x 13 cm) (2 per side) were placed at a height of 1.5 m in every compartment and about 200 specimens of every species released in a 1.5 m high platform placed in the centre. Traps were changed 5 times at 2 h intervals during 3 consecutive days. Results show that thrips (which occurred naturally) followed by the whitefly, were the most captured insects in the traps. Among enemies only *O. laevigatus* was captured in important numbers. There were no significant differences in captures between the 2 nets, irrespective of the species, except for thrips which flew better under the control net.

TU 25
Effect of *Artemisia annua* L. essential oil on mortality, development, reproduction and energy reserves of *Plodia interpunctella* (Hübner). (Lepidoptera: Pyralidae)

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Essential oil of worm-wood (Artemisia annua) a weed growing around paddy field in northern Iran showed insecticidal and physiological effects on Plodia interpunctella. The essential oil extracted from A. annua were tested against various life stages (egg, larvae and adult) of Plodia interpunctella under laboratory conditions (26 ±1°C, 65±5 % RH and 13L:11D). The leaves were collected from plants around paddy fields in Rasht city-Iran. The essential oil was extracted by a modified clevenger apparatus and the yellowish oil was diluted in acetone and different concentrations (15%, 11%, 8%, 5.5% and 4%) made. LC25, LC50 and LC75 were measured 5.96%, 8.4% and 11.3% after 24 h. The sub lethal concentration showed that essential oil reduced adult emergence, longevity of males and females in addition to fecundity and fertility upon treatment of larvae. The susceptibility of males and females showed no significant differences. Evaluation of toxic vapors on the adults was also considered at LC25, LC50 and LC75 and were calculated to be 6.35%, 8.13% and 10.45%, respectively. There were no differences in the mortality of either sexes. The protein, carbohydrate and lipid contents of

treated larvae were significantly reduced compared to controls but no significant differences were observed between male and female treated larvae ($p>0.05$).

TU 26
Enhancement of nucleopolyhedrovirus infectivity against *Mamestra brassicae* (Lepidoptera: Noctuidae) by proteins derived from granulovirus and a fluorescent brightener

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The synergistic enhancement of nucleopolyhedrovirus (NPV) infection by granuloviruses (GVs) is well documented; and a GV granule protein, named viral enhancin, has been identified as an active contributor to this effect. We detected the presence of two proteins with molecular mass of 93 and 108 kDa in granules of a GV isolated from *Xestia c-nigrum* (L.) (XecnGV) as candidates for enhancin, and we confirmed that at least the 108-kDa protein enhances the infectivity of *Mamestra brassicae* nucleopolyhedrovirus (MabrNPV). We tested the effect of virion-free proteins obtained from XecnGV granules (GVPs) on MabrNPV infection, and we made a comparison with an enhancing chemical, the stilbene-derived fluorescent brightener Tinopal. Bioassay was performed employing the diet contamination method, by using second instars of *Mamestra brassicae* (L.) (Lepidoptera: Noctuidae). The enhancing effects of GVPs (0.1 mg/g diet) and Tinopal (1 mg/g diet) were estimated to be 70.7-81.5-fold and 26.9-33.7-fold, respectively, as calculated from the LC_{50} values of MabrNPV with or without the additives. The additives reduced the lethal time of MabrNPV-infected larvae and they caused death at a younger instar. These results suggest that GVPs can enhance MabrNPV infection as effectively as Tinopal.

TU 27
Evaluation of some botanical extracts for their deterrence towards melon fruit fly under laboratory and field condition

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Kernel and leaves of neem, *Azadirachta indica* (Meliaceae) and 'dhrak'/bakain, *Melia azadirachta* (Meliaceae), peel of sweet orange fruit, *Citrus sinensis* (Rutaceae), chilli fruit, *Capsicum annuum* (Solanaceae), ginger rhizomes, *Zingiber officinale* (Zingiberaceae) and garlic cloves, *Allium sativum* (Alliaceae) were evaluated for their effect on the deterrence/attraction of melon fruit fly towards treated fruits under the laboratory and treated crop under field conditions. The olfactometeric studies revealed that garlic, ginger and neem extracts deterred the maximum number of released fruit flies, from oviposition, (94.54 % to 92.8 % of released flies) for a longer period (8 days) and resulted in least fruit infestation (3.4±3.3% to 7.13±4.5%). After eight days, 13-15 fruit flies (26-30% of released fruit flies) were attracted to the fruits, placed in the small jars of an olfactometer and 16.67% to 33.3% of the fruits, placed in small jars, were found infested on 10th day. 13.4±3.12 (26.8% of released flies), 8.47±2.18 (16.94% of released flies) and 7.93±2.47 (15.86% of released flies) fruit flies were attracted to and 40.47±12.9, 56.67±12.7 and 63.33±10.3% fruit infestation was observed in those fruits, which were treated with chilli, 'dhrak' and citrus, respectively. Field studies also showed that spray of garlic, ginger and neem extracts resulted in fruit infestation ≈ 1.8-4.5 times less, yield loss/plant ≈ 2.1-4.3 times less, marketable fruits/plant ≈ 4.1-6.4 times more and marketable yield/plant ≈1.8-2.8 times more than control. However, the spray of other botanical extracts resulted in more than 40% fruit infestation, less than 4 marketable fruits/plant, more than 150g yield loss/plant and less than 350g marketable yield/plant. Conclusively, garlic, ginger and neem extracts, which were found comparatively more effective, can be integrated with other non-chemical fruit fly control tactics in cucurbits cropping system to reduce the number of cover spray with insecticides and ensure the provision of cucurbits free of toxic residues of insecticides.

TU 28
Investigating the role of colored-egg-receptacles in the management of melon fruit fly, *Bactrocera cucurbitae* (Coquillett) (Diptera: Tephritidae) in bitter gourd, *Momordica Charantia*

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In the first experiment, egg-receptacles of different colours, i.e., red, white, yellow, orange, green, blue and black, having watermelon juice and its paste, were evaluated, in flat sowing methods, for the attraction of melon fruit flies to different colours for oviposition. The results revealed that egg-receptacles of different colours had highly significant effects, on the number of eggs/egg-receptacle/day, percent fruit infestation, marketable fruits/plant, yield loss/plant and marketable yield/plant. The installation of yellow egg-receptacles, which resulted in maximum number of eggs/egg-receptacle/day (25.3±1.4 eggs), marketable fruits/plant (4.8±0.18 fruits) and marketable yield/plant (252.8±9.4g); and a minimum fruit infestation (56.3±1.62%) and yield loss/plant (326.3±9.4g), was found to be the most effective and attractive to the melon fruit-fly, followed by those of white, orange, red, green, blue and black egg-receptacles. In the second experiment, oviposition-baits prepared from six cucurbits, viz., bitter gourd (*Momordica charantia*), pumpkin (*Cucurbita moschata*), cucumber (*Cucumis sativus*), tinda (*Citrullus vulgaris*), melon (*Cucumis melo* and water-melon (*Citrullus lanatus*) and two non-cucurbits, viz., tomato, *Solanum lycopersicum* (Solanacae) and banana, *Musa paridasiaca* (Musaceae) were evaluated under two sowing methods [Flat Sowing Method (HSM) and Trellis/Hang Sowing Method (T/HST)] with yellow egg-receptacles. The results of this experiment revealed that all the oviposition-baits performed better in T/HSM than in the FSM. Fruit infestation and yield loss/plant were found significantly lower in HSM and higher in FSM, whereas, the marketable fruits/plant and marketable yield/plant were significantly higher in HSM and lower in FSM. Among different oviposition-baits, an oviposition-bait, having a water-melon juice and paste, with 41.7±2.7 eggs/egg-receptacle/day (≈ 4.4 times more marketable fruits/plant, ≈ 4.3 times more marketable yield/plant ≈ 1.9 times less fruit infestation percent and ≈ 2 times less yield loss/plant than control), performed better. Others oviposition-baits resulted in < 30 eggs/egg-receptacle/day, more than 50 percent fruit infestation, < 5 marketable fruits/plant, > 300g of yield loss/plant and ≤ 250g of the marketable yield/plant. In conclusion, the sole use of oviposition-baits in egg-receptacles of different colours, did help to attract the female fruit flies and collect eggs, but, these did not significantly reduced the fruit infestation and yield loss. However, a

combination of an oviposition-bait, having a water-melon juice as well as its paste, in yellow egg-receptacle and HSM can be integrated with other IPM tactics to manage melon fruit flies more effectively.

TU 29
The effects of Pyriproxifen, Hexaflumuron, and Teflubenzuron on the sunn pest, *Eurygaster integriceps* Put. (Hemiptera: Scutelleridae) in the laboratory

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The sunn pest (*Eurygaster integriceps* Put.) is the major insect problem of cereals, especially wheat and barley in Iran. This pest causes severe damage to the vegetative growth stage of wheat in the early season. One of the reasons for repeated outbreaks of sunn pest during recent decades is attributed to the vast application of fenitrothion, the only insecticide used to control sunn pest for three decades. The purpose of this project is to determine the effects of selected biopesticides and insect growth regulators (IGRs) against sunn pest.

The effects of pyriproxifen, teflubenzuron and hexaflumuron on hatching rate of 2 and 5-day old eggs and the rate of mortality of 2nd and 5th nymphal instars were evaluated under laboratory condition. The experiments were conducted in a complete randomized design with 5 concentrations for each insecticide and 8 replications. The characters including the weight and length of the adults and morphologic changes have been evaluated. The maximum and minimum of hatching rate for 2-day eggs treated were 73.63 and 38.3 in pyriproxifen and teflubenzuron, respectively. There was no significant difference between the maximum of hatching rate for 5-day eggs treated by pyriproxifen (78.7) and hexaflumuron (79.21). The hatching rate minimum was 49.89 in teflubenzuron. The maximum percent mortality of 2nd instar was 96.29% in teflubenzuron in 2000 ppm and there was no significant difference between pyriproxifen and hexaflumuron. The minimum mortality was occurred in pyriproxifen in the lowest concentration. The maximum mortality for 5th instar treated was in teflubenzuron (77.29%). 5th nymphal instar treated with the IGRs showed morphological abnormalities such as formation of adultoid, size reduction, body segmentation disturbance, strongly deformation of wings. The most deformation was observed in pyriproxifen. The weight reduction for 5th nymphal instar was more effective for pyriproxifen. The results of this laboratory experiments showed that teflubenzuron is the most effective juvenoid for reducing *E. integriceps* population and the insect's growth regulators such as teflubenzuron and pyriproxifen appeared to be promising candidates for *E. integriceps* management programs.

TU 30
Effects of natural food additives on the protein content of adult and immature stages of the wax moth endoparasitoid, *Apanteles galleriae*.

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The endoparasitoid, *Apanteles galleriae*, is one of the effective parasitoids on the greater and lesser wax moths, *Galleria mellonella* and *Achroia greissella*. The parasitoid was kept in the laboratory on lesser wax moths, *Achroia greissella* as a host. Males and females were fed on pure honey, diluted honey (80%), diluted honey + royal jelly (20 mg/ml), diluted honey + Pollen (20mg/ml) and diluted honey + royal jelly + pollen (same ratio). Food substitutes were offered to the parasitoid freely. The resulting generation was then used for the protein content studies. The protein content of both males and females was monitored throughout their life span. In Addition, the protein content of parasitoid larvae and pupae were monitored as well. Protein electrophoresis, for previous treatments has shown heterogeneous band distribution when compared with controls. Band distributions and densities were characteristically variable over time, food supplement and insect stages.

TU 31
Side effects of modern pesticides on the predatory bug *Orius laevigatus* (Fieber) (Hemiptera: Anthocoridae) under laboratory conditions.

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Biological Control is considered nowadays as a key tool in Sustainable Agriculture and in Spain, the predatory bug *Orius laevigatus* plays an important role as biocontrol agent of several key pests of pepper under plastic greenhouses: *Bemisia tabaci* (Gennadius), *Frankliniella occidentalis* Pergande and phytoseiid mites.

Laboratory studies were conducted to determine the residual contact effect of 7 modern insecticides included in annex I of the directive 91/414/EEC, with different mode of action. Pesticides were applied on glass surfaces using the Potter precision spray tower and adults were exposed to fresh or 7-days-old residues. Mortality at 72 hours as well as fecundity and fertility of the surviving bugs was recorded and pesticides classified according to IOBC toxicity ratings. Flubendiamide (ryanodine receptor modulator), Methoxyfenozide (moulting accelerator) and Spiromexifen (lipid synthesis inhibitor) were harmless (1). Emamectin benzoate (chloride channel agonist) was slighty toxic (2), but harmless (1) after 7 days. Abamectin (chloride channel agonist), Deltamethrin (neurotoxic pyrethroid) and Spinosad (neurotoxic naturalyte) were harmful and further studies under more realistic conditions are needed to completely ascertain their effects on the predatory bug.

TU 32
Selectivity of different acaricides to the predatory mite *Triphlodromus pyri*

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Knowledge of specific effects new acaricides against mite predators may facilitate their integration into IPM programs. The effects of fenpyroximate, etoxazole and spiridiclofen on adult female *Triphlodromus pyri* Scheuten (Acari: Phytoseiidae) survival, fecundity and fertility were assessed following different exposure routes: worse case situation (WCS), leaf surface residue (LSR), direct contact (DC) and prey treatment (PT). Etoxazole reduced female fertility when treated by WCS and LSR. Significant increases in fecundity were observed when exposed to LSR and DC treatments. Mortality was not affected by any exposure route. Fenpyroximate reduced fertility when exposed to PT and fecundity was significantly decreased by LSR and PT treatments. Mortality was high when females were exposed to WCS, LSR and DC. Spiridiclofen reduced fertility, fecundity and survival in all cases. Total effects varied among chemicals. Physiological selectivity and the significance on pest management programs are discussed.

TU 33
Sub-lethal and lethal effects of *Datura stramonium* L. leaf extracts on European Red Mite, *Panonychus ulmi* and its predator *Stethorus gilvifrons*

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The ethanol extracts obtained from leaf in the thorn apple (*Datura stramonium* L.) (Solanaceae) were investigated for adult mortality and repellent properties against both European red mite [*Panonychus ulmi* (Koch)] (Acari: Tetranychidae) and its predator *Stethorus gilvifrons* (Muls.) (Col.: Coccinellidae) under laboratory conditions. The current study demonstrated that leaf extracts of *D. stramonium* had lethal effects on both the spider mite and lady-bird using a Petri leaf disc-spray tower method. Furthermore, an increase in the dose of leaf extract was associated with a significant increase in the death rate of both *P. ulmi* and *S. gilvifrons* adults. Using probit analysis and estimating the parameters, the LC_{50} values of leaf extract were determined to be 7097.5 and 5427.5 mg/l at 24h residual activity for spider mite and lady-bird adults, respectively. In addition, the mite and lady-bird mortality by the extract was higher at 48h than that at 24 h, with 2013 and 1030 mg/l LC_{50} values, respectively. But, the LC_{90} value of the extract at both 24h and 48h was lower to lady-bird adults compared with spider mite adults. According to Pearson's chi-squared test, both spider mites and lady-birds adults showed the strongest run off to apple leaf surfaces sprayed with the extracts in sub-lethal doses (from 13.72 to 1058.0 mg/l). Moreover, the odour test using two-choice olfactometer demonstrated the lady-bird adults exhibited a significant going towards to clean air instead of the extract odour. These results suggest that *D. stramonium* extract can effectively be utilized as safer phytopesticidial products for manage *P. ulmi* in both organic and inorganic apple growing, but it is not suitable for Integrated Pest Management strategies due to its toxic and repellent effects to *S. gilvifrons*.

TU 34
Screening of insecticidal activity of nine medicinal essential oils against *Brevicoryne brassica* L. (Hemiptera: Aphididae)

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Essential oils are volatile mixtures of hydrocarbons with a diversity of functional groups and their insecticide activity has been linked to the presence of monoterpenes and sesquiterpens. The present abstract discuses this environmentally benign pest control using nine aromatic plant oils, *Salvia officialis*, *Mentha longifolia* , *Zataria multiflora* and *Nepeta cataria* from Lamiaceae, *Tagetes minuta* and *Artemisia siberi* from Asteraceae, *Trachyspermum* ammi from Apiaceae and *Myrtus comunis* from Myrtaceae family against adult of cabbage aphid, *Brevicoryne brassica* L. (Hemiptera: Aphididae). The fumigant toxicities of the oils were assessed at 5 rates for *Z. multiflora*, *N. cataria, T. minuta, T.* ammi and *A. siberi* (0.25, 0.5, 1, 2and 4 µl corresponding to 3.9, 7.9, 15.7, 31.5 and 62.9 μlL^{-1}air) and 6 rates for *S. officialis*, *M. longifolia* and *M. comunis* (0.5, 2, 3.5, 5, 6.5, 8 µl of essential oils which corresponds to.9.95, 39.81, 69.67, 99.59, 129.38, 159.24 $\mu l/l^{-1}$air) in five replications under laboratory conditions (25± 2 ˚C and 55± 5 %RH). Results showed, the most toxicity essential oil was *T. minuta* , as its lethal concentration, LC_{50}= 11.60, LC_{99}=768.35 μlL^{-1}air. *M. comunis* essential oil had the least toxic effects against *B. brassica*, as its LC_{50} = 78.58 and LC_{99} =367.24 μlL^{-1}air. The results of the present study concluded that these plant essential oils have the potential to provide efficient and safer insecticide activity for human and the environment.

TU 35
Insecticidal activity of five essential oils against *Myzus persicae* (Sulzer) (Hemiptera: Aphididae)

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Myzus persicae (Sulzer) (Hemiptera: Aphididae) is one of the most important aphids in Iran. This insect causes both direct and indirect damages. Screening for pesticidal activity of plant essential oils with some known medicinal attributes could lead to discovery new agent pesticides. The current study was carried out to find safe aphidicides for controlling green peach aphid. So essential oils extracted from five aromatic plants, *Tagetes minuta* (Asteraceae) , *Trachyspermum* ammi (Apiaceae), *Artemisia siberi* (Asteraceae), *Zataria multiflora* (Lamiaceae) and *Nepeta cataria* (Lamiaceae), grown in Iran by Using a Clevenger type apparatus, then the oils were analyzed by gas chromatography– mass spectrometry (GC–MS) and evaluated for insecticide activity against adult *M. persicae* by fumigant toxicity method in 25± 2 ˚C and 55± 5 %RH with five replications. After 24h of toxicity bioassay, using five doses (0.25, 0.5, 1, 2and 4 µl corresponding to 3.9, 7.9, 15.7, 31.5 and 62.9 μlL^{-1}air) indicates that for all treatments, mortality increases when concentration exceeded. Results showed, the most toxicity caused by *Trachyspermum* ammi essential oil (LC_{50}= 5.28 and LC_{99}= 75.60 μlL^{-1}air). *Tagetes minuta* essential oil had the least toxic effect on *M. persica*e (LC_{50}= 9.44 LC_{99} =135.33 μlL^{-1}air). The results concluded that these plant essential oils have potential to be used in promoting research aiming at the development of new pesticides from the plants with medicinal values.

TU 36
Effect of five essential oils against two aphids, Aphis gossypii Glover and Schizaphis graminum Rondani (Hemiptera: Aphididae) under laboratory conditions

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The use of natural products raises several concerns related to environment and human health. Among these products, essential oils from plants have been extensively tested for having repellent and toxic activities. In this survey the effect of five essential oils extracted from *Tagetes minuta*

(Asteraceae), *Trachyspermum* ammi (Apiaceae), *Artemisia siberi* (Asteraceae), *Zataria multiflora* (Lamiaceae) and *Nepeta cataria* (Lamiaceae) were tested against adults of *Aphis gossypii* and Schizaphis graminum (Hemiptera: Aphididae), two important vector of viruses of gramineae and green house plants in Iran, respectively. Chemical compositions of the essential oils were determined by GC–MS analysis. The fumigant toxicities of the oils were assessed at 5 rates (0.25, 0.5, 1, 2and 4 µl).10 adult *A. gossypii* and S. graminum, were put in a Petri dishes with a leaf disk of its host plant, *Cucumis sativus* and Triticum *aestivum*, in laboratory conditions (25+ 2 °C and 55+ 5 %RH) respectively. *N. cataria* showed the most toxicity on *S. graminis*. Its LC_{50} and LC_{99} were 9.6 and 188 μlL^{-1}air. The least toxicity on *S. graminis* caused by *Z. multiflora* (LC_{50} =14.16 and LC_{99} = 278.00μlL^{-1}air). *T. minuta* was the most toxic essential oil against *A. gossypii* (LC_{50} =14.27 and LC_{99} =35.20 μlL^{-1}air). Whilst *A. siberi* had shown least effect against this aphid (LC_{50}= 21.52 and LC_{99}=53.10 μlL^{-1}air). Results show these oils are potential alternatives to synthetic fumigants in the treatment of agricultural products.

TU 37

Evaluation of the effects some conventional and biorational insecticides on cotton bollworm, *Helicoverpa armigera* (Hubner) (Lep.; Noctuidae)

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Cotton bollworm, *Helicoverpa armigera* Hub. is the most important pest of cotton, tomato and chickpea in Iran. The pest found to has developed resistance against conventional insecticides such as chlorinated hydrocarbons, synthetic pyrethroids and organophosphates. Using of insecticides with different mode of action may result an appropriate control of the pest and may delay insecticide resistance development. The effects of conventional and biorational insecticides thiodicarb, chlorpyrifos, spinosad and abamectin were studied on 3rd larval instars of the pest at 26±1°C,70±5% RH and photoperiod of 16:8 (L:D) h. Third instar larvae of the pest were exposed to thiodicard and spinosad by feeding and exposed to abamectin and chlorpyrifos by contact residue methods. The LC_{50} values of thiodicarb, chlorpyrifos, spinosad and abamectin were 798.4, 4.6, 62.26 and 460.5 ppm or 638.7, 2.21, 14.94, 8.29 mg a.i./l, respectively. The results showed that chlorpyrifos and spinosad were the most effective insecticides against 3rd instars larvae of cotton bollworm based on formulated materials compared to the others. Because of having least environmental effects of spinosad, this insecticide would be recommended for controlling the cotton bollworm in agroecosystems. Moreover, effects of LC_{30} as a sublethal concentration of the insecticides were studied on longevity and fecundity of adult moths.

TU 38

Efficacy of the novel juvenogen esters on the red firebug *(Pyrrhocoris apterus)*

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At present the use of some insecticides is restricted by the reason of their toxicity to non-target organisms and for the increasing resistance of insect pest to them. In this regard, it is necessary to search for alternative methods of pest control. One of the promising ways is the usage of insect growth regulators, namely juvenoids and juvenogens. Due to their high biological effectiveness and low toxicity to warm-blooded animals they are environmentally safe pest management agents.

A series of 10 new juvenogens was synthesized using isomeric synthetic juvenoids and steroid molecules. The topical and peroral efficacy of these novel juvenogen esters and their parental juvenoids were tested on the red firebug *Pyrrhocoris apterus* (Hemiptera). The final biological activity is expressed as ID_{50} values that represent doses of the compound in µg per individual that are responsible for 50 % inhibition of metamorphosis. The efficacy of tested compounds was comparable with commercially used juvenoids. This study should be helpful for the discovery of more potent analogs and for establishment of new means of pest management.

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TU 39

Choice and no-choice tests to evaluate the compatibility of kaolin with *psyttalia concolor* (szèpligeti) and *anthocoris nemoralis* (f.) in laboratory

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Olive groves are largely represented in Spain by more than 2.4 millions has. The olive fruit fly, *Bactrocera oleae* Rossi, is the most serious pest of olives in most of the countries around the Mediterranean basin, following by the olive moth, *Prays oleae* (Bernard), and the olive scale *Saissetia oleae* (Olivier). Among the products tested as alternative to dimethoate to control *B. oleae* in the last years, kaolin can be stand out due to its good ecological profile. Kaolin, a natural clay mineral, used to protect crops of sunburns and thermal stress, limits olive fly harmful infestation, providing also good control of the carpophagous generation of *P. oleae*, as well as a minor presence of *S. oleae.* Kaolin sprayed on crops was found to act as a physical barrier. It creates a hostile environment for insects and a physical barrier to infestation, preventing insect movement, feeding and egg-laying. *Psyttalia concolor* (Szèpligeti) and *Anthocoris nemoralis* (F.) are two natural enemies present in olive groves; the former parasitizing the third instar larvae of the olive fly; the latter, predating on the olive psyllid, *Euphyllura olivina* (Costa).

Dual-choice and no-choice laboratory tests on both natural enemies were conducted to evaluate the effects on

reproduction of kaolin at the maximum dose recomended. Our results did not show any effects of kaolin limiting the beneficial capacity of *P. concolor*, whereas it strongly reduces the oviposition of *A. nemoralis*, only in the choice tests.

TU 40
Diabrotica virgifera virgifera in selected European countries and emerging options for pest management by biotechnical and cultural techniques

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Globalized traffic activities, monocultural production practices and generally increasing demand patterns for food, feed and fiber all favor the spread of alien invasive species. Among them, the western corn rootworm (WCR) (Col:Chysomelidae) ranks high within the top dozen agricultural pests worldwide. Overreliance on non-sustainable control approaches with pesticides and genetically modified plant varieties may have raised false hopes of eventual WCR eradication throughout Europe. In contrast, WCR is now so firmly established in parts of Europe that eradication is a hopeless dream. Nevertheless, the present situation in Central Europe including Germany with a narrowly spaced network of monitoring and survey efforts offers at least the option of succeeding in WCR management and containment.- As the special example of Switzerland shows, exclusive use of crop rotation and phytosanitation conserves the "status quo" at minimal cost and risk for the environment. However, this approach may not be directly applicable to the conditions of large countries with vastly different economic, ecological and geographic structures. Thus, the search for practical IPM approaches suitable throughout Europe will continue and will require a high degree of intra-European cooperation. - Some surprising current observations in Romania and E. Slovenia employ sustainable biotechnical methods such as monitoring and trapping with specific attractants: 1. Specifically noteworthy is the long term performance of the pheromone baited Vario type mass capacity trap in SE. Slovenia near Pince. 2. Amazing is the consistently high trapping of WCR adults in pheromone baited Metcalf sticky traps within sorghum fields at Timisoara, Romania, which is not statistically different from adjacent maize fields. 3. Unexpectedly, the attraction power during the late growing season of MCA kairomone for WCR in sorghum exceeds that in maize fields by a factor of 2. 4. Lack of host specificity may prove harmful for the efficacy of crop rotation as an IPM strategy against WCR.

TU 41
The Comparison of Biology of Myiopardalis pardalina (Bigot) and Dacus ciliatus Loew and their mechanical control in Iran

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Baluchistan Melon Fly, *Myiopardalis pardalina* (Bigot), and Cucurbit Fly, *Dacus (Didacus) ciliatus* Loew, cause high damage in quality and quantity of cucurbit crops in Iran. Both of them together are the key pests of the plants throughout many parts of Iran wherever is implanted cucurbit crops. The adults of *M. pardalina* emerge after breaking diapause and damage on the fruits in the early growth stages. They mate after 2-3 days. The female lays 63 until 114 eggs below the skin of unripe melons individually each time. These hatched maggots feed the inside fruit. The larval period is 10 to 13 days. When full-grown, the maggots leave the fruit through a hole, and drop to the ground. After about 13-14 days they emerge adults flies, which mate and lay eggs. *M. pardalina* has 2-3 generation per year in north and central region and 4 generation in south and east of Iran. *D. ciliatus* attacks late season (Aug) and has no obligate diapause according as it is active through the year in south of Iran(8-9 generation). However, it overwinters as pupae in the soil in central part of Iran. *D. ciliatus* lays eggs as batch on the melons. In some cultivated areas, 30%- 80% of the fruit are being lost due to the attack of *M. pardalina.* Some studies show that the infestation of cultivar Sefidak was about 30% more than cultivar Sefidak Khar-Dar. Then using variety with thick skin can decrease infestation. To put small fruit in the adjacent leaves and burial it and Doing flower and fruit recision two times on plant can prevent laying eggs on fruit. To burial leftover of fruit in cucurbit area is use to control. Evaluation of two type of plowing on the mortality of over wintering pupae of the *M. pardalina* showed that plowing without turning the soil back 3-check- no plowing have highest mortality on over plowing and turning the soil back to a depth of 30 cm.

TU 42
Compatibility of Nuclear Polyhedrosis Virus (H-NPV) and Indoxacarb for the control of chickpea pod borer (*Helicoverpa armigera*)

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The efficacy of Nuclear Polyhedrosis Virus (H-NPV) and Indoxacarb was evaluated for the control of chickpea pod borer *Helicoverpa armigera* Hübner (Lepidoptera: Noctuidae) a notorious polyphagous insect pest of field crops. The commercial formulation of H-NPV (Heli-Cide™, India) was tested at three dose rates, 0.3, 0.4 and 0.5 ml per liter of water which was applied twice with the interval of 10 days either alone or in combination with the commercial formulation of Indoxcarb (Steward®, DuPont) at two dose rates, 185 and 375 ml per acre on chickpea crop under the filed conditions. The data for the larval population per plant of *H. armigera* was recorded after 5 and 7 d of application while the pod damage and the yield was measured at the time of harvesting of the crop. All the alone treatments were less effective in comparison with the combined use of both of H-NPV and Indoxacarb against *H. armigera*. The lowest larval population per plant and pod damage was exhibited in the plots where the highest dose rates of H-NPV + Indoxacarb were applied. The results of the present study clearly indicate that a blending of H-NPV with Indoxacarb may give the better option even at low dose rates for the eco-friendly control of *H. armigera* on chickpea crop.

TU 43

Flavonoid compounds of *Chrozophora* Neck (Euphorbiaceae) and insects

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Flavonoids are polyphenolic compounds among secondary metabolites in plants. They have basic role in pollination and life cycle of anthmophyllus plants and also their spreading abroad and survival. In most cases flavonoid glycosides rather than others are implicated in feeding stimulation, perhaps because glycosides are more water-soluble and also the sugar moiety within the glycoside plays important role in the feeding activity and taste different to the insects.

Chrozophora Neck that are grown in Asia (Iran), Europe and Africa are one of the anthomophyllus herb or shrub plants. Phytochemical studies on 25 collected *Chrozophora* populations of 2 species (*C. hierosolymitana* and *C. tinctoria*) from Iran were done using 2-dimentional paper (2-DPC) and thin layer chromatography (TLC). Results showed all of populations contain flavonoid sulphates, flavone *C* and *C-/O*-glycosides and aglycon. Also all of studied samples have apigenin and quercetin while rutin was just found in four populations of *C. tinctoria* species. Almost of identified flavonoids contain glycoside agent that can taste different to the insects. Also glycosides play important role in feeding, pollination and survival of plants. Studies of mature plants of *Chrozophora* in Iran showed existence of *Exochomus nigromaculatus* (Coccinellidae) and *Tapinoma* sp. (Formicidae) on these plants.

TU 44

Identification of parasitoids of *Helicoverpa armigera* (Lep.: Noctuidae) in Jiroft region and assignment of effectiveness rate of postharvest deep plowing on reduction of pest damage

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Helicoverpa armigera (Lep.: Noctuidae) is one of the most important pests of tomato. It's often damage to tomato, Maize and Pea in Jiroft region. Hazardous effects of application of chemical pesticides to environment conduct us to use of other control methods. In this study tomato fields in Jiroft region were regularly and weekly searched during growth period of tomato for being different stages of *H. armigera.* Collected eggs, larvae and pupae of *H. armigera* in any sampling time were reared in laboratory and appeared parasitoids were collected and identified. Also, to assignment of effectiveness rate of postharvest deep plowing on reduction of pest damage, two tomato fields were selected that one of them had been plowed in summer after harvest and the other had not been plowed. All of the farming practices in these two fields were the same during this study. The rate of damaged and undamaged tomato fruits in every one of these fields were recorded in the last season. Three species of parasitoid wasps on *H. armigera* were identified. Two of them were from genus, *Bracon* (ectoparasitoid) and one of them was from genus *Apanteles* (endoparasitoid). Also results showed, the damage rate of this pest could reduce from the minimum 2.3% until the maximum 25.1% with postharvest deep plowing of tomato field.

TU 45

Comparative demography of olive psyllid, *Euphyllura pakistanica (*Hemiptera*:* Psyllidae*)* and its parasitoid *Psyllaephagus zdeneki* (Hymenoptera: Encyrtidae) on Yellow olive cultivar under laboratory conditions

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Life history and demographic parameters of the most important olive pest in Iran, *Euphyllura pakistanica* Loginova (Hemiptera: Psyllidae) and its newly described parasitoid species, *Psyllaephagus zdeneki* Noyes and Fallahzadeh, 2005 (Hymenoptera: Encyrtidae) was studied under controlled conditions in order to develop biological control program. The experiments was conducted in growth chamber at temperature of 20±1°C, relative humidity of 60±5% and a photoperiod of 16:8 (L: D) hours on Yellow olive cultivar. The results indicated that developmental period was significantly longer on *P. zdeneki* than *E. pakistanica* ($P<0.01$). The pre-imaginal developmental period and adult female longevity was 25.26± 0.90 and 13.24± 0.59 days on *P. zdeneki* even if it was 20.32± 0.25 and 31.37± 1.18 days on *E. pakistanica*, respectively. The adult longevity of females was significantly longer than males in *E. pakistanica* and its parasitoid. Survival rates (l_x) in newly emerged females of psyllid and its parasitoid were determined 63.72% and 82.25% on Yellow olive cultivar. The mean number of eggs laid per female was 138.39± 4.22 and 397.94± 18.42 in *P. zdeneki* and *E. pakistanica*, respectively. The values of intrinsic rate of increases of *P. zdeneki* was significantly higher than this value in *E. pakistanica* ($P<0.01$) which was obtained 0.260± 0.002 and 0.167±0.001; also mean generation time was gained 15.72±0.15 day in *P. zdeneki* and 26.42± 0.35 day in *E. pakistanica*, respectively. The present research has revealed that population growth characteristic that is important in investigating the effectiveness of parasitoid such as intrinsic rate of increase of *P. zdeneki* is higher than those of its host, *E. pakistanica*. The hypotheses become improved that *P. zdeneki* has potential usefulness as a biological control agent of *E. pakistanica.*

TU 46

Evaluating the relationsh between the kind of plants and biochemical parameters in *Aphis gossypii* Glover (Hemiptera: Aphididae)

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In the present investigation the role of kind of host plants on some biochemical parameters of cotton aphid were studied. The experiments will be done on three strains of cotton aphids including of very sensitive, medium and very resistant to neonicotinoids.

This study showed the used energy in sensitive strains exposured to imidacloprid was 2.84 times of resistant population in squash. In contrast on greenhouse cucumber (GC) var Sultan and Turkey, resistant strains were 1.8 and 1.41 times more to sensitive strains.

The probability of relationship between the kind of plants and calculated biochemical parameters confirm this relationship ($p<0.000$).

Changes in biochemical parameters showed the proportion of protein in all of the resistance strains reared on three different plants were more than sensitive strains and were respectively 1.46, 2.23 and 1.73 times to sensitive strains on squash, GC var. Sultan and Turkey. The proportion of lipid was the most in the resistant strains reared in all of the mentioned plants and was respectively 6, 2.5 and 1.43 times to sensitive strains reared on squash, GS var Sultan and Turkey. The pattern of sugar consuming in sensitive strains were 2 times of resistant

Strains. These proportions were 3.6 and 4.5 times to sensitive strains reared on GC var. Sultan and 1.76 times to GC var. Turkey.

TU 47
Comparison toxicity of different dose of Tondxir against *Tetranychus urtica* Koch a pest of *Brassica napus* L

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The main goal of this study was to determine the toxicity of natural insecticidal Tondxir which is the crude extract of the red pepper on control of two spotted mite *Tetranychus urtica* Koc (Arachnida: Acari: Tetranychidae) a pest of *Brassica napus* L. In this experiment five dose of Tondxir (3000, 1000, 300, 100, 3 and 0 ppm) have been tested. Leaves of Kolza with were used in all tests. The mortality was monitored after 24, 48 and 72 hours post treatments. The analysis of variance (ANOVA) has shown that there were significantly different between treatments and control ($p<0.01$) also ANOVA has shown that there were significantly different among post treatment periods. The mortality of the two spotted mite (TSM) with Tondxir was dose dependent. Tukay-Test with different dose of the Tondxir have shown that 3000 of Tondxir with 85. 5 ± 1.2 percentage mortality and 1000 ppm of Tondxir with 69.58 % mortality after 72 h were more effective than the other doses ($p<0.01$). Tukay-Test among post test period has shown that after 72 hours post treatments with 45.58 percentage of total mortality were more effective than 24 hours post treatments respectively. Based on the composite response of this assay with the probit analysis, the predicted LC_{50} of Tondxir was 280.64 ppm with confident interval 232.78-331.9 ppm respectively.

TU 48
Biology of *Hippodamia variegata* (Col.: Coccinellidae) fed on *Aphis fabae*

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Hippodamia variegata Goeze is one of the important predators of black bean aphid. Biological characteristic of *H. variegata* including duration of different life stages and life table parameters were studied under laboratory condition at 23ºC on *Aphis fabae* as prey. 123 eggs laid within 6 hours were collected and were kept in individual test Petri dishes. Mortality and development were checked every 12-h until adult stage. After the emergence of adults, males and females were paired and their daily fertility and longevity were recorded. The raw data of life table were analyzed based on the Birch (female age specific) model. The Mann-Whitney U test was used to determine the differences in development times and longevity of males and females. The total developmental time for all pre-adult stages of *H. variegata* was 16.06 d. There was significant difference between pre-adult development time of males and females ($U= 379$, $P< 0.001$). In particular, males took about 12 more hours to complete theirs development. the adults of *H. variegata* lived an average of 54.59 d and the male adults (63.56 d) lived significantly longer than the female adults (46.26 d; $U=585$, $P=0.027$). The intrinsic rate of increase (r_m) was 0.197, other table parameters including: Net reproductive rate (R_0), Mean generation time (T), Dueling time (DT) and Finite rate of increase (λ) were estimated as 365.430, 29.963, 3.518 and 1.218, respectively.

TU 49
Predation capacity of Hippodamia variegata (Col.: Coccinellidae) fed on Aphis fabae (Hem.: Aphididae)

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Hippodamia variegata Goezee is an abundant predator in a wide range of Palearctic regions and it has established in Nearctic regions newly. The kill-rate (k_m) is the most useful parameter for comparing the predators as biological control. Predation rate of *H. variegata* was studied under laboratory condition at 23ºC on black been aphid as prey. To determine the kill-rate, the daily consumption rate of each individual on prey was measured for all stages of the predator over its immature and adult life span. The raw data of predation rate were analyzed based on the Birch (age specific) method. Consumption rate increase from the first to the fourth instar for both sexes. Fourth instar Larva consumed more aphids than other instars but their consumption was less than adults. Females consumed more than 2 times aphids than males. On average the daily predation of the adult females and adult males were 39.52 and 13.19 aphids respectively. The net predation rate (K_0) was 1127.31 aphids per individual during the total life span. The kill-rate (K_m) and predation period (T_k) were 0.48 and 14.68 respectively.

TU 50
Host plant effect on life table parameters of Silverleaf Whitefly *Bemisia argentifolii* Bellows and Perring (Hemiptera;Aleyrodidae)

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Silverleaf whitefly (SLW), *Bemisia argentifolii* Bellows & Perring also known as B-biotype of *B. tabaci*, is one of the most serious pest on many crops in the world. In order to develop a successful integrated pest management (IPM) program, it is critical to understand the life table parameters of pest. In this study, the life table parameters of SLW evaluated on Eggplant, Cucumber and Cotton. Two-four leaves hosts wich covered by plexiglas cages (n=18) in controlled condition (26±2°C, 60±5% RH, and 16:8 L:D). Then one pair 24-h old adults released under each cage separately . All males removed after 24-h. Each female transferred daily into a new cage plant. Related data collected daily until the death of the last female. Results showed that life table parameters on Eggplant, Cucumber and Cotton were as follow; The Intrinsic rate of natural increase (r_m) on were 0.167±0.00005,0.139±0.00007 and 0.147±0.00012; Net reproductive rate (R_0) : 151.64±.6, 84.06±.352 and 69.72±0.36; Gross reoproductive rate (GRR) : 203.22±1.2, 181.524±1.27 and 110.99± 5.64; The mean generation time (T) : 29.98±0.02, 31.73±0.0224 and 28.805±0.0179; Doubling time (DT) : 4.140±0.001, 4.96±0.0027 and 4.70±0.0039; The Finite rate of increase (λ): 1.182±0.0001, 1.149±0.0001 and 1.158±0.000. The

result showed significant difference between all parameters on the hosts. According to these results, it seems that Eggplant is more suitable host than others.

TU 51

Study on the susceptibility of *Galleria mellonella* (L.) to *Heterorhabditis bacteriophora* (Poinar) under laboratory conditions

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Entomopathogenic nematodes (Heterorhabditidae) are obligate parasites of insects. These nematodes have a symbiotic association with bacteria of the genus *Photorhabdus.* The infective third-stage juvenile, the only free living stage, harbors the bacteria in its intestine. Upon encountering a susceptible host, the infective juvenile enters it through natural openings (mouth, anus or spiracles) and penetrates in to the insect homocoel where it releases the bacterium. The bacterium multiplies; kill in the host within 48h. For biological control of *Galleria mellonella* (L.) larvae, the *Heterorhabditis bacteriophora* (Poinar) nematode was used. This nematode is belonging to Nematoda phylum and has been used against different pests. The susceptibility of 4th–8th instars of *G. mellonella* larvae to this nematode was evaluated through bioassays. The estimated LC_{50} values for fourth, fifth, sixth, penultimate and ultimate larval stages were 79, 164, 207, 270 and 319 nematodes in 0.1 ml of test solutions respectively. The slopes in regression lines indicated that the older larvae were more susceptible to *H. bacteriophora* than the youngest cohorts. This was due to differences in the size of larvae, body holes and more mobility of the older larvae. On the basis of present results we concluded that the older *G. mellonella* larvae, seventh and eighth instars, are more suitable hosts for mass production of *H. bacteriophora* nematode.

TU 52

Trophic interactions of parasitoid wasps (Hymenoptera: Aphidiidae) and aphids (Hemiptera: Aphididae) in Western Siberia

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Trophic interactions of aphids and parasitoid wasps were investigated in forest-steppe zone of the Novosibirsk and Kurgan regions and in forest zone of Altai Republic in 2006–2009. More than 3500 parasitoids were reared from larvae collected from the colonies of 37 aphid species. 28 wasp species from 13 genera were determined. Dendrobiont-aphids with aphids migrating from trees and shrubs to the grasses and chortobiont-aphids account for 49% (18 species) and 43% (16 species) of the trophic specters of parasitoid wasps under investigation, respectively. The smallest number of species belongs to root-aphids inhabiting underground part of plants (8%, 3 species). Usually only specialized wasps such as *P. enervis* parasitize on the root-aphids. The majority of parasitoid wasps (9 species) feed on aphids of genus *Aphis* L. More than a half of parasitoid species revealed (16) were found out in the colonies of myrmecophile aphids. The majority of parasitoids were registered in the aphid colonies tended by dominant ants *Formica* s.str. New species of host-aphids were registered for parasitoid wasps of genus *Ephedrus*. *Ephedrus cerasicola* Starý, 1962 parasitizes in aphids *Brachycaudus prunicola* (Kaltenbach, 1843), and *Ephedrus niger* Gautier, Bonnamour & Gaumont, 1929 develops in *Aphis fabae* Scopoli, 1763 and *Titanosiphon dracunculi* Nevsky, 1928.

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TU 53

Effects of methanolic extracts of *Spinacia oleracea*, a plant containing phytoecdysteroids, on development of *Ephestia kuehniella*

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Since the isolation of the first phytoecdysteroids, numerous molecules related to arthropods molting hormones have been isolated in large quantities from several plant species, where they are generally considered to participate in the defenses against phytophagous insects. Indeed, such phytoecdysteroids have been shown to disturb insect growth when incorporated in diets. We describe here the effects of extracts from *Spinacia oleracea* L. (Chenopodiceae), a plant producing phytoecdysteroids, on the growth and development of *Ephestia kuehniella* Zeller (Lepidoptera: Pyralidae). Spinach is one of the very few crop plants which produce large amounts of phytoecdysteroids, specially 20 hydroxyecdysone. Methanolic extracts of leaves from this plant were incorporated into flour given to insects. Newly hatched larvae were reared individually in test glasses. Hundred replicates were used for each concentration and larval growth and mortality were investigated. The plant extract-supplemented diets induced mortality in first and second larval instars. Life expectancy (e_x) for control and 10, 20 and 30% concentrations of the plant extracts were 49.7, 42.92, 35.5 and 25 days. Pathophysiological effects were also observed; larval development was significantly slower on experimental diets. The total development time in treated insects was always significantly longer than in control. Control insects have four instar larvae, but it was six for treated larvae. Data demonstrated that *E. kuehniella* is remarkably resistant to ingested exogenous ecdysteroids. Also, exogenous ecdysteroids are able to disrupt larval development by an interference with the hormonal regulatory system of the larvae.

TU 54

Biology and demography of lesser mulberry pyralid *Glyphodes pyloalis* Walker (Lepidoptera: Pyralidae) in laboratory condition

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Lesser mulberry pyralid *Glyphodes pyloalis* Walker is a monophagous pest of mulberry which has been recently reported from north of Iran. The biology and life table of this pest was studied in controlled condition (24±1°C, 75±5 RH and 16:8 LD). Mortality rate, metamorphosis and appearance of adult insects and their sex ratio was daily recorded. The collected data were analyzed based on an age-stage, two-sex life table, and in order to consider both sexes and the variable developmental rate among individuals and between sexes. Developmental period for egg, first through fifth instar larvae, prepupae and pupae were 4.05, 2.45, 2.03, 2.01, 2.1, 4.1, 2.06 and 4.7 days respectively. The mean total developmental period from egg to adult was 35.40±0.37 days. Maximum adult longevity was recorded 7 and 11 days

for male and female respectively. Preoviposition period lasted 2.14±0.04 days and laboratory observation showed that adults are nocturnal and female lay eggs during nights. The intrinsic rate of increase (r), the finite rate of increase (λ), the net reproductive rate (R_0), gross reproductive rate (GRR) and mean generation time (T) was calculated 142 d^{-1}, 1.152 d^{-1}, 134.675 female offspring, 294.71 egg and 34.44 days respectively. Life expectancy of freshly laid eggs was 32.15 days and with increasing age life expectancy decreased.

TU 55

Spatial distribution and seasonal population fluctuations of *Etiella zinckenella* (Lepidoptera: Pyralidae) on ten soybean cultivars in Tehran, Iran

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The limabean pod borer, *Etiella zinckenella* (Lepidoptera: Pyralidae) is one of the most destructive insects on soybean in Iran. Seasonal population fluctuations and spatial distribution of *E. zinckenella* were evaluated on ten soybean (*Glycine max* (L.) Merril) cultivars including Zane, Dpx, Sari, Gorgan3, Williams, L_{17}, 032, 033, Clark and Sahar in Tehran region, during 2008. Spatial distribution pattern of this pest was determined on these cultivars using regression models (Taylor's power law and Iwao's patchiness). Mean seasonal infestation among various cultivars were compared using one-way ANOVA. If significant differences were detected, multiple comparisons were made using the SNK procedure ($P<0.01$). The survey results indicated that population density was highest on Clark (11.38±3.46) on the 11th of September. The mean seasonal infestation was highest on Clark (4.51±0.88) and lowest on Gorgan3 (0.04±0.03) cultivars. There was significant differences between the mean infestation among the various cultivars ($P<0.000$), thus it is possible to transfer the desirable genes from Gorgan3 to other cultivars in the future programs. Spatial distribution pattern of this pest was determined to be random on 032 cultivar and regular on Gorgan3 and Sari cultivars and aggregated on the other cultivars. Determining the spatial distribution and seasonal infestations of limabean pod borer can be used in integrated pest management in soybean fields.

TU 56

Synergistic interaction between sub-lethal doses of *Bacillus thuringiensis* and *Campoletis chlorideae* in managing *Helicoverpa armigera*

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Campoletis chlorideae Uchida (Hymenoptera: Ichneumonidae) is an important solitary larval endoparasitoid of the tomato fruit borer, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae) in India. The interaction between *Bacillus thuringiensis* subspecies *kurstaki* (*Btk*) HD-1 and *C. chlorideae* was studied under laboratory condition to explore their compatibility in managing *H. armigera*. The results indicated that the growth and development of *H. armigera* was affected in a dose dependent manner upon feeding on sub-lethal doses of *Btk* HD-1 treated diets. There were no larval survivors in lethal doses of *Btk* HD-1 (LC_{70} and LC_{90}). The growth and survival of the parasitoid were normal whenever the host larvae were fed with sub-lethal doses or subjected to short time exposure to lethal doses of *Btk* HD-1. However, the parasitoid offsprings developed slowly and pupal as well as adult period, adult weight and adult emergence rate were reduced significantly if the parasitoid was developing inside a severely *Bt* intoxicated host larvae. There were no evident differences in longevity of parasitoid adults that were fed on honey solution containing different concentrations of *Btk* HD-1 as compared to adults fed only on honey solution. This indicates no direct adverse effect of *Btk* HD-1 on *C. chlorideae*. Further, the gravid female parasitoid did not discriminate *Bt* intoxicated and normal *H. armigera* larvae for oviposition. No direct adverse effect of *Btk* HD-1 on the parasitoid was observed. The result implies that spore crystal formulation of *Btk* HD-1 can be effectively used in a synergistic manner along with existing natural or pre released population of *C. chlorideae* in organic farming or as components in biointensive IPM module for managing *H. armigera*.

TU 57

Study on the larval parasitism of *Heliothis viriplaca* Huf in the Western Azarbaijan provience of Iran

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Insect pests are a major constraint to chickpea production. In Iran, the legume pod borer *Heliothis viriplaca* Huf is the major insect pest of rain-fed chickpeas. A range of parasitoid and predatory insects attacks *Heliothis* larvae. Identifying and conserving these beneficial insects is fundamental to implementing pest management with a reduced reliance on chemical insecticides. During 2007-2008 in Western Azarbaijan province, larva were sampled from insecticides free fields and kept in the laboratory to observe and count emerging parasitoid adults. Three Hymenopterous parasitoid species were collected: the Braconid *Habrobracon hebetor* Say, Ichneumonid *Hyposoter didymator* (Thunberg) and other Ichneumonid *Thronia* sp?.Results revealed that late instar larvae generally were parasitized inside the pods by *H.hebetor.* Mean parasitism was 33.16% and maximum recorded 48%. Early instar larvae before boring into pods and cause damages generally were parasitized on the leaves. Mean parasitism rate was 11.23% and maximum was recorded 26.83%. Parasitism by *Theronia* sp was also considerabl. Mean parasitism was 11% and maximum was recorded 15.83. However the *H. didimator* is considered promising for biological control programs.

TU 58

Can nematodes control the invasive alien western corn rootworm, *Diabrotica v. virgifera*?

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Maize yield is affected by root-feeding larvae of the chrysomelid beetle Western Corn Rootworm (*Diabrotica virgifera virgifera* LeConte), which, since it invaded into Europe, is a prime target for novel control measures. We investigated the control potential of three entomopathogenic nematodes, *Steinernema feltiae* (Filipjev), *Heterorhabditis bacteriophora* Poinar, and *H. megidis* Poinar, Jackson, Klein (Nematoda: Rhabditida) in four field plot experiments in

southern Hungary between 2004 and 2007. Moreover, below ground interactions between maize roots, pest larvae, and attacking nematodes were assessed in below ground olfactory laboratory experiments as well as under field conditions. Six different nematode application techniques were tested in five fields. Several of these application techniques resulted in decreased rootworm populations. When applied as a solid stream into the soil at maize sowing, *H. bacteriophora* was more effective at reducing *D. v. virgifera* (81 %) than *H. megidis* (49 %) and *S. feltiae* (36 %). When applied as a solid stream onto the soil near maize rows in June, *H. bacteriophora* and *H. megidis* were more effective (about 70 %) than *S. feltiae* (32 %). All nematode species significantly reduced damage to maize roots. Maize hybrids, emitting the nematode attractant beta-caryophyllene from their roots upon larval feeding, facilitated the orientation of nematodes towards the pest larvae. The use of *H. bacteriophora* and *H. megidis* as a biological control product for inundative releases against rootworm larvae is proposed.

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TU 59
Interaction between *Mabr*NPV and the Braconid parasitoid *Habrobracon hebetor* (Hym.: Braconidae) on larvae of beet armyworm, *Spodoptera exigua* (Lep.: Noctuidae)

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The survival of a Braconid parasitoid *Habrobracon hebetor* was investigated on nucleopolyhedrovirus (NPV)-infected *Spodoptera exigua* larvae. The second-instar larvae were exposed to 30, 51.4 and 180 PIB/mm^2 of *Mamestra brassicae* NPV (*MabrNPV*) as under-LD_{50}, LD_{50} and over-LD_{50} values, respectively. They were got accessible to be parasitized by *H. hebetor* after 24, 48 and 72 h. post-treatment. Infection of the larvae with *MabrNPV* was deleterious to the survival and parasitism of *H. hebetor*. The survival of *H. hebetor* in *MabrNPV*-infected *S. exigua* larvae was dependent on the interval between viral infection and parasitization, as well as on the treatment dose of *MabrNPV*; very few adults of parasitoid emerged from infected hosts when host larvae were exposed to 180 PIB/mm^2 of *MabrNPV* on 72 h. interval treatment. The inoculation dose of *MabrNPV* and the timing of parasitoid release had significant effect on the development of *H. hebetor* on virus-infected hosts. Field applications of virus for biocontrol of *S. exigua* may lead to substantial mortality of immature parasitoids.

TU 60
Life table parameters of green house Whitefly, *Trialeurodes vaporariorum* (Westwood), on tomato

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Trialeurodes vaporariorum (Westwood) is a major pest of green house crops throughout of the word. It attacks to a wide range of crops especially Tomato in glass house condition. Life table parameters such as intrinsic rates of increase (r_m), gross reproductive rate (GRR), net reproductive rate (R_0) and mean generation time (T) evaluated in this study. For this purpose, 24 h old adults collected from source plants and released on 2-4 leaves Tomato (var. Cherry, Bakker Co.). All males separated after 24 h and each female transferred to new plants daily. All plants covered with the Plexiglas cages and remained in control condition (24±2^{0C}, 60±5% RH and 16:8 h L: D). Number of eggs, and number of new emerged females counted until emerging of last adult. All parameters calculated by jackknife model. Results showed that r_m, GRR, (R_0) and (T) were 0/093, 159/87, 15/357 and 28/64(days) respectively. Also other demographic parameters such as intrinsic birth rate (b), intrinsic death rate (d), finite rate of increase (λ) and doubling time (DT) calculated that were 0/09, 0/008,1/1 and 7/25 (days) respectively.

TU 61
Role of *Blattisocius Keegani* Fox as a Biological Control Agent on two date mites in Egypt

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Mites are among the most important pests of stored products in many parts of the world. This study is conducted on mite populations associated with stored dried dates on the Gazally date variety in Alexandria, Egypt. The results indicated that ten mite species belonging to seven families were collected and recorded. The most common species belongs to family Acaridae (27.69%) followed by families Ascidae (19.7%), Glycyphagidae (15.49%) Carpoglyphidae (13.1%) and Cheyletidae (11.21%). The most dominant species were *Tyrophagous putrecentiae, Blomia freemani, Blattisocius keegani, Carpoglyphus lactis* and *Cheyletus malaccensis* with averages 30.2 ± 2.3, 21.7 ± 2.1, 18.5 ± 1.8, 18.3 ± 1.9 and 15.7 ± 2.2 mites/kg. dates, respectively. The effect of the predatory mite, *B. keegani* as biological control agent on two date mites, *T. putrescentiae* and *B. freemani* was done. The data showed that the daily mean numbers of consumed mites by predatory mite, *B. keegani* were 2.65 ± 0.18 and 1.83 ± 0.06. While, the total mean numbers of consumed mites were 40.7 ± 1.68 and 35.9 ± 1.1 mites/female when fed on two mite species associated with dried-dates, *B. freemani and T putrescentiae* respectively. The total means of life days (longevity) were 15.3 ± 0.83 and 19.7 ± 0.81 days/female when fed on the two date mites, *B. freemani and T. putrescentiae* respectively. Statistical analysis showed that a significant difference between means.

TU 62
Efficiency of entomopathogenic nematodes on frit fly *Oscinella frit* under laboratory and field conditions

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Insects can cause great damage during the establishment phase of wheat because few tillers are present and many seedlings can be killed by a low incidence of insects. Larvae of dipterous stem-borer frit fly *Oscinella frit* (L.) can cause considerable damage in newly sown summer wheat. Frit fly population was surveyed by using different color water traps to determine the suitable date to control. The efficiency of three types of entomopathogenic nematodes (EPNs) and one pyrethroid (Karate) were evaluated to control frit fly in laboratory and in field on two wheat varieties (Triso & Sakha 93).

This is the first report on the control of the frit-fly with EPNs. *Heterorhabditis bacteriophora* had more efficiency against the pest in laboratory than *Steinernema carpocapsae,* while

the latter was better in field. The numbers of frit flies caught in water traps were relatively higher on May 4th and 11th 2009. In the laboratory, up to 100% mortality in the pest larvae could be achieved with all tested nematodes as well as the chemical insecticide when higher concentrations and younger pest larvae were used. EPNs and Karate were sprayed twice in field. All treatments induced significant reduction in frit-fly infestations and increase in larval mortality compared to control plots. *S. carpocapsae* being the most effective nematode in the field, achieved 70% larval mortality, 88% infestation reduction and yielded 4776kg/ha when it was applied at 5 billion IJs/ha. Karate induced 67.7% larval mortality, 92% infestation reduction and yielded 5339Kg/ha, when it was applied at 150 ml/ha. The result showed that yield/ha was higher in Triso than in Sakha 93. The results indicated that EPNs were effective against frit fly and could be used as biocontrol agents in IPM programs.

TU 63
Impact of three prey species and their densities on the performance of *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae) under laboratory conditions

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Laboratory studies under controlled conditions are important tools for obtaining information regarding predator-prey interactions and chances of the sustainability of a predator in cropping systems with exclusive prey species. We evaluated the impact of *Aphis gossypii, Bemisia tabaci* and *Amrasca devastans* and their different densities (10, 20, 40, 80 and 160 per day) on the longevity, fecundity, survival and predatory potential of *Chrysoperla carnea* under laboratory conditions in 2003 and 2004. The developmental duration of all immature stages, total developmental duration and preoviposition period decreased with the increasing prey density of *A. gossypii, B. tabaci* and *A. devastans*. However, oviposition period, longevity of female, fecundity, consumption rate of larvae, consumption rate of each larval instar, searching efficiency of larval instars and survival percentage of all stages of *C. carnea* increased with the increasing prey densities in three prey species. Prey species also had pronounced effect on these parameters. *A. gossypii* maximized the oviposition and postoviposition period, longevity of female, fecundity, total prey consumption, searching efficiency of instars and survival percentage of all stages of *C. carnea* followed by *B. tabaci* and *A. devastans*. Similarly, developmental duration of *C. carnea* was shortened, when fed on different densities of *A. gossypii*, intermediated, when fed on *B. tabaci* and prolonged when fed on different densities of *A. devastans*.

TU 64
Bottom-up effects of canola cultivars on performance of *Diadegma semiclausum* (Hymenoptera: Ichneumonidae) parasitoid of the diamondback moth

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The diamondback moth (DBM), *Plutella xylostella* (L.), is one of the most damaging pests of cruciferous plants worldwide and has gained economic importance over the years. The bottom-up effects of three cultivated canola cultivars (SLM_{046}, Opera and RGS_{003}) on development, survival, reproduction, parasitism and several fitness correlates of *Diadegma semiclausum* Hellen, the larval-pupal parasitoid of DBM, were determined under laboratory conditions at 25±1°C, 65±5% RH and 16L: 8D h. Both DBM and its parasitoid could complete their life cycle on all cultivars examined. The egg-larval period and total development time of *D. semiclausum* were not significantly affected by the host plants. The lowest (2.54 mg) and highest (3.24 mg) pupal weight of *D. semiclausum* were observed on SLM_{046} and RGS_{003}, respectively and the longest and shortest pupal period of the parasitoid were recorded on Opera (6.60 days) and RGS_{003} (6.24 days). Female longevity without host and food was significantly shorter than those supplied by food and host (1.46 and 4.7 days, respectively on RGS_{003}). Costal vein length varied significantly for females (longest: 3.49 mm on RGS_{003}, and shortest: 3.06 mm on Opera) and males (longest: 3.31 mm on RGS_{003}, and shortest: 2.92 mm on Opera). The intrinsic rate of natural increase of *D. semiclausum* was 0.188, 0.153 and 0.147 females/female/day on RGS_{003}, Opera and SLM_{046}, respectively, which showed significant difference among cultivars. The total number of produced offspring was significantly the highest on RGS_{003} (22.33 pupa) and the lowest on Opera (14.44 pupa). Consequently, *D. semiclausum* indicated better performance on RGS_{003}, which was partial resistant to DBM in comparison with other cultivars.

TU 65
Biological Control of Beet Armyworm, *Spodoptera exigua* (Lep.: Noctuidae), by *Chelonus oculator* (Hym.: Braconidae) in Greenhouse Crops

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The Beet Armyworm, *Spodoptera exigua* (Hübner), is a pest of great economic importance in pepper and strawberry crops in greenhouses and open air in Spain. Since the adult females lay the eggs in a patch, in several layers and leave them protected by scales; the eggs are safe from parasitism by *Trichogramma* species. Therefore, the aim of the present work has been to find a biological control agent that could be applied in the conditions of the above mentioned crops. From the studied autochtonous parasitoids, we selected, by means of laboratory studies of functional response, the egg-larval parasitoid: *Chelonus oculator* (Panzer). Also, this species is easily mass-reared on alternative host: *Ephestia kuehniella* (Zeller), at low costs. A total of 10 trials have been carried out in pepper and strawberry crops, at different release doses (from 0.13 to 3.0 adult females/m^2), and we found a very good control of the pest populations, with maximum percentages of parasitism, 92.2 %. The found results show that the species could be a good biological control agent for commercial use in Spanish greenhouses, for the control of *S. exigua* and, probably also *S. littoralis*.

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TU 66

Tomato varieties effects on the efficiency of natural enemies against South American Tomato Pinworm, *Tuta absoluta* (Lep.: Gelechiidae)

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The South American Tomato Pinworm, *Tuta absoluta* (Meyrick) causes important damages in tomato crops in Spain; nevertheless, the damages are different in open air crops, spring - summer cycle, with constant and increasing infestations by overlap populations; respect to greenhouse crops, autumn - spring cycle, in that the attacks take place at first and at the end of the crop cycle and that originate from discreet populations. Therefore, the control methods, according to the kind of crops, must be different; also, the varieties used in every case are different. For it, the aim of this work was to study the influence of the cultivated host plant on the efficiency and activity of biological control agents. The works were carried out in a greenhouse (1,000 m^2), transplanted with plants of 5 tomato varieties, more representative of two types of crops, as mentioned before: Razymo® Rijk Zwaam, Realeza® Ruiter Semillas, Tovi Star® Zeraim Ibérica, Tyty® Syngenta Seed and Vernal® Enza Zadem; the biological control agents used were: *Trichogramma achaeae* Nagaraja & Nagarkatti, released at a dose of 25 adults/m^2 two times per week and *Nesidiocoris tenuis* (Reuter), with only one release (1 adult/m^2) at the beginning of the cycle crop. As results of our study, we have not found significant effects on the activity of both natural enemies, assessed by the percentage of parasitism or the depredation rate, respectively, according to the variety. On the contrary, it has been observed a significant effect of the pest incidence, according to the variety, measured by the assessment of the ovipositiomal rate of the females (*F=28.17, d.f.: 72, P<0.01*) that also could explain partly the differences between the two types of crop systems.

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TU 67

Superparasitism in semi-massive rearing of *Spalangia cameroni* perkins (Hymenoptera: Pteromalidae), a parasitoid of medfly (Diptera: Tephritidae)

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The frequency of superparasitism and its effects on the quality of semi-massively reared *S. cameroni* parasitoids were investigated under laboratory conditions. The following relationships were determined: the number of marks per pupa and superparasitism, adult emergence and sex ratio, female size, emergence ability from soil and longevity, fertility and survival of adult parasitoids emerging from *C. capitata* pupae with different levels of superparasitism. A high frequency and prevalence of superparasitism under semi-massive rearing conditions was observed. The number of "marks" per pupa ranged from 1 to 17, with an average (±SD) of 2.8±3.4. The number of marks produced by females of *S. cameroni* on the pupae of *C. capitata* affords information about the degree of superparasitism withstood by the medfly. As the level of superparasitism increased, the probability of female emergence increased, although overall adult emergence decreased. Nevertheless, no relationship was discerned between female size and level of superparasitism. The "emergence ability from the soil" was higher in those parasitoids that emerged from strongly superparasitized hosts, but not related to the type of substrate in which the host pupae were buried. The level of superparasitism did not have a significant effect on the longevity, fertility and survival of female parasitoids. Our results support the hypothesis that superparasitism in *S. cameroni* might be adaptive, since attributes such as "emergence ability from the soil", longevity, fertility and survival were not affected by the level of superparasitism or the presumably detrimental effects derived from physical combats among conspecific larvae.

TU 68

Bioassay studies of three *Bacillus thuringiensis* Iranian strains on third larval instar of diamondback moth, *Plutella xylostella* (L.) (Lep.: Plutellidae)

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Diamondback moth, *Plutella xylostella* (L.) (Lep.: Plutellidae) is a serious lepidopteran pest of cruciferous plants throughout the world and in Iran. Resistance to basic insecticide classes has developed in *P. xylostella.* Therefore this research is trying to review for biological pest control. The bacterium *Bacillus thuringiensis* (Bt) is characterized by its ability to produce proteic crystalline inclusions during sporulation. Cry1 protein has insecticidal activity and is highly specific to certain insects and not toxic to unrelated insects, plants or vertebrates. In this work, the pathogenicity of three *Bt* Iranian isolates (20, 29 and 87) was tested against *P. xylostella*, one of the most important insect pests of cruciferous plants and the lethal concentrations (LC_{50}) of their crystal proteins to *P. xylostella* 3rd larval instra was determined.. The experiment was designed in random complete block with 5 treatments and 5 replications. Spore-crystal complex was applied to the surface of natural diets (cabbage leaves) and the mortality of *P. xylostella* larvae was assessed 120 hours after exposure of *Bt* toxin in each treatment. Treatments were included five concentrations (10^8, 10^7, 10^6, 10^5, 10^4 CFU/ml) of native bacteria isolates and for each container 10 third larval instars of *P. xylostella* were used on cabbage leaves. Results showed that percentage of survival was significantly higher for larvae fed untreated leaves after 120 h in compare with *Bt*-treated leaves. Results also showed that after 5 days, Lc_{50} for 3 isolates were equal to 5.4×10^4, 1.5×10^5 and 5×10^3 CFU/ml, respectively. Isolate 87 showed the highest percent of mortality and lowest mortality was seen in isolate 29 (10^8 CFU/ml).

In conclusion, these *Bt* Iranian isolates were more toxic to diamondback moth than a standard commercial strain and these native Iranian strains of *Bt* constitute a very promising tool in the control of diamondback moth.

TU 69

Effects of some conventional and biorational insecticides on ectoparasitoid, *Habrobracon hebetor* Say (Hymenoptera: Braconidae)

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H.hebetor is one of the most important parasitoids of larval stage of many important agricultural pests such as noctuid and pyralid moths. The effects of chlorpyrifos, thiodicarb, abamectin and spinosad was studied on adult wasps at 26±1^0 C, 60±5 % RH and a photoperiod of 16:8 (L:D) h.The young (<24h) female adult wasps were exposed to the field recommended rates of the insecticides by using of exposure cages. Chlorpyrifos, thiodicarb and spinosad caused 100% mortality on adults, but the parasitoid suffered just 44.4% mortality from the abamectin. Dose-response studies also were conducted on adults. The young adults were exposed to fresh residue of the insecticides at exposure cages and dead and alive adults were counted 24h after initial exposure. Probit analysis was conducted using SAS software. LC_{50} values of chlorpyrifos, thiodicarb, spinosad and abamectin were 1.75, 146.5, 117.4 and 245.8 ppm based on formulated materials or 0.84, 117.175, 28.169 and 3.424 mg a.i./l, respectively. Above mentioned values were equivalent to 0.001, 0.07, 0.35 and 1.22 of field recommended concentrations of the insecticides, respectively. The results showed that chlorpyrifos had the hieghest toxicity and abamectin had the lowest toxicity to the parasitoid based on formulated material. After conducting the advanced field studies, abamectin and thiodicarb may be used as a compatible chemical materials with biological control agents in IPM programs.

TU 70

Causes of synergistic action between entomopathogenic fungi Metarhizium anisopliae and bacteria Bacillus thuringiensis ssp.morrisoni var. tenebrionis under the infection of Leptinotarsa decemlineata

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Using of the mixed infections for biologic control of insects represents more interest.

We conducted experiments by synchronous coinfection of the *Leptinotarsa decemlinneata* larvae with the entomopathogenic fungus *Metarhizium anisopliae* and bacteria *Bacillus thuringiensis* ssp. *morrisoni* var. *tenebrionis*. This combination led to synergistic effect in mortality of colorado potato beetle larvae. Mortality rate in a variants a mix-infection was more in 2 times as compared with a variants of mono-infection. This tendency was observed in the mortality dynamics at all larval ages. This microbial complex is highly efficient under natural conditions (80–90% larval mortality rate and no plant defoliation) (Kryukov et al., 2009). We studied the mechanism this synergism. We found out that bacteria arrest the nutrition, delay the growth and lengthen the intermolt period, while the fungal spores kill the weakened larvae. Also we studied reactions of cellular immunity (rate of encapsulation) and detoxication enzymes activity (nonspecific esterases and gluthation-S-transferase) under mix-infection of larvae. It was reported that inhibition rate of encapsulation and detoxication enzymes activity under influence of a bacteria, that possibly increased their susceptibility to entomopathogenic fungi.

TU 71

Effects of selected botanical insecticides on the biology and behavior of the *Chelonus oculator* Panzer (Hymenoptera: Braconidae)

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The wasps are important agents for suppressing the pest population, and it is useful to investigate the effect of botanical insecticides on parasitoids. *Chelonus oculator* (Hymenoptera: Braconidae) is an egg-larval parasitoid of several important lepidopterous pests. In this study toxicity and behavioural bioassays were conducted to assess the sub-lethal effects of two products derived from *Azadirachta indica* (Neem Azal ®–T/S) and pyrethrum (Spruzit ® Neu) on the parasitoid. Experiments were carried out under the laboratory conditions. In these experiments, LC_{50} and LC_{25} values were determined in the third larval stages of *Spodoptera littoralis* (Lepidoptera: Noctuidae). The parasitized third larval stages of *S. littoralis* were treated with the LC_{50} and LC_{25} values of the two insecticides. The toxicity and behavioral bioassays indicated that both botanical insecticides had negative effects on the parasitoid. Treatment with Neem Azal ® –T/S at the LC_{50} and LC_{25} values exhibited a negative effect in parasitoid progeny. Development time of parasitoid was prolonged, and the longevity and emergence rate were significantly reduced in both values. As expected, the parasitoid was much more affected at LC_{50} than LC_{25}. Treatment with Spruzit ® Neu was much more toxic for the parasitoid. LC_{50} value caused %100 mortality in *C. oculator*. On the other hand, LC_{25} value exhibited a great reduction in parasitoid progeny, prolonged development, and reduced the longevity. Behavioural responses of C. ocultor to the two insecticides were also investigated in a Y-tube olfactometer. The behavioral bioassays indicated that *C. oculator* was negatively affected from both insecticides. The repellent effect of the insecticides increased with increasing dose in both insecticides. However, Neem Azal ® –T/S was much more repellent than Spruzit ® Neu.

TU 72-75: Phytoplasma vectors

TU 72

An approach to the control of *Hyalesthes obsoletus*, vector of Bois Noir, using entomopathogenic agents

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The planthopper *Hyalesthes obsoletus* Signoret (Homoptera, Cixidae) is vector of the grapevine yellow Bois Noir, one of the most important phytoplasmosis in Europe. Reduction of phytoplasma associated diseases incidence relies on the control of the insect vectors and on the eradication of affected host plants. Management of Bois Noir is especially difficult because both the vector and the phytoplasma can develop also in plants other than grapevines; the overwintering younger instars of the insect live underground feeding on the roots of wild plants normally nearby vineyards (like nettle and bindweed) and chemical interventions are ineffective and unsustainable. The aim of this trial was to evaluate the possibility to control the young forms of the leafhopper by means of entomopathogenic agents applied to nettle roots. During summer, hundreds of wild *H. obsoletus* adults were captured and allowed to breed in a greenhouse with nettle pots; the following late spring groups of young leafhoppers obtained from the pots were treated by sprinkling the ground with strains of entomopathogenic fungi

(*Beauveria bassiana* and *Paecilomyces fumoseroseus*) and nematodes (*Heterorhabditis bacteriophora* and *Steinernema feltiae*). The mortality of *H. obsoletus* was recorded on day 3, 7, 14 after the treatment. The positive results obtained in the experiment suggest that microbiological control of the vector could represent a promising option for the integrated management of Bois Noir.

TU 73
Data on the Auchenorrhyncha fauna associated with vineyard agro-ecosystem in South Romania

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A study on the Auchenorrhyncha fauna was performed in four vine plots with different varieties and pest control intensities in Dobruja and Oltenia regions and in an untreated uncultivated plot in Bucharest area in 2008 and 2009. The aim of this study was to obtain information related to the presence of the vector insects associated with the grapevine yellow symptoms, particularly because they had been signaled in some Romanian vine regions in the last years. Insects were sampled using yellow sticky traps. According to their relative abundance, the species found in the investigated vine plots were: *Empoasca vitis*, *Philaenus spumarius*, *Fieberiella florii*, *Macrosteles viridigriseus*, *Reptalus panzeri*, *Macrosteles laevis*, *Psammotettix striatus*, *Scaphoideus titanus*, *Hyalesthes obsoletus*, *Neoaliturus fenestratus*, *Stictocephala bisonia*. The leafhopper *S. titanus*, the well-known vector of the phytoplasma which causes the *Flavescence Dorée* diseases, was detected in one of the vine plots in Dobruja and in an untreated plot in Bucharest.

This study was financially supported by Romanian Ministry of Research Education and Innovation within the project PN II no. 52-130/2008.

TU 74
Feeding activity of European grass-feeding leafhopper on unsuitable host plants

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The European grass-feeding leafhopper *(Psammotettix alienus*, Cicadellidae) is an abundant floem feeder on grasses in most part of Europe. The species occurs in high numbers also on some dycotyledonous plants, and stolbur phytoplasma was also detected from its body. In our work we aimed to answer if *P. alienus* can use other plants than grasses as occasional food resource.

Survival times and feeding activity of *P. alienus* imagoes were compared on barley seedlings and two unsuitable hosts (*Carex tomentosa,* Cyperaceae and *Ambrosia artemisiifolia,* Asteraceae). On unsuitable host plants the mortality of leafhoppers was complete in 8 days, but in 4 days the survival rate was 10 %, which means that these plants were better than starvation. The feeding behavior of *P. alienus* imagoes was monitored by DC eletrical penetration graph (EPG) method. The stylet penetration periods were significantly longer on barley, than on *A. artemisiifolia* or *C. tomentosa*. The sucking activity of *P. alienus* on its unsuitable hosts was characterised by frequent short penetrations (< 3 min), but longer penetration periods (10-60 min) were also occuring. Based on the analogy of EPG signal patterns of *P. alienus* and the known patterns described in other hemipterans, we can conclude that the stylet of *P. alienus* can reach the plant's transport tissues in case of all the three plant species, including the dycotyledonous *A. artemisiifolia*.

The research was financed by the Hungarian Scientific Research Fund (No. 68589).

TU 75
Presence and distribution of stolbur phytoplasmas in insects captured in 'Lambrusco' vineyards in Northern Italy

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During 2007/2009 a survey was carried out in 25 vineyards of a grape-growing area in Northern Italy to detect and identify the presence of possible insect vectors of the 'bois noir' phytoplasmas (stolbur group) in Lambrusco variety. The leaf/planthopper population was monitored weekly by sticky traps, and sweep nets on herbaceous vegetation and "frappage" on grapevine carried out in the middle and on the border of vineyards from June to September. Captured insects were identified and analyzed with molecular analyses to detect the presence of stolbur phytoplasmas. Identified Cixiidae were *Hyalesthes*, *Cixius* and *Reptalus*. The most abundant species were *Hyalesthes obsoletus* Signoret (98% of the 761 *Hyalesthes* genus captured), *Cixius cunicularis* L. (over 93% of the 273 *Cixius* captured) and *Reptalus panzeri* Löw (65% of all the 177 *Reptalus* captured). Scattered specimens of *H. luteipes* Fieber*, C. nervosus* L.*, C. wagneri* China and *R. quinquecostatus* Dufour were also identified. The best way to catch the insects was using the sweep net for *Hyalesthes* and *Reptalus* (over 97% of *H. obsoletus* and 78% of *Reptalus* captured) whereas the "frappage" was the best method for *Cixius* (64% of all captures). Most of the insects were captured in the vineyard borders (95% *Hyalesthes,* 72% *Reptalus* and 60% *Cixius*). Phytoplasma presence as determined by nested-PCR/RFLP analyses on 16S ribosomal and tuf genes allow identifying stolbur phytoplasmas in different percentages according with species.

TU 76-80: Taxonomy of Lepidoptera

TU 76
The Noctuidae *s.l.* (Lepidoptera) in sugarcane fields of Iran

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Faunistic studies were carried out in four sugarcane agro-industries located in the Khuzestan province, southwestern Iran, during 2007 and 2008. A total of 50 noctuid species belonging to 10 subfamilies were recorded. Among them, provisionally, four species and one subspecies are new to Iran and several species new to the province. The role of these species in the sugarcane fields is discussed.

TU 77
Molecular investigation of *Elachista* (Lepidoptera: Elachistidae: Elachistinae) moths at the species group level

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The *Elachista* Treitchke, small moths with wingspan from 5 to 14 mm, is the largest genus in the subfamily *Elachistinae.* Forewing pattern mainly consist both a white fascia and spots on dark background or fuscous marks on light background or moths are unicoloured (white, yellowish, or creamy). Larvae of *Elachista* are typical leaf-miners, trophically connected with Monocotyledonous grasses. *Elachista* species morphologically are rather uniform and thus difficult to identify based on external examination. *Elachista* species were examined using traditional entomological methods (making of morphological preparations, species identification, and documentation of morphological structures) and DNA analysis. We used pined specimens and specimens, which were stored in 96% ethanol. DNA was extracted usually from head or thorax using the Nucleospin Tissue Kit (Machery-Nagel, Düren, Germany). The polymorphism of sequenced mtDNA segments of the cytochrome oxidase I (COI) gene were assessed in 10 species of *E. argentella, E. bedellella, E. bifasciella and E. freyerella* species groups. PCR amplification of genomic DNA with COI primer in each of the samples across the 10 species yielded specific fragment of 700 bp corresponding to position 2239–2944 of sequence. The tree was constructed using Neighbor-Joining (NJ) method, Kimura 2–parameter model. Molecular data shows significant difference between some species.

TU 78
Variability of larval pattern elements in the West Palaearctic *Hyles euphorbiae* complex (Lepidoptera: Sphingidae, Macroglossinae)

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The *Hyles euphorbiae* complex (HEC) consists of a number of species and subspecies showing high inter- and intraspecific variability in both larval and adult characters. The variation in larval colour pattern in particular has led some authors to exaggerated taxonomic splitting and controversy. We will present an extensive overview of the variation in the elements of these patterns based on representative and independent samples from numerous populations across Macaronesia, North Africa, Yemen, Europe, the Middle East and Western Asia. We found that variability within populations was much higher than previously believed and it proved difficult to characterize any species, subspecies and even local populations unequivocally. We discuss these findings in the context of Western Palaearctic biogeography, challenge the validity of some taxa and postulate several areas of hybridization between the two main lineages, namely the European *Hyles euphorbiae* and North African *H. tithymali*. We also consider the potential of these moths as a model system for tracking the effects of future climate change in the Mediterranean Basin as climatic oscillations in this region since the Last Glacial Maximum may have been predominantly responsible for the mosaic distribution patterns observed today in the HEC.

TU 79
Sphaeroceroidea – an important member of snow active group of flies in Poland

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Snow active flies are the most numerous group of snow active insects, however they are still poorly studied. Two closely related families of Diptera – Heleomyzidae and Sphaeroceridae (Heteromyzidae in the sense of McAlpine, 2007) have high share in snow active group of flies. Authors present the actual state of knowledge upon snow activity of these families and the results of few years of investigations upon flies recorded on snow in Poland. Almost 300 individuals were collected and eighteen species of Heleomyzidae and nine species of Sphaeroceridae were found active on snow in Central Poland and in the mountains. Among them *Tephrochlamys rufiventris* (Meigen, 1830) clearly predominated. Four other species had also a big share in the collected material: *Eccoptomera obscura* (Meigen, 1830), *Heteromyza rotundicornis* (Zetterstedt, 1846), *Crumomyia notabilis* (Collin, 1902) and *C. fimetaria* (Meigen, 1830). The highest number of specimens of Heleomyzidae was observed in the second part of November, while Sphaeroceridae were most abundant at the end of December. In the second part of winter and in early spring the snow activity of flies from both families slowly decreased.

TU 80
Clutch size adjustment of a leaf-mining moth (Lyonetiidae: Lepidoptera) in response to resource availability

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Clutch size variation of a leaf mining moth *Cemiostomaaceris* (Fuchs) *(Lyonetiidae: Lepidoptera)* was investigated on two host plants, *Populuseuphratica*Olivierand *Salix elaeagnus*Scopthat female moths oviposited egg clutches with different size on the two host plants and that clutch size was correlated with leaf area between host species. Therefore, we concluded that females are adjusting clutch size in response to variation in resource availability for offspring. Positive correlation was also found between clutch size and leaf area within host species, however, the relationship was weak. Expected clutch size was determined from estimates of leaf area consumed by a larva until pupation. Females laid significantly smaller clutches than the expected size that could be supported by a single leaf on both host plants.Wediscussed how the females determined clutch size in response to resource availability.

TU 81-83: Vector-borne diseases - biology and control

TU 81
Detoxificative system of *Aedes aegypti* laboratory strain larvae and zooplankton grazer *Daphnia magna* Straus under pyrethroid esfenvalerate treatment

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The effect of exposure of *Aedes aegypti* larvae and crustacean *Daphnia magna* to sublethal concentrations of the pyrethroid esfenvalerate was investigated. *Aedes aegypti* larvae and *Daphnia magna* was exposed to different sublethal esfenvalerate concentrations (60 and 120 ng reactant/L) during 4 days. Rate of mosquito larvae mortality was 10 and 25% respectively. Biochemical assays showed no changes after exposure of 60 ng reactant/L of esfenvalerate but level of esterase activities in the mosquitoes after exposure of 120 ng reactant/L of esfenvalerate for 8, 24, 72, 96 h have been decreased. Larval glutathione S-transferases activities were decreased after exposure to esfenvalerate only for 96h. Rate of mortality of *Daphnia magna* was 0 and 3% respectively. Esterase activities of daphnids were decreased after exposure to esfenvalerate (60 and 120 ng reactant/L). But glutathione S-transferases activities of daphnids were increased after exposure to esfenvalerate for 72 and 96 h. Therefore, the present study suggests that sublethal doses of esfenvalerate caused LC_{10} and LC_{25} for *Aedes aegypti* larvae have inhibited esterase activities, the same doses of esfenvalerate have caused no-observed-effect concentration and LC_3 for *Daphnia magna*, but in this case esterase and glutathione S-transferases activity increased. This fact can relate with higher tolerance of *Daphnia magna* to esfenvalerate, than *Aedes aegypti* larvae.

TU 82
Bed bugs control in Russia

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The blood-sucking bed bugs parasitizing on people – is multithousand -year problem. However, in the middle of the last century this problem has been almost liquidated – for example in Moscow bugs control 0,9 % from all were desinsektion measures. From the beginning of XXI century bugs again began to appear in large cities of Russia.

In Moscow on 2005 the share of desinsektion measures against bugs has increased from 0,8 % up to 6,3 %. Inhabited apartments made 50 % of all processed objects, hostels of 20,8 %, hotels of 12,5 %, hospitals - 16,7 %.

Principal causes of increase of frequency and quantity of bugs in Russia are next:: 1. Invasion of bugs with property of gastarbeiters from the countries of the former USSR and their multiplication in places of their residing; 2. absence of knowledge at the majority of the population and even experts in a problem of bugs; 3. difficulties in revealing places of bugs shelters that interferes with their duly detection

At control measures against bugs we used the pyrethroids organophosphorus and carbamates preparations. The basic method of processing was spraying by water solutions of emulsions or microcapsulated preparations. At high quantity of bugs was added dust on plinths. All of preparations were effective, that did not point out resistance to them in bugs. Organophosphorous preparations were more reliable, since possessed ovicidal action. Results of control measures on bugs depend, basically, from desinsektion of all premises where bugs are revealed and adjacent to them as preventive, and also from full detection of all places bugs shelters.

TU 83
Climate change and insect biodiversity In Pakistan: A critical review

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Studies have been made to investigate the impacts of climate change on this region and biodiversity in Pakistan. Climate change affects biodiversity directly, and leads to the extinction of plants and animals that cannot keep up with rapid climate change. This is especially devastating in places where there are few plants or animals scattered over large areas. Because ecosystems are interlinked (i.e. if one plant dies out, it may affect a whole range of animals and insects (and possibly even other plants) that rely on it for food, shelter or reproduction) then even small changes may be important to the system as a whole. It is predicted that a major shift of flora and fauna is due to the increased temperatures and variable rains, especially on tropical dry forests, arid and semi-arid regions and deserts of Punjab, mangrove and sandy desert of Sindh, rocky desert of Balochistan and moist & dry savanna and pine forest of North-West Frontier Province of Pakistan. Climate change may alter the range and abundance of species present in an ecologic community. Nutrient cycle changes, community relocation, and biodiversity loss may each affect vector physiology and behavior (such as host-seeking characteristics and biting rates), vector populations (by increasing or decreasing birth or death rates), and vector migration (by changing availability of suitable habitats). Similarly, the ecologic factors may each directly influence pathogen dynamics for non-vector-borne diseases. Increase in rainfall and temperature could involve expansion of the malaria-carrying Anopheles mosquito into areas where malaria has never existed, or had been eradicated. Desertification may counter this effect, but "on the whole, increasing temperatures could be expected to increase the reproduction rates both of the parasites and their vectors and hence augment transmission of malaria. Humid and warm weather throughout July and into August has provided an ideal environment for bed bug, cockroaches, termite, ants to breed. It is expected that these insects infest thousands of Pakistani homes.

There has been little research on Insect Biodiversity of Pakistan with reference to climate change. About 5,000 species of insects have been recorded (out of which 1,000 species of true bugs, 400 species of butterflies and moths, 256 species of grasshoppers & locusts and crickets, 135 species of beetles & weevils, 103 species of bugs, 110 species of flies, 73 species bees, wasps & ants, 65 species of plant hoppers, 52 species of thrips, 49 species of termites, 48 species of dragonflies and damselflies, 42 species of neuropterans, 32 species of cockroaches and few number of species in minor insect's orders are reported by the Department of Entomology, University of Agriculture, Faisalabad and University of Karachi, Pakistan, Biodiversity Action Plan for Pakistan, WWF - P, IUCN - P and GoP.

Climate change impacts many of insect populations i.e., reductions in the extent of distribution size of some of the species that feed on pests in forest, grassland, and agricultural ecosystems. Pollinators' population in plains has been decreased and observed to shift to mountainous region (northern part of Pakistan) whereas bees' swarms which were moved from southern part to central and to northern part have been decreased 50 percent since last 10 years due to environmental change including high temperature, dust and pesticide sprays. Few years back in Murree, Galiat, AJK typical die back symptoms were observed in Kail pine trees during summer. A pine shoot beetle (*Tomicus piniperda* L.) was the culprit. Its population flourish owing to the climatic change in the area like high temperature, less snow etc.

resulting a severe outbreak while Leaf butterfly- *Kallima inachus* (Nymphalidae: Lepidoptera) in Pothohar region has been extinct due to this climate change.

TU 84-94: Vector-borne diseases - biogeography and population biology(incl. Myiasis)

TU 84
Prevalence of head louse infestation and associated factors in elementary schools students in city of Aran and Bidgol (Esfahan Province, Iran) 2008

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Objective(s): Pediculus capitis is one of the blood sucking insects and an external human parasite that has worldwide distribution. Infection by this parasite has been observed in all age groups, but it is more prevalent among elementary school students. Louse infection causes serious health as well as social problems and stigma. These problems may lead to drop in academic achievement of students. Since no systematic study has been conducted in the city of Aran and Bidgol, this study was carried to examine the frequency rate of infection and factors associated with this disease in elementary students in education year in 2007-2008.

Methods: In descriptive epidemiologic research, head louse infection was examined in all groups of schools children male and female student in the city of Aran and Bidgol. The students were screened by standard questionnaire and demographic data and related information were obtained by interview and observation. The diagnose of head lice infestation was based on live louse, nymph or nit on the scalp of students. The data were analyzed by SPSS using Chi-square and fisher's exact tests.

Results: In this study, a total of 3589 students were examined in 19 male and female schools. The mean age of students was 8.67±1.57 year and age group ranged between 6-12 year. The prevalence of head louse infestation in students was 0.47%. The head louse frequency were 0.42% and 0.05% in female and male respectively. The head louse infection rate in male and female schools was 0.1% and 1%, respectively. This survey showed that 1% of the female student schools and 0.1% of the male student schools were infected to head louse.

The results showed a significant association between pediculosis and sex, father's job, mother's education, bathroom in home, prior infection, drug use and nationality, respectively.

Conclusion: The results of study indicated that the prevalence of pediculosis wasn't a major health priority and health concern in the city of Aran and Bidgol in education year 2007-2008. However, it was suggested that enhancing general knowledge about the infection can prevent the increase of infestation incidence. Hygienic teachers and individual hygiene instruction to students play an important role.

TU 85
Pediculus and Pediculosis from the past to today

Nihal Doğan

Turkey

Pediculosis, an infestation by *Pediculus* sp. arthropods commonly known as lice, has been a public health problem for all of human history. While its effects are for the most part mild because the infestation occurs only on the surface, managing the disease has presented a challenge for public health measures because lice are so common and widespread. Lice exist in virtually every country of the world, particularly within poor rural areas and communities where personal hygiene and sanitation are bad. They are spread easily from person to person.

Lice have been a human annoyance throughout all human prehistory and history, since biblical times. A passage in the Bible describes how Aaron "stretched out his hand with his rod and smote the dust of the earth and it became lice in men and beast" Lice were present in ancient civilizations across the globe, although they were not considered bad in all civilizations. For example, the Aztecs used to bring bags of lice in place of gold to pay their respects to Montezuma. Lice were also present across time, running rampant in Europe of the Middle Ages and Renaissance, especially among the poor people who didn't bathe and lived in squalor.

In the 16th and 17th centuries, lice began to be documented as distinct species for the first time, by Francesco Redi who described *P. pubis* in 1668, and by Carl de Geer who described *P. capitis*. Pediculosis, or the infestation of lice, was first described by Joseph Jakob Plenck in the 18th century, as he identified five types of lice based on where they were found on the body. In 1842 Erasmus published a textbook in which pediculosis and lice were identified and defined in current terms. Since then, starting with Zinsser in 1935, most modern studies have focued on outbreaks of lice as well as the role of lice in the transmission of typhus.

TU 86
New areas of Asian tiger mosquito (*Aedes albopictus*) invasion in North Eastern Italy

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Since its introduction in 1991, the Asian tiger mosquito (*Aedes albopictus*) has colonized almost all Italian regions. Recently the mosquito was found in mountain areas of northern Italy, overcoming the supposed altitude limit of 600 m.a.s.l.. From 1992 several monitoring programs aimed to assess the presence of *A.albopictus* involved progressively 580 municipalities of Veneto region. We report the results of the monitoring comparing 1992-2004 to 2005-2009 period. In addition, from June to November 2009 a ovitrap sampling (30 traps per city; weekly collection) was realized in 5 cities to estimate the population density. Sampling sites included private properties, public gardens, tire depots and cemeteries. *A. albopictus* (larvae or adults) was present in 475 (82%) municipalities and 94 of them (16%) were previously not infested. The highest density of eggs was recorded in August in all sites (mean eggs/trap range 16.1-210.3). The municipality more infested was Legnaro (Padua province), located at sea level, with 38.265 eggs collected, the less infested was Feltre (Belluno province), with 2.661 eggs, located at 325 m.a.s.l. in an area recently colonized. The results show that *A. albopictus* is spreading in northern areas and at higher altitude. These data can be used by the local and regional authorities to monitor the expanding trend

of this tedious mosquito, to control the effectiveness of disinfection actions and to design preventive plan on possible transmitted agents.

TU 87
Flea-borne Anaplasma sp. in Lithuania

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A total 259 fleas were collected from 6 species (*Apodemus agrarius*, *Apodemus flavicollis*, *Myodes glareolus*, *Microtus agrestis*, *Microtus arvalis*, *Sciurus vulgaris*) of 163 specimens rodents. Three families of fleas were recorded: Ceratophyllidae, Ctenophthalmidae and Hystrichopsyllidae. A few species *Ctenophthalmus agyrtes*, *Megabothris turbidus, M. walkeri* and *Hystrichopsylla talpae, Ceratophyllus sciurorum* was described. The rodents infestation of fleas was different depending on rodents species and district of capture. Each fleas was individually tested for the presence of Anaplasma pathogens of 16s rRNR gene. The prevalence of *Anaplasma phagocytophilum* infection in flea's samples was determined by polymerase chain reaction using primers EHR521 and EHR747. The obtained specific products of 247 base pairs were considered as a positive result. Anaplasma pathogens were detected in 124 (14,4%) fleas.

TU 88
Infection of *Ixodes* ticks by *Borrelia burgdorferi* s.l. in Baltic countries

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A total of 524 unfed *Ixodes* ticks were collected from the vegetation by flagging in 19 sampling sites, spread with distance of 50 km from each other, in Lithuania, Latvia and Estonia during May of 2008. In Lithuanian locations were collected only *I. ricinus*, in Latvia and Estonia *I. ricinus* and *I. persulcatus* tick. 419 collected ticks were tested for presence of causative agent of Lyme borrelioses *Borrelia burgdorferi* s.l by using molecular detection methods. The overall infection rate of *B. burgdorferi* s.l. in *I. ricinus* ticks collected in Lithuania was 18%, in Latvia 11.1 %, and in Estonia 4.3%; infection rate in *I. persulcatus* from Latvia was 25.9%, in Estonia 19.4%. According to our date, in general, the higher infection rate was noticed in *I. persulcatus* than in *I. ricinus* ticks and the prevalence of *B. burgdorferi* s.l. infection in *I. ricinus* have decreased from southeast to northwest (from Lithuania to Estonia). *B. afzelii* was the predominant genospecies in ticks from all three countries and was detected in both tick species. *B. garinii* was identified only in *I. ricinus* from Lithuania. *B. valaisiana* were found in infected *I. ricinus* and *I. persulcatus* ticks in Latvia and Estonia.

TU 89
New anophelines catches in Eastern Spain

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As in other European countries, malaria was an endemic disease in Spain until the second half of the twenty century. Furthermore the disease showed an important heterogeneity in the transmission rates due to different aspects related with the vector abundance and it's specific richness, as well as anthropogenic factors (agronomic practices or socioeconomic questions) that occurred in our country. In 2005 we started intensive larval samplings in Valencian and Murcian Autonomous Regions (Eastern Spain) in order to establish possible scenarios of malaria reemergence. At the moment our samplings allowed the capture of the next 7 *Anopheles* species: *Anopheles algeriensis* Theobald, 1903*, An. atroparvus* Van Thiel, 1927*, Anopheles claviger* (Meigen, 1804), *Anopheles maculipennis* Meigen 1818*, Anopheles marteri* Sévenet & Prunelle, 1927*, Anopheles petragnani* Del Vecchio, 1939 and *Anopheles plumbeus* Stephens, 1828. Finally the "malariogenic potential" of the investigated area will be discussed according to the following three factors: receptivity, infectivity and vulnerability.

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TU 90
Invasion of cockroaches in Russia cities

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9 species of synanthropic cockroaches are registered in cities of Russia. Its can be divided into the following groups.

1. Blatta orientalis (L). and Blattella germanica (L.) have got on territory of the European part of Russia in XVII-XVIII centuries. Live in many cities - all-the-year-round inside buildings. During a warm season these species can meet outside of structures.

2. Periplaneta americana (L). and P. australasiae (Fabr.) for the first time have been marked in Russia in the beginning of XX century. These species, and also species representatives of the following group meet only inside buildings.

3. Species of this group: Neostylopyga rhombifolia (Stoll.), Supella longipalpa (Fabr.), Nauphoeta cinerea (Oliv.), Blaberus sp., Gramphodorina sp.

Invasion of cockroaches of these species is marked in 70-80 years of XX centuries with increase in contacts of Russia with the countries of a Earth southern hemisphere. Despite of the data numerous invasions of cockroaches of these species, the majority of them does not form constant populations in cities of Russia.

Now such populations are known to us from four species: Bl. germanica, Bl. orientalis, P. americana and S. longipalpa. Constant dwelling and distribution of introduced species of cockroaches in territory of Russia is interfered, apparently, by the following factors. Low temperatures, especially in the winter, do not allow thermophilic species of cockroaches to live and move outside of buildings. Inside its the temperature 14-22º C also is not optimum for their development and reproduction. The food supplies accessible to cockroaches, also do not correspond to their natural preferences.

TU 91
The comparison of three primers for detection of *Plasmodium vivax* parasites from *Anopheles sinensis* (Diptera : Culicidae)

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Vivax malaria reemerged in the Republic of Korea (ROK) in northwestern Gyeonggi Province near the demilitarized zone (DMZ) in 1993, and it increased exponentially to 4,142 cases by 2000 before declining to 774 cases in 2004. Anopheline mosquitoes were individually tested by using a PCR for the presence of *Plasmodium vivax* MSP-1, CSP and 18S rRNA gene proteins. The conditions for PCR-based detection of *P.*

vivax from anopheline mosquitoes were determined according to the detection method of *P. vivax* from human blood in the malaria management guideline of Korean Center for Disease Control & Prevention. However, the detectable sensitivity was decreased when the conditions were applied to the mosquitoes. In this study, we corrected some conditions for dragging status occurred when CSP primer was used for detection of *P. vivax* from anopheline mosquitoes and selected the most effective primer among the primers for detection of *P. vivax* from anopheline mosquitoes. The detection of *P. vivax* from the anopheline mosquitoes was the most effective when 18S rRNA gene protein was used.

TU 92

Infection of *Plasmodium vivax* parasites in Anopheline mosquito (Diptera: Culicidae) from Inter-Korean transit office, 2009

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Species distribution and *Plasmodium vivax* infection Rates were evaluated on *Anopheles* mosquitoes from two Inter Korean Transit Offices (IKTO) near in malaria high-risk areas (Dora Mt. and Geumgang Mt.) near the demilitarized zone (DMZ) in the Republic of Korea (ROK) from April to September, 2009. *Anopheles sinensis* Wiedemann (42.6%) was the most abundant *Anopheles* mosquito captured from DIKTO, followed by *Anopheles kleini* Rueda (30.4%) and *Anopheles pullus* M. Yamada (15.3 %). At GIKTO, *An. sinensis* accounted for 89.1 % of all *Anopheles* spp. captured by New Jersey light trap, followed by *Anopheles belenrae* (4.5%) and *An. pullus* (3.9%), whereas collection rate of *An. kleini* was lower than one of DIKTO (2.4%). In addition, *Anopheles* mosquitoes captured by New Jersey light trap at two areas were assayed by Polymerase Chain Reaction (PCR) for *P. vivax* 18s gene and the results were very different. *Anopheles pullus* of *Anopheles* mosquitoes from DIKTO demonstrated the highest vivax impaction rate of 3.0 % , followed by *An. belenae* and *An. kleini* with impaction rates of 2.7 % and 2.5 %, respectively. *Anopheles kleini* of Anopheline mosquitoes from GIKTO exhibited the highest vivax impaction rate of 5.6 %, followed by *An. belenrae* with vivax impaction rate of 1.5 %, while no *An. pullus* and *An. lesteri* demonstrated positive impaction activity of *P. vivax*.

TU 93

Detection of flaviviruses in mosquitoes (Diptera: Culicidae) in Central Europe

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Several viruses are transmitted (vectored) between susceptible vertebrate hosts by hematophagous arthropods. Predominantly, members of the Alphavirus genus (Togaviridae), Flavivirus genus (Flaviviridae), Orthobunya-, Phlebo- and Nairovirus genera (Bunyaviridae), as well as Orbi- and Coltivirus genera (Reoviridae) are arboviruses (arthropod-borne viruses); however further RNA and DNA viruses belong to this ecological category. In most cases the arthropod vectors (mosquitoes, ticks, midges, flies, *etc*.) are biological vectors, therefore significantly contribute the maintenance of the pathogens in the environment.

The genus Flavivirus in the family Flaviviridae comprises over 50 virus species, including significant human and animal pathogens (i.e. Yellow fever virus, Dengue virus, Tick-borne encephalitis virus, West Nile virus). Flaviviruses are vectored by ticks or/and mosquitoes.

In Central-Europe the unexpected emergence of two mosquito-borne flaviviruses has been recorded within the last decade. West Nile virus (WNV) is a well-known pathogen, which occurs world-wide and causes outbreaks of encephalitis, predominantly in horses, humans and birds. An exotic strain of WNV (genetic lineage 2) emerged in 2004 in the South-Eastern region of Hungary, and caused sporadic cases of encephalitis in wild birds. In the subsequent years the strain established a successful transmission cycle, became endemic, and in 2008 exhibited considerable geographic spread, in Hungary, and in the eastern regions of Austria. The strain caused mortality in birds of prey, and encephalitic illnesses in horses and in humans. The principle vector of WNV is the *Culex pipiens*; however the virus was also detected in several other mosquito species and in ticks too. Limited surveillance studies were applied to detect WNV RNA in mosquito pools collected in WNV affected regions of Hungary and Austria. Our studies demonstrated the presence of WNV in approximately 5% of the *Cx. pipiens* pools. In 1997 another WNV strain (Rabensburg virus, genetic lineage 3) was isolated from *Cx. pipiens* in South Moravia, Czech Republic. This virus was re-isolated in the same area in 1999 from *Cx. pipiens*, and in 2006 from *Aedes rossicus*, however its ecology and clinical importance is not clarified yet.

Another mosquito-borne flavivirus, the Usutu virus (USUV) emerged in Austria in 2001. Previously this virus was detected only in Africa, without apparent pathogenicity. The virus caused significant wild bird mortality in Austria, and within a few years spread to Hungary, Italy and Switzerland. Predominantly wild birds (blackbirds, owls) were affected; however, recently encephalitic human USUV-cases were also reported in Italy. Our studies identified the presence of USUV RNA in *Cx pipiens, Cx hortensis, Cx territans, Culiseta annulata, Ae. vexans* and *Ae. rossicus* pools.

The results of our studies emphasize the human- and veterinary health importance of the surveillance and control activities on culicid mosquitoes in Central Europe.

TU 94

Evaluation of the human biting ticks in Crimean-Congo Hemorrhagic Fever endemic and non-endemic areas of Turkey

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Ticks are important pests of domestic animals and vectors of the health threatening agents for both animals and humans. Risk of tick-borne diseases is dependent upon the presence of the infective agents in the area as well as the prevalent tick species, its abundance and their preferences towards humans as hosts. Turkey has been experiencing a large outbreak of Crimean-Congo Hemorrhagic Fever (CCHF), mainly in Central Anatolia. Most CCHF cases had the history

of tick bite. In 2007, a passive surveillance for tick bites in humans was undertaken in various regions of the country. The purpose of this study was to evaluate the species of ticks biting humans in the CCHF endemic and non-endemic areas. A total of 15477 ticks were collected from the individuals residing in areas with hyperendemic, sporadic and non-endemic CCHF characteristics. Various developmental stages of 7 genus were encountered in tick samples. The ticks from hyperendemic areas (Central Anatolia) were mostly *H. marginatum* (35,53%), while the pravalent ticks from non-endemic and sporadic areas (Black Sea and Trace regions) were *Ixodes ricinus* (86,79%) and *H. aegyptium* (69,35%). Although certain differences have been observed in the prevalent human biting tick species according to the regions, the highest tick-bite case numbers were encountered between May and August in all regions. Considering that the study was a passive surveillance and involved the hospital applications, this situation was concluded with the human-tick interaction rather than the actual annual activities of the certain species.

TU 95-98: RNA interference, a novel tool in analysing hormone function

TU 95
The variability of mtDNA in *Drosophila subobscura* from the Derventa River Gorge (Tara National Park, Serbia)

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The variability of mtDNA haplotypes of *Drosophila subobscura* has remained largely uncovered in studies in the region of Balkan Peninsula, which is considered as one of the glacial refugia for many European species, including insects. Therefore we analyzed haplotype variability in the population collected from the Derventa River Gorge (Tara National Park, Serbia). In addition, we had special interest to check for the previously described linkage disequilibrium between this type of polymorphism and chromosomal arrangements, which can shed more light on the variability of mitochondrial haplotypes. This population, like others in the species range is characterized by the prevalence of two haplotypes (named II and I), as well as less frequent ones derived from them. One of the rare haplotypes from this study has never been described before. The presence of Wolbachia was excluded. The Tajima D test did not show significant deviation from neutrality. Linkage disequilibrium has not been found, except for the significant negative association between haplotype I and $O_{\underline{3+4}+1}$ arrangement, which can be accidental due to relatively restricted sample size, together with the relatively small frequency of this gene arrangement.

TU 96
Do meiotic prophase stages occur in parthenogenetic weevils (Coleoptera: Curculionidae)?

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All asexual weevils studied so far have been described as apomictic, lacking recombination with equationally divided chromosomes as in meiosis. The adoption of parthenogenetic reproduction by weevils is accompanied by a change in the mechanism of meiosis. Because there is no gene recombination, the progeny are genotypically similar to the mother and new forms may arise only through mutation. Almost all parthenogenetic forms of curculionids are polyploids, and triploidy is by far the most common level of ploidy. In all analysed species single clusters of metaphase plates with a haploid number of n = 11 were visible. Some oogonial cells showed nuclei configurations resembling the stages of diplotene and diakinesis. At this stage chromosomes are strongly contracted, short and thick and clearly deviate from mitotic chromosomes. The spiralized chromosomes in these nuclei may have been connected by chiasmata resulting in rods figures and ring-shaped bivalents. Presence of remnants of meiosis shows that incomplete suppression of meiotic stages occurs in parthenogenetic weevils but unfortunately this observations does not settle the origin of apomictic forms from bisexual ancestor.

TU 97
Isolation of mutants by transposon remobilization in the *Drosophila* genes coding for the FMRFamide-related neuropeptides and their specific receptors

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Neurohormones steer important processes like reproduction, feeding, behaviour, circadian rhythm, etc. in all the Metazoa from worms to humans. They are also very important regulators of insect life. We apply the powerful method of genetic analysis for studying the action mechanism of the FMRFamide-related (FaRP) neuropeptides (FMRFa, Dms and Dsk) and their receptors (FR, DmsR-1, DmsR-2, DskR-1, DskR-2) in the Dipteran *Drosophila melanogaster*, one of the most developed model systems available among the higher Eukaryotes. To this end, we isolate mutants of the genes coding for the *Drosophila* polyproteins (carrying the peptide fragments) and the specific receptors. To induce mutations we use the method of transposon remobilization. Except for the *Dromyosuppressin* (*Dms*) gene, all the other genes have P element (P) or Minos (Mi) transposon insertions. With the help of their specific transposase enzymes, the transposons are made to „jump", leaving behind a double-strand break lesion in the DNA. The repair process of the lesion frequently generates intragenic deletions, equivalents of „null" mutations which abolish gene function.

The poster summarizes the results of the ongoing mutant isolation experiments, and the preliminary characterization of the mutants with respect to gene activity and the possible developmental effects.

TU 98
Molecular characterization of a sodium channel gene from *Spodoptera littoralis*

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Pyrethroids are known to target voltage sensitive sodium channels in nerve membranes in insects. However intensive use of pyrethroids has led knock down resistance. Studies on the relationship between knockdown resistance and mutations in insect sodium channel genes were greatly

advanced. Characterization of insect sodium channel gene is important in terms of understanding insecticide resistance mechanisms. Isolating sodium channel sequences identified numerous gene mutations associated with knockdown resistance both in insects. In this study we cloned and sequenced full length cDNA sequence of sodium channel gene from *Spodoptera littoralis* (*SpliNa*), an important pest of cotton and vegetables in Turkey. The deduced amino acid sequence of SpliNa shares identity with *Bombyx mori, Bombyx mandarina, Heliothis virescens,* and *Plutella xylostella*. A phylogenetic tree was generated based on the sequences in order to understand the evolutionary relationships between sodium channel genes in insects. The sequence data will provide a critical step toward a comprehensive functional characterization of insect sodium channels and will provide further information on insecticide resistance mechanism.

TU 99-100: Science and society (incl. Communication of entomology to society and decision makers

TU 99
Role of the European Food Safety Authority in pest risk assessment and risk communication with reference to insect species potentially harmful to plants

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The European Food Safety Authority provides independent scientific advice and transparent communication on risks relating to the safety and security of the food chain in the European Community. The EFSA Scientific Panel on Plant Health addresses the increasing demand of EU risk managers for scientific advice on risks posed by organisms harmful to plants and plant products. Advice is published as scientific opinions which provide a basis for consideration of phytosanitary measures to protect against the introduction and spread of harmful or invasive species in the European Community, under Council Directive 2000/29/EC. Since its inception in 2006, the Panel has delivered forty scientific opinions on the risks posed by species of invasive plants, invertebrate pests and pathogens, and pathways for pest movement and guidance on the process and methodology for the evaluation of risk.

The process and methodology for the evaluation of risk is discussed with reference to insects considered harmful to managed plants of agricultural, horticultural or silvicultural importance, and to plants in their natural environment.

TU 100
Bugwood Image Database System: Web-accessible, taxonomically-referenced images available to support education

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The four web systems that comprise The Bugwood Image Database System (http://Images.bugwood.org/) is operated by The Center for Invasive Species & Ecosystem Health (www.bugwood.org). The four sister websites are based upon a fully-relational, taxonomically-base database and are focused on species of economic, environmental and natural system concern. 115,000 referenced images taken by 1,600 photographers that are reviewed for content and quality are available for no-cost educational uses.

Topics covered include invasive species (Invasive.org), forestry (ForestryImages.org), integrated pest management (IPMImages.org), forest health (ForestPests.org) and natural resource management topics. The fully-integrated systems enable users to access/locate images through subjects that include insects (InsectImages), diseases, plants, diagnostic characteristics, and geographical area. Over 20,000 images originated outside of North America with 13,000 images taken in Europe. We view images as tools that are available to be used by others for their applications. Bugwood Image Database System received 145 million hits and was accessed by 2.6 million users during 2009.

We will: introduce the Bugwood Image Database system, provide examples of how they are being used, how they are being integrated with and support other web systems, cover how they are serving as global resources, and outline plans for building a European component of them to support educational programs.

S37: Phylogeny of insects I.

Room Rome

Hexapod affinities and basal evolution: lessons from neuroanatomy

Rudi Loesel

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The brain of arthropods provides a large amount of independent morphological characters that can be used for evolutionary considerations. In the last few years neuroanatomy has become increasingly important in postulating new trees and in testing existing hypotheses on phylogenetic relationships. These studies demonstrate that within the Hexapoda the basic architecture of the brain is surprisingly conserved. Minor differences, e. g. with respect to the relative size or complexity of certain brain regions are correlated with the behavioral ecology rather than with the phylogenetic position of a given taxon. While neuromorphological studies therefore offer only a poor resolution on the interordinal level, they nevertheless provide a rich amount of data that helps to elucidate the origin of hexapods and their position within the arthropod tree. This talk summarizes recent phylogenetic studies that are based on neuroanatomical comparisons and provides novel hypotheses on the evolution of the (pan-) arthropod brain.

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The "Entognatha-problem" from the molecular data perspective

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In the recent past both nuclear and mitochondrial markers have been used to elucidate the phylogenetic relationships of the entognathous Protura, Collembola, Diplura and Ectognatha. Results obtained so far, however, leave the sister group relationships among entognathous hexapod orders as well as the monophyly of the Entognatha and even of the Hexapoda still controversial topics.

Nuclear rRNA 18S and 28S genes give support to monophyly of Entognatha and to a sister group relationship between

Protura and Diplura (Nonoculata). Since this relation has never been proposed before by morphological research, it was surmised to be an artificial result due to shared G-C bias and lineage specific changes in rate of evolution. However, Nonoculata is also supported when statistically refined methods of data analysis are used (time heterogeneous models of sequence evolution).

On the contrary, mitochondrial rRNA 12S and cytochrome b give weak support to the traditional grouping of Protura with Collembola (Ellipura). Although no complete mitochondrial genome of Protura is published so far (i) available genomes from other entognathous hexapods indicate that their gene order seems not to be informative at interordinal level and (ii) concatenated protein-coding gene sequences generally fail to recover monophyly of Hexapoda even when a new matrix of amino acid replacement is used.

Multi-gene as well as phylogenomic approaches cannot significantly contribute to the discussion as long as no data are available for Protura.

Aim of this contribution is to review and critically discuss the state of the art and to present new data from ongoing studies which may help to deepen our insights into the earliest splits in the hexapod lineage.

Evolution of the earliest true insects: anatomical evidence

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Phylogenetic analyses of early branching events in insects are still based on only a few exemplars of the extant subgroups Archaeognatha and Zygentoma and also commonly ignore the fossil record of primarily wingless insects. Previous attempts to trace character evolution in insects accordingly remain incomplete and disputable. A morphological character matrix has now been developed to cover the diversity of taxa and character states in apterygote insects more comprehensively. The present sampling particularly contributes and summarizes the current knowledge of characters inferred from internal anatomy, including the alimentary canal, excretory organs, gonads, the tracheal and circulatory systems, as well as the composition of the central nervous system. Character optimizations proved to be particularly sensitive to competing resolutions of the Lepidotrichidae and of the extinct Monura. Extinct and extant members of the Lepidotrichidae are retrieved as a monophyletic unit, but are variably resolved as sister group of remaining Dicondylia (Zygentoma + Pterygota), of remaining Zygentoma, or of the Nicoletioidea (Nicoletiidae + Ateluridae) among zygentomans, which strongly impedes the reconstruction of ancestral character states of the dicondylian insects. Monurans are either resolved as sister group of Archaeognatha or as representatives of the insect stem-lineage, which likewise causes some ambiguity with respect to the insects' ancestral character states.

Grylloblattodean affinities: new light on a classic enigma

Benjamin Wipfler
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Since its discovery in 1914 Grylloblattodea puzzled scientists. The extant 26 species that colonize very cool alpine habitats around the northern Pacific are grouped in one family. They represent the scarce remnants of a once successful insect lineage with 43 families distributed all over the world. The extant species were addressed as "living fossils". They are characterised by a considerably number of plesiomorphies such as for instance 5-segmented tarsi, multi-segmented cerci, and articulated male coxosternites, combined with some highly derived features like a completely reduced flight apparatus (still functional in fossil species), carnivorous and scavenging habits, and the preference for very cool habitats. The phylogenetic placement of the order promised to illuminate the largely unsolved phylogenetic relationships of lower Pterygota. However, during the decades, virtually every lower neopteran order was proposed as closest relative.

The discovery of Mantophasmatodea in 2002 revived the interest in the phylogeny of the basal neopteran lineages. In several recent studies a sistergroup relationship between Grylloblattodea and Mantophasmatodea was suggested, i.e. a clade Xenonomia. It was supported by molecular data, sperm ultrastructure, and features of the proventriculus. New investigations of head and thoracic structures revelaed new potential apomorphies: a membranous nuclei-containing connection between the antennal ampullae and the supraoesophageal ganglion, a distinct angle formed by the submentum and mentum, ventrally orientated labial palps, the presence of M. metaspina-coxalis, and the loss of M. tentoriohypopharyngalis, M. tentoriopraementalis superior, M. mesocoxasubalaris, M. mesofurca-coxalis posterior, M. metacoxa-subalaris and M. metafurca-trochanteralis.

S38: Chemical mimicry and defence mechanisms of arthropods II.

Room Maastricht

Chemical mimicry and the evolution of pollination systems

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Chemical signals are of major importance in the communication of insects. Several plants imitate such signals to manipulate the behavior of insects for their own advantage. Chemical mimicry in pollination is most diverse among the orchids, which mimic dung, carrion, fungi, and mating partners (sexual deception) by producing the olfactory signal insects use to locate these items. Sexual deception is among the best investigated and can serve as a model system for mechanistic and evolutionary questions. Sexually deceptive orchids mimic the sex pheromones of their pollinator species, and pollination occurs when the males attempt to copulate with the flowers. The mechanisms of pollinator attraction are well understood in certain genera, and have proven to be surprisingly diverse. The floral scent of these plants is under selection driven by the pollinators' preferences. This form of selection has lead to the evolution of super-normal stimulation, either through the production of high amount of pseudo-pheromones, or bouquets that differ slightly from the females' sex pheromones, a form of imperfect mimicry. Sexual deception has evolved from food deception, possibly via intermediate pollination mechanisms, with both male and female insects as pollinators. Sexually deceptive orchids, however, suffer lower pollen loss than food deceptive species, possibly as a consequence of the high fidelity of pollinators in this pollination system. In this way, specificity may be a major reproductive benefit, but also driving the diversification in this group of orchids. Adaptation to different pollinators via mimicking their sex pheromones can lead to reproductive isolation through specific pollinator attraction.17.00 –

Spatiotemporal variation and frequency-dependent similarity in morphology of an intra-specific mimicry system

Arne Iserbyt[1], Jessica Bots[1], Stefan Van Dongen[1], Janice J. Ting[2,3], Hans Van Gossum[1], Thomas N. Sherratt[2]

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Discrete and heritable phenotypic morphs limited to one sex only are frequently observed throughout the animal kingdom. This phenomenon is particularly common in damselflies (Insecta; Zygoptera) with typically one female morph (andromorph) resembling the male in body coloration, whereas the other female morph (gynomorph) is differently coloured. The coexistence of these female morphs is usually explained as an outcome of selection to reduce unwanted male harassment. One leading hypothesis is that andromorphs are functional mimics of males, with harassment rates being frequency and/or density dependent. Further, earlier studies suggested that besides body coloration, female morphs also differ in other traits, including life-history characteristics, behaviour and morphology. Here we studied morphologic variation for three consecutive years in six populations of *Nehalennia irene* with high spatial variation in frequencies and densities of males and the female morphs. Despite considerable spatial and temporal variation in morphology, it appears that andromorphs are closer in size to males than gynomorphs. These results suggest that andromorphs mimic males in multiple, phenotypically integrated traits of at least body coloration and various morphologic characters. Furthermore, the extent of morphologic similarity between andromorphs and males, measured by Mahalanobis distances, appears to be frequency dependent. Specifically, the estimated mimic to model similarity increases as mimics become more abundant, as predicted by Batesian mimicry literature and, by our knowledge, tested for the first time in an intra-specific mimicry system.

Does the chemical communication system of tropical *Heliconius* butterflies related to their mimicry-rings?

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The American *Heliconius* butterflies are well known for the complex mimicry-rings basing on their colorful wing patterns. During courtship the males of many species transfer a pheromone to the female scent gland. This so called antiaphrodisiac repels other males and protects a mated female from the vigorous mating attempts of other males during the time consuming egg-laying process. In our studies we analyzed the secretion of the males produced in the scent glands. The monoterpne (*E*)-β-ocimene is the antiaphrodisiac used by *H. melpomene*. Behavioral experiments showed the repellent activity of the fast evaporating compound against males. In contrast, the mated females remain non-attractive for males for several days, pointing to a mechanism which reduces the volatility of the (*E*)-β-ocimene. This evaporation rate reduction can be explained by the concurrent transfer of a mixture of lipidic compounds of low volatility from males to females, which takes place in *H. melpomene* and other species. In summary, the transferred male scent gland secretion comprises two parts, a volatile signal compound embedded in a lipidic matrix.

This two part system also occurs in other species investigated by us. Surprisingly, the volatile signal is identical in some species, but different in others, Furthermore, the lipidic matrix is also specific, pointing to additional functions than alteration of the evaporation rate of the antiaphrodisiac, only. Furthermore, the system is more complex because often two species with similar wing pattern live close together, one usually being a so called pupal-mater, the other not. Males of pupal maters can locate female pupae just prior to eclosion by chemical cues, also identified by us, while non-pupal maters do not show such behavior.

In the presentation the composition of the scent bouquets of males of different species will be discussed and their connection to mimicry discussed.

Generation of reactive oxygen species and antioxidants activity in hemolymph of Galleria mellonella (L.) (Lepidoptera: Piralidae) larvae during encapsulation response

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Insects possess a complex and efficient defense system against pathogens and parasites. The recognition of nonself particles stimulates cellular defensive responses with the recruitment of haemocytes. The main components of insect cellular response are phagocytosis and encapsulation. The encapsulation results in the binding of haemocytes with larger targets like parasitoids, nematodes and nylon implants. It is well known that the melanisation and reactive oxygen species (ROS) activity are the key reactions that lead to encapsulation and destroying of antigen (Lavine and Strand, 2002). But the high ROS levels may result in oxidative stress and significant damage to cell structures of host (Rahman and Macnee, 2000). At present the mechanisms of ROS localization and host protection during encapsulation are not clear. To achieve a better understanding of the encapsulation reaction in insects, the ROS generation, antioxidants activity in haemocytes, phenoloxidase activity in haemocytes and limf of *Galleria mellonella* larvae during encapsulation response by nylon implantates treatments have been tested. Activity of enzyme antioxidants (superoxide dismutase, glutathione-S-transferase and catalase) in hemocytes and generation of reactive oxygen species (ROS) in lymph of the greater wax moth *Galleria mellonella* were studied during encapsulation of nylon implants. We observed that active formation of capsule on the surface of implant is occurred in 15 min after puncture of cuticle by implantant. Active capsule melanization proceeds during 4 hours. ROS generation was significantly increased in lymph of *G. mellonella* and activity of enzyme antioxidants was decreased in insect hemocytes after implant penetration. We suggest that nonenzyme antioxidants of lymph have the key role in maintenance of redox balance during encapsulation.

S39: Biocontrol in crops and storage II.

Room Copenhagen

Entomoparasitic nematodes for control of the Western Corn Rootworm, *Diabrotica virgifera virgifera*

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Entomopathogenic nematodes (EPN) have great potential as biological control agents of arthropod pests and several species of the genera Steinernema and Heterorhabditis are able to infect the larvae of Diabrotica virgifera virgifera. However, field experiments using EPN to control rootworm larvae often produced poor results although nematodes caused high Diabrotica mortalities in laboratory tests. Among

others, the host specificity and the host finding strategy of the nematode species, the environmental conditions in the soil and the timing and method of application are considered important factors influencing the field efficacy of EPN against Diabrotica larvae.

One of the most promising EPN species for corn rootworm control is Heterorhabditis bacteriophora, a species which is already successfully applied against grubs. The species is able to survive in the field in regions with limited precipitation and was proven to propagate very well in Diabrotica larvae. We carried out a three years field study at a location with high corn rootworm infestation in Austria, to test (i) the efficiency of two different formulations of the nematode, (ii) the optimal timing of nematode applications and (iii) the technical applicability of the nematodes with only slightly modified, standard machinery. Diabrotica infestation was standardized before the experiments by infesting maize plants at the experimental sites with Diabrotica eggs during sowing. Approximately 35 000 EPN/plant were applied either at sowing time in mid April or during mechanical weed control in mid June. Nematodes were either shipped in clay and suspended in water prior to application, or formulated as a granulate and directly applied to the soil.

The number of beetles emerging from nematode treated plants was significantly lower than that from control plants, irrespective of application time and nematode formulation. There was a trend that the effect of the nematode treatments on the emergence of beetles was even better than that of coating maize seeds with Clothianidin. However, an estimation of the root damage of the treated plants gave contradictory results. Only maize roots from Clothianidin-coated seeds were significantly less damaged, whereas nematode treated maize plants showed similar damage levels than untreated plants.

One reasons for these results may be that EPN attack root worms late in their development, when roots have already been exposed to larval feeding for weeks, and root damage is already severe. Alternatively, rootworms may avoid the root bases of Clothianidin - treated plants, where the concentration of the insecticide is presumably high, and may complete development by feeding on less contaminated, small peripheral roots. This kind of damage would be underestimated by standard root rating systems (IOWA or Node Injury Scale).

In conclusion, EPN have proven their potential to significantly reduce root worm populations under field conditions. They are a promising tool in a sustainable, trendsetting IPM strategy against western corn rootworm in Europe.

An abundance of mole crickets

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Western Europe and the southern United States have opposite problems with mole crickets (Orthoptera: Gryllotalpidae). In western Europe, populations of a native mole cricket *Gryllotalpa gryllotalpa* (L.), which inhabits (or used to inhabit) 'water meadows' are reported to have declined, and this insect has been declared in the United Kingdom to be an endangered species. The decline has been blamed on change from traditional labour-intensive management of 'water meadows', mechanical cultivation, and use of chemical pesticides. In contrast, the southern states of the USA are beset with enormous numbers of one or more of three South American invasive species of mole crickets. The invaders in the southern USA belong to the genus *Scapteriscus*, which is classified not in Gryllotalpini but in Scapteriscini. These *Scapteriscus* mole crickets cause tremendous damage to non-native cultivated plants. Prodigious use of chemical pesticides against them for decades has yielded only temporary local suppression of their populations at sites of application.

Scapteriscus populations in Florida in the southern USA began to decline from about 1990 in localities where one or more of three species of classical biological control agents, released in the 1980s, became established. These three biological control agents are, a wasp (*Larra bicolor* F., Hymenoptera: Crabronidae), a nematode (*Steinernema scapterisci* Nguyen and Smart, Rhabditida: Steinernematidae), and a fly (*Ormia depleta* (Wiedemann), Diptera: Tachinidae). The population of the wasp is now being enhanced locally, where its services are wanted to control pest mole crickets, by provision of nectar sources in "conservation biocontrol". The nematode is being marketed commercially.

Susceptibility of the plum fruit moth, *Cydia funebrana* (Lepidoptera: Tortricidae) to infection by the *Cydia pomonella* granulovirus (CpGV)

Annette Reineke

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The *Cydia pomonella* granulovirus (CpGV), a member of the family Baculoviridae, is effectively used worldwide for controlling larvae of the codling moth *Cydia pomonella* in apple orchards. Although CpGV is known to be highly specific especially to non-target organisms, few studies could show that CpGV can infect other *Cydia* spp. and other members in the family Tortricidae if viral dosages are substantially increased. The plum fruit moth, *C. funebrana* is regarded as one of the key pests in plum in Europe, with biological control being severely held back mainly due to a lack of available and efficient control agents. To test if infection of plum moth larvae by CpGV is in principal possible, viral suspensions of different CpGV isolates were sprayed at a concentration of 10^7 occlusion bodies/ml on mature plums in the laboratory. Sterile water was used as a control. Freshly hatched *C. funebrana* larvae were allowed to feed and to bore into these fruits and were assessed for mortality within a period of 3-14 days. A substantial number of dead and liquefied larvae were present in the virus treatments and absent in the control. Presence of CpGV in the cadavers was confirmed with CpGV-specific primers in polymerase chain reaction (PCR) and subsequent sequence analysis of obtained PCR products. This result opens up new possibilities for *C. funebrana* control in organic and integrated plum production.

The effects of entomopathogenic nematodes in suppressing hairy rose beetle, *Tropinota squalida* Scop., (Coleoptera: Scarabaeidae) populations on cauliflower in Egypt

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The potential of entomopathogenic nematodes in suppressing *T. squalida* populations on cauliflower from transplanting to harvest was evaluated. Significant reductions in plant infestation percentage and population density/m^2 were recorded throughout the plantation seasons in 2006 and 2007, before and after spraying the plants. Percent reduction in number/m^2 was the highest in March for the treatments with *Steinernema carpocapsae* All and *Heterorhabditis bacteriophora* during the plantation season 2006, while at the plantation season 2007, the reduction in population density was the highest in January for *S. carpocapsae* All and in February for *H. bacteriophora* treatments. In a comparison test with conventional insecticides Hostathion and Lannate, there were no significant differences in control measures resulting from treatments with *S. carpocapsae* The treatments also, reduced the economic threshold of *T. squalida* on cauliflower in this experiment as compared with before and after spraying with both the two entomopathogenic nematodes at both seasons im 2006 and 2007. This means an increase in the marketability of heads harvested as a consequence of monthly treatments.

Wednesday, 25 August

Plenary Lecture 4

Room Copenhagen

Landscape mediation of insect biodiversity patterns and processes

Teja Tscharntke
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Understanding local biodiversity patterns and processes under global environmental change needs a landscape perspective. In this review, we suggest seven hypotheses (and a few subhypotheses) to encourage more systematic research efforts on the role of landscape composition and configuration in determining ecological communities and ecosystem functioning and services.

(1) *The dominance of beta diversity hypothesis*: dissimilarity of local communities determines landscape-wide biodiversity much more than the fragmentation level of habitat.

(2) *The intermediate landscape complexity hypothesis*: effectiveness of conservation management is highest in structurally simple, not cleared (extremely simplified) or complex, landscapes.

(3) *The landscape species pool hypothesis*: local biodiversity is largely influenced by the landscape-wide species pool.

(4) *The landscape-mediated insurance hypothesis*: structurally complex landscapes provide spatio-temporal insurance, i.e. higher resilience and stability of patterns and processes in changing environments.

(5) *The across-habitat spillover hypothesis*: spillover across habitats, including managed systems and natural habitat, contributes to landscape-wide community structure and associated processes.

(6) *The landscape-mediated concentration and dilution hypothesis*: spatio-temporal changes in landscape composition can cause transient concentration or dilution of populations.

(7) *The landscape-mediated trait and functional-group selection hypothesis*: landscape structure drives the selection of particular species traits and functional groups. Broadening the view from local to landscape-mediated effects will help generate solutions for future biodiversity and ecosystem service management.

S41: Insect biochemistry and physiology, including their hormonal regulation I.

Room Maastricht

The quest for novel adipokinetic hormone structures

Gerd Gäde
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A family of peptides that is generically referred to as "adipokinetic hormones (AKH)" is found in the major arthropod taxa (insects and crustaceans). All decapod crustaceans contain the same octapeptide member, namely Panbo-RPCH (red pigment-concentrating hormone), which has a chromatophorotropic effect. In a branchiopod crustacean, such as the cladoceran water flea *Daphnia pulex*, a different octapeptide, named Dappu-RPCH, is found with an undetermined function (to date) and a sequence which is more similar to the AKHs of insects than to Panbo-RPCH. In insects about 50 different octa-, nona- or decapeptide members of this family have been found; functionally, the majority of the peptides are involved in the mobilisation of either lipids, carbohydrates or proline. Structurally similar peptides and receptors are also found in the nematode *Caenorhabditis elegans* and in mammals, where these "gonadotropin-releasing hormones" control reproduction.

In this state-of-the-art lecture I will dwell on one of my research interests, which is to survey the major insect orders and possibly even major families with respect to AKHs present. In this quest I aim to elucidate the primary sequences of the AKHs (in some cases, the preproAKH is cloned) and then to use the structural data, in conjunction with other published characters, to suggest phylogenetic relationships. This review-type lecture will present a strategy for how to derive structural data and will focus on recent examples of novel AKH members, preprohormones and some phylogenetic relationships.

Financial support from NRF and UCT is acknowledged.

Characterising the adipokinetic peptide from the African water scorpion, *Laccotrephes fabricii* (Heteroptera: Nepidae)

Heather G Marco, Petr Simek, Gerd Gäde
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The water scorpion *Laccotrephes fabricii*, is an African bug (Order: Hemiptera; family Nepidae) found in fresh water systems of varying water quality. These bugs are active swimmers and were, thus, investigated with respect to activity metabolism. We identified a neuropeptide hormone that regulates metabolism; the peptide was isolated and its structure determined by mass spectrometry. Analyses of haemolymph metabolite levels revealed that the lipid concentration is almost 4-fold higher than the carbohydrate concentration. Upon swimming of 1h duration, lipids increased significantly in the haemolymph, whereas the concentration of carbohydrates did not change at all. Conspecific injection of an extract from the corpus cardiacum resulted in a highly significant hyperlipaemic response, but no hypertrehalosaemic effect was measured. An octapeptide with the primary sequence pEVNFSPNW amide (code-named Peram-CAH-I), previously known as one of the hypertrehalosaemic and cardioacceleratory peptides from blattid cockroaches, was identified by HPLC and ion trap mass spectrometry in the CC of *L. fabricii*. The lecture will include a comparison with data sets from European nepid species, viz. *Nepa cinerea* and *Ranatra linearis*.

Funding from NRF and UCT is acknowledged.

Lipid, glycogen, carbohydrate and protein patterns during metamorphosis of *Anarsia lineatella* (Lepidoptera: Gelechiidae) reared on different nutritional media

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The patterns of total lipid, glycogen, carbohydrate and protein content were investigated during the metamorphosis of the peach twig borer *Anarsia lineatella* (Lepidoptera: Gelechiidae). Larvae were reared on different nutritional media (shoots, young fruits and artificial diet) under laboratory conditions (25±1°C, 65±5%RH and L:D 16:8h). Biochemical analyses were conducted on specimens sampled at different developmental stages during metamorphosis, from pupation (0h) to adult emergence (120h). Pupae were individually homogenized in 2%Na_2SO_4 solution and diluted with 3 volumes of chlorophorm:methanol (1:2, v/v) and

centrifuged for 10min at 10.000*g* at 25°C. The resulting supernatant was used for total lipid determination, and the pellet, containing most of the polysaccharides, was further treated for the estimation of glycogen and low carbohydrates. General lipid quantification was based on the vanillin reagent method and no further determination of specific lipid classes was made. Cellular lipids were oxidized to small fragments after chemical digestion with sulfuric acid. After the addition of a solution of vanillin and phosphoric acid, absorbance of the colored complex was measured at 490nm (standard: triolein). Glycogen and total carbohydrates (mainly trehalose and glucose) were measured using the anthrone reagent colorimetric method (absorbance on 450nm; standard: glucose). Protein determination was made on crude extracts from individuals of separate samples. Individuals were homogenized with Protein Buffer Solution (PBF1). The homogenate was centrifuged for 4min at 10.000*g* and 25°C. An aliquot of the supernatant was diluted with PBS2 and the amount of protein was determined with the Bradford reagent at 595nm (standard: bovine serum albumin). Mean weight was significantly higher in pupae reared on artificial diet (6.5±0.19 mg) or on young peach fruits (5.7±0.19 mg), when compared to those developed on young shoots (4.4±0.19 mg), ($F=30.402$, df= 2,120, $P<0.05$). Mean lipid concentration of pupae, developed as larvae on young shoots was significantly higher (13,5±1.4 µg/mg of pupae), than that of pupae developed on young fruits (6,3±0.4 µg/mg of pupae) or artificial diet (0,27±0.9 µg/mg of pupae) ($F=23.173$, d.f.=2,84, $P<0.05$). The rearing medium affected significantly the mean concentration of glycogen which was higher in pupae reared on shoots (6,6±0.6 µg/mg of pupae), in contrast to those reared on fruits (2,2±0.4 µg/mg of pupae) or artificial diet (4,3±1,0 µg/mg of pupae) ($F=3.927$, d.f.=2.84, $P<0.05$). No significant differences were observed in carbohydrate ($F=0.768$, d.f.=2.84, $P=0.467$) and protein levels ($F=0.513$, d.f.= 2.90, $P=0.601$) in relation to rearing medium, although carbohydrate levels were considerably lower (9,2±1,4 µg/mg of pupae) compared to proteins (66.4±4,8 µg/mg of pupae).Trends on lipid and glycogen concentration displayed in most cases a U-shaped pattern throughout pupal development. Concentration of lipids and glycogen were higher during early and late stages of metamorohosis (0-24h and 96-120h after pupation, respectively). Glycogen and protein levels appeared quite stable in relation to aging, although in some cases observable pulse trends were indicated.

Lipid metabolism in the midgut of *Rhodnius prolixus*

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A female of *Rhodnius prolixus* requires substrates derived from digestion of blood meal to produce about 40 eggs. Triacylglycerol (TAG)-lipase activities were detected in the midgut of this insect, in the lumen and also in the tissue. These activities were characterized and midgut tissue showed optimum activity at pH 7.0-7.5 and the luminal content at pH 5.0-5.5. TAG-lipase activities varied at days after feeding, were highest at second day, and then decreased. It is possible that lipases are modulated at transcriptional level. Free fatty acids released by lipase were incorporated by the midgut epithelium and used for the synthesis of glycerolipids. After feeding females with radioactive triolein (^{3}H-TAG), labeled lipids, as diacylglycerol and phospholipids, were synthesized in the midgut. The metabolic route responsible for the synthesis of glycerolipids in the midgut was investigated and gene expression of the enzymes of the phosphatidic acid pathway was detected. These reactions require acyl CoA-esters, and the expression of an ACBP (acyl-CoA binding protein) was analyzed. Feeding or the injection of serotonin into unfed females produced similar effects, inducing an increase of 10-5 fold in ACBP gene expression. The mechanisms involved in this control are being studied.

S42: Phylogeny of insects II.

Room Rome

Molecular markers and insect phylogeny: the state of the art

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Molecular systematic analyses have traditionally employed a couple of well characterized genes (e.g. rRNA genes, mitochondrial markers, etc.), well established alignment methods and the three (four) well known tree reconstruction approaches. If we look at the results of all past efforts, we see partial success and also failure in areas, in which morphological analyses have not been able to present robust hypotheses as well. A possible solution to the missing resolution of molecular data is the compilation of enormous genomic/EST data to address phylogenetic problems. I will review these attempts and will show which of the old known phylogenetic problems can potentially be solved with these enormous data. I will also analyze the pitfalls of these data and will try to analyze the new problems we are confronted with using genomic/EST data. As examples I will use the analyses of hexapod relationships and relationships of endopterygote insects.

An additional aspect of molecular systematics is the presence of unused data in publicly available data bases e.g. Gen Bank. For many insects groups, enough data has been published to draw a fairly comprehensive tree, however many investigators are not aware of this. I will discuss strategies to harvest these data and analyze their quality in relation to phylogenetic signal. As an example, I will use the still missing comprehensive tree of Hymenoptera.

Endopterygote interrelationships: the morphological evidence

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We analysed the largest morphological character set ever compiled for Holometabola. The acquisition of anatomical data was optimised. Micro-computer tomography in combination with other techniques turned out as highly efficient for documenting morphology. Our phylogenetic results show little congruence with studies based on rRNA but confirm most clades retrieved with nuclear genes: Holometabola, Holometabola excluding Hymenoptera, Coleopterida (=Strepsiptera + Coleoptera), Neuropterida, Neuropterida excl. Neuroptera, and Mecoptera including Boreidae and Nannochoristidae. Siphonaptera are placed as sister group of Diptera. Mecopterida (=Antliophora + Amphiesmenoptera) was only retrieved in the Bayesian analysis, and with low support. Problems are caused by taxa with many autapomorphies and/or inapplicable character states due to the loss of major structures. Good flying performance, the ability to occupy different habitats as larvae and adults, parasitism, liquid feeding, and co-evolution with flowering plants have likely contributed to the evolutionary success. We argue that even in the "age of phylogenomics", morphology can still play a vital role in phylogenetics. In addition, it is essential for reconstructing evolutionary transformations at the phenotypic level, testing evolutionary scenarios, and for placing fossil taxa.

The tentorium in Neuropterans – adding another piece to the evolutionary jigsaw

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Neuroptera are a small but biologically and morphologically highly heterogeneus hexapod lineage. While the monophyly of the order Neuroptera is well established, the phylogeny within this order is the object of controversial discussions. However, only a few morphological character systems have been examined thoroughly in a phylogenetic context so far.

Aiming to add another informative character set to the analysis of the Neuroptera, we have studied the tentorium, which has already proven to be a phylogenetically informative character in other arthropod taxa. The head capsules of representatives of all neuropteran families were imaged using microCT, and three-dimensional reconstructions of the tentoria were compared.

The tentoria show a high diversity in the shape and the solidity, in the formation of dorsal tentorial arms, and in the muscle attachment areas. While a few characters are clearly driven by functional adaptations to known feeding habits, others show no correlation with ecological types but do exhibit a strong consistency with existing phylogenetic hypotheses.

The evolution of the female genital segments in mecopterid insects

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The female genital segments of mecopterid insects were examined, with the focus on the skeleto-muscular arrangements and on the identification of homologies of the sclerotized parts. Fourty phylogenetically informative characters related to the female postabdomen were analyzed together with 316 other morphological characters, in the framework of a major project on holometabolan phylogeny and evolution. Based on the phylogeny, an evolutionary scenario for the female postabdomen was derived. With high probability, the configuration in Nannochoristidae is closest to the ground plan of Mecopterida: on segments VIII and IX, paired, unspecialized sclerites are found that are certain homologues of elements of the genuine orthopteroid ovipositor. However, the functional ovipositor is not retained in the mecopterid ground plan. The terminal segments (VIII – XI) are telescoping, thus forming a viable device for oviposition in soft, moist substrates. Secondary ovipositors evolved several times independently within Mecopterida (e. g., in Diptera-Tipulomorpha and Mecoptera-Boreidae), but clearly differ from the orthopteroid type. In Amphiesmenoptera, segments IX – X (XI) are extensively fused. Ventral sclerotizations of segment IX are lacking in the ground plan. The anterior margins of segments VIII and IX bear pairs of long apophyses. In contrast to all other mecopterids, the terminal segments are extruded by muscle force.

Endopterygote interrelationships: evidence from thoracic morphology

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With approximately 770.000 described species Endopterygota (=Holometabola) is an extremely species-rich group of organisms. The interordinal relationships are presently still a matter of controversy, especially with respect to the position of Hymenoptera, Strepsiptera and Neuropterida, and the monophyly of Mecoptera. Modifications of thoracic features have apparently played a crucial role in the evolution of endopterygote insects. This includes various subsets of characters such as wing venation, wing articulation, attachment structures, but especially the skeletomuscular system of the complex locomotor apparatus. Cladistic analyses of thoracic features yielded new insights in the phylogeny of the group and the evolution of the character system. The monophyly of Endopterygota is well supported by several thoracic autapomorphies. The most conspicuous feature is a novel type of sterno-coxal articulation. All traditional "orders" with the exception of Megaloptera were confirmed as clades. Hymenoptera are the sistergroup of all remaining endopterygote "orders". The highly controversial Strepsiptera were not placed as sistergroup of Diptera (Halteria-concept) but consistently as the sistergroup of Coleoptera. This clade is mainly supported by characters associated with posteromotorism. The traditional concept with a unit comprising Neuropterida and Coleoptera was not confirmed. Within the former lineage, Neuroptera were placed as the sistergroup of a megalopteran-raphidiopteran clade. Features of the sterno-coxal joint and the wing base associated muscles support a clade Mecopterida (= Amphiesmenoptera + Antliophora), and both subgroups are also monophyletic. Characters of the thoracic skeleto-muscular system strongly suggest the monophyly of Mecoptera, but other character systems (especially the adult head) seem to support a clade comprising Nannochoristidae and Diptera (and Siphonaptera).

S43: Landscape ecology and management I.

Room Copenhagen

Predatory arthropods in agroecosystems relative to habitat age and landscape context

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One measure to counteract the dramatic loss of arthropod species in agroecosystems is the establishment of semi-natural habitats. Along an early successional gradient of sown wildlfower areas (SWA), one type of semi-natural habitats, the nutritional condition and reproductive success of common arable carabid beetles increased with the age of SWA, suggesting populations of predators in agroecoystems to increase with advancing habitat age. In fact, density, biomass and species richness of predatory spiders, carabids and bugs increased significantly with successional age of SWA. Thus, it is recommended to support older stages of succession to increase the numbers of beneficial predators.

In oilseed rape fields located in landscapes ranging from structurally poor to complex, abundance and diversity of predatory spiders were investigated at eight spatial scales. Total number of spider species revealed the strongest positive response to proportions of woody areas at small scale, and agrobiont species were best explained by increasing proportions of fallows at larger scales. Spider density was positively related to length of road-side strips with maximum effects at large scales. The results demonstrate the scale dependent influence of semi-natural habitats on spiders in agroecosystems.

Overall, older semi-natural habitats and complex landscapes appear to particularly encourage populations of predatory arthropods in agroecosystems.

Effects of agricultural management on insect populations and assemblages in Hungary

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Most of the European landscapes are primarily affected by agricultural management. Here we review the results of three studies on the effects of agricultural management on insects in Hungary. In the first study, we examined the influence of set-asiding on butterflies. We sampled set-asides, winter wheat fields and semi-natural grasslands. The species richness and abundance was lowest in wheat fields, set-asides and grasslands were occupied by similar number of species, although abundance was higher in grasslands. Since species composition in set-aside fields vs. grasslands was remarkably different, set-asides can promote the diversity of butterflies in agricultural landscapes. In the second study, we compared the assemblages of true bugs and leafhoppers in extensively vs. intensively grazed grasslands in three different regions of the Hungarian Great Plain. Grazing intensity had no effect on either species richness or abundance of both taxa. Proportion of grasslands within a 500 m circle around influenced the species richness of leafhoppers negatively. In the third study, we started a long-term management experiment on wetland meadows in the Őrség NP (W Hungary) to find the optimal mowing frequency for the populations of the highly endangered scarce large blue butterfly (*Maculinea teleius*). Our preliminary results showed positive mowing effect on the abundance of the butterfly and its host plant (*Sanguisorba officinalis*), while it influenced the frequency of host ants negatively. We conclude that insect taxa may respond differently to agricultural management, thus management schemes should be evaluated and proposed on a case-by-case basis.

Scale and intensity of interaction between meadow and arable field spider assemblages in a Hungarian agricultural landscape

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The Mezőföld region in Hungary typically consists of intensive arable land which dominates large areas on the loess plateaus of the region, and meadows in mosaic with wooded areas which are typical for the incised loess valleys. We carried out a landscape experiment in seven 5x5 km quadrates in the region. The quadrates contained different proportions of arable land and meadow areas, thus represented a land-use intensity gradient. We studied the interaction between the spider assemblages of these habitat types at a series of spatial scales. Samples were taken for three years in two cereal field plots and in one meadow plot per landscape quadrate. We studied the effect of the presence of different habitat types in the landscape neighbourhood of the plots on spider species richness, abundance and community composition. For spiders in the meadow plots the presence of arable habitats had in general a negative effect, while for spiders in the cereal plots the presence of meadows had a positive effect after controlling for local environmental variables and taking into account spatial effect. This analysis had been performed five times for each plot to take into account habitat types within five different radii between 50-1000 m. The strongest effects were observed for habitats within the 100 m and 600 m circles both for meadow and cereal plot spider assemblages. These and further studies into the effective distances of interacting habitat types may help to optimize the spatial distribution of semi-natural areas in a landscape in order to maximize landscape-level biodiversity.

Effects of organic management on carabids and spiders in wheat fields and meadows

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Agricultural intensification is one of the main drivers of biodiversity decline. Organic farming has been introduced to counteract this decline. We investigated the effects of organic farming in a landscape study considering carabids and spiders sampled parallel in two major habitat types. In 2008 we selected ten different landscapes in the vicinity of Göttingen, Central Germany. Within each landscape a pair of organic and conventional winter wheat field and a pair of organic and conventional mown meadow were studied. Within the fields, carabid beetles and spiders were captured by funnel traps in four edge and four interior sites in a one-week sampling period in June. The total diversity of carabids and spiders was partitioned to alfa diversity at sites, between-transect beta diversity, between-pair diversity and between-landscape diversity. Relative values of alfa- and beta diversity depended on taxon and habitat type. Both between-transect and between-pair beta diversities were in comparable amount to alfa diversity (around 8 and 12–15%). Alfa diversities were analysed in glmm models using the following explanatory variables: amount of boundaries in 500m buffer area, management and within-field location. Regardless of taxa and habitat type, alfa diversity was higher in the edges than in the interiors. Organic management increased only the alfa diversity of meadow spiders. We found an interaction between the amount of boundaries and management on the alfa diversity of wheat carabids with negative effect of boundaries in organic and positive effect of that in conventional wheat fields. Our results suggest that the beneficial effects of organic farming depend on taxa and habitat.

S44: Semiochemicals in agroecosystems I.

Room Brussels

Are volatiles from host-plants encoding host quality for the offspring? The case of the grapevine moth, Lobesia botrana

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Females of phytophagous insects use vegetative volatiles as signal to locate plants potentially suitable for oviposition. Polyphagous insects could conceptually use the information carried by blends of volatiles from different sources to differentiate among their host range. Microorganisms interacting with the host plant release volatile compounds, which may, along with plant volatiles, signal the quality of the substrate. Here we tested the hypothesis that the attraction encoded by a given blend is related to the suitability of the emitter substrate as food for the offspring. The polyphagous moth Lobesia botrana exhibit a behavioural

plasticity in response to volatiles from host plants. To test our hypothesis we examined the wind tunnel and the oviposition responses of this insect toward a range of volatile blends emitted by natural oviposition substrates co-occurring in the habitat of L. botrana. Females discriminated among host-plants and a higher attraction was generally observed for plants with a higher suitability for the offspring. A highly complex odour was identified from the most attractive plant. Females were also capable to discriminate among the odour of natural occurring microorganisms that increase food quality of the host-plant.

Oriental fruit moth responses to a plant-derived synthetic mixture: from the behavioural to the neurophysiological level

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Understanding the effects of fluctuations in the ratios of release of volatiles mediating insect attraction to host plants could bring a two-fold benefit. It could provide empirical evidence useful for developing future semiochemical mixtures for pest management and increase our knowledge on olfactory information processing at the neurophysiological level. We used a host-plant derived synthetic four-component mixture that is only bioactive in the presence of a fifth, *per se* inactive compound, namely benzonitrile. This 'model mixture' attracts oriental fruit moth females, *Grapholita* (*Cydia*) *molesta*. We studied the robustness of behavioral and physiological responses of females to manipulations of benzonitrile ratios in the mixture. In Y-tube olfactometer tests, increases of benzonitrile enhanced female attraction to the mixture up to a certain threshold value. Further increases led to behaviourally ineffective but not yet repellent mixtures. We used neurophysiological calcium imaging studies to investigate mixture interactions in the brain. We found two distinct glomeruli in the females' antennal lobes that respond differently to the mixtures. One of these mimicked the behavioural effects. Our results demonstrate the importance of relative concentrations of a minor component (i.e. benzonitrile) in a behaviourally active mixture and indicate that odour mixtures processing inside the antennal lobes is not uniform across glomeruli. Final processing of mixture-related information likely takes place in higher order brain centers.

After landing: leaf surface metabolite activity on a lepidopteran pest

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When the insect is engaged in host plant finding, upon contact with the plant, a perception of sapid chemical cues is involved.

The permeability of plant cuticle to the water soluble plant primary metabolites allows a breakthrough in understanding the recognition of host by the insect. Indeed their proportions onto the plant surface and their quantities (ng per cm^2) provide information on both the plant chemical specific "identity", the plant organ, its physiological status and its adaptation to its environment.

For Cydia pomonella (Lepidoptera, Tortricidae) we observed similarities of landing sites amongst two host and non host rosaceous trees; however following the landing, a scanning of the leaf surface with the ovipositor is a crucial step leading to the acceptance of the site for egg-laying. Thereby a leaf surface metabolite blend of three soluble carbohydrates and three polyols influences the host acceptance and egg-laying. Changing quantity of one of these compounds alter either or both behaviors.

Unintentional actions of pesticides (granulovirus) formulated with sugars as co-formulant on the composition of this leaf surface blend and consequently on the egg-laying and damages of the insect were discovered.

We could induce short or long term modifications of the plant metabolite surface blend by spraying on plants respectively the defense elicitor Acibenzolar-S-Methyl (ASM) and low doses (ppm) of soluble carbohydrates. The metabolite blend induced a reduction or delocalization of the laid eggs.

Interesting implications for the reduction of C. pomonella damages on apple (variations between 20 and 60 % of Abbott efficacy compared to untreated control) were obtained in commercial orchards in Europe during the last four years.

Cabbage root fly-induced volatiles influence behaviour of ground-dwelling predators

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Volatiles resulting from plant – herbivore interactions play a major role in resource foraging by predators and parasitoids; they can be involved in orientation processes, oviposition or feeding site acceptance or patch quality estimation. In the present study we investigated the influence of dimethyl disulfide (DMDS), a major volatile constituent of *Brassica napus* roots heavily infested by the cabbage root fly, *Delia radicum,* on orientation and resource use by its main coleopteran predators. We first carried out laboratory studies where we showed that the staphylinid beetle *Aleochara bilineata* is strongly attracted by this compound and uses it for microhabitat choice. Attractiveness of this compound was also tested in the field, in a naturally complex odorous environment. Using an original setup, specially designed for ground dwelling beetles, different concentrations of the pure molecule as well as attractiveness of the natural blend emitted by infested roots were tested simultaneously. The main predators of *D. radicum* (i.e. the two staphylinids *A. bilineata* and *A. bipustulata* and carabid beetles of the genus *Bembidion*) were shown to be significantly attracted by DMDS but responded in different ways both to the natural blend and to the different concentrations tested. The potential resources searched by each species and their specificity for these resources could explain the differences in the responses of the 3 ground-dwelling predators. The possible use of DMDS for enhancing the natural control of *D. radicum,* a major pest of cabbage crops in northern Europe, will be discussed.

Olfactory response of the acarophagous ladybird beetle, *Stethorus gilvifrons* and the generalist predator *Orius laevigatus* to synthetic herbivore-induced plant volatiles

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Plants infested with a herbivore arthropod can attract predators and/or parasitoids through the emission of natural herbivore-induced plant volatiles (HIPVs). Early laboratory and field studies have also demonstrated synthetic HIPVs to be attractive to the predators. The compounds such as benzaldehyde, farnesene, linalool, methyl salicylate (MeSa) and methyl jasmonate (MeJa), have the potential to effectively recruit the natural enemies, thereby improving Conservation Biological Control. Therefore we studied the

olfactory responses of both the ladybird beetle, *Stethorus gilvifrons* (Coleoptera: Coccinellidae) and the minute pirate bug, *Orius laevigatus* (Hemiptera: Anthocoridae) adults towards odours of synthetic HIPVs in a Y-tube olfactometer. In addition, their effect of different dosages of the HIPVs on behaviors of both *S. gilvifrons* and *O. laevigatus* adults was also studied. Our result shows that the minute pirate bug was highly attracted to trans-2-Hexenal followed by farnesene, linalool, MeSa and MeJa. However, the high dosages of farnesene and linanool were repellent for minute pirate bug. The attraction of ladybird beetle was higher to farnesene odours than that of MeSa, MeJa, trans-2-Hexenal and benzaldehyde. However, the high dosages of farnesene, MeJa and trans-2-Hexenal were repellent to *S. gilvifrons*. The results indicated that some synthetic HIPVs is attractive to these beneficial insects, but further studies should be performed in field conditions for their potential as aids to crop pest management.

The role of herbivore-induced plant volailes in above- and belowground defense priming in maize

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Plants respond to herbivore attack with the release of volatile organic compounds, which can act as indirect defense compounds by attracting natural enemies of the herbivores above- and belowground. Recent studies show that herbivore-induced leaf volatiles can also prime healthy plants nearby, which then react stronger and faster when they themselves are attacked aboveground. This mechanism has been studied exclusively for leaves and it is unclear whether roots can also be primed against belowground herbivores. In a series of ongoing experiments we expose 'receiving' maize plants to the odors of 'emitting' maize plants that are either infested with the belowground larval herbivore *Diabrotica virgifera virgifera* (below-belowground priming) or the aboveground herbivore *Spodoptera littoralis* (above-belowground priming). Receiving plants are subsequently infested with *D. virgifera* to see whether the earlier exposure has an effect on larval performance, plant volatile emission, and/or expression of defense genes. Preliminary results suggest that maize below-belowground priming does not play a major role in the defense of belowground herbivores. We will present our latest results on above- and belowground priming in maize.

S45: Large European and international projects and initiatives

Room Strasbourg

The European distributed institute of taxonomy

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The European Distributed Institute of Taxonomy (EDIT) is a consortium of 29 leading European, North American and Russian institutions, supported by the European commission and aiming at integrating taxonomic research in the European Union and beyond. The EDIT consortium agreement has started on the 1rst of March 2006 and will last 5 years.

Among the members of EDIT are the premier natural history collections-based institutions worldwide, which have both the management capacity and the will to progress towards more modern taxonomy. Their collections are global in coverage and are supported by complementary expertise. More than half of the world's natural history specimens, which constitute the large scale infrastructure for taxonomic research, are held in the repositories of EDIT's membership. EDIT works to provide better, faster and more accountable tools to taxonomists, so that the global production of taxonomic knowledge is significantly accelerated. We organise year-round All-Taxa Biodiversity Inventory and Monitoring programmes, we develop an Internet Platform for Cybertaxonomy with software for the management of taxonomy and biodiversity data, we create collaborative Scratchpad websites to empower research communities across the globe and we improve the training of next generation's taxonomists. All this in addition to helping major taxonomic institutions work better together.

SYNTHESYS: Synthesis of systematic resources

Ian J. Kitching
Natural History Museum, London

SYNTHESYS provides funding for European scientists to undertake short visits to utilise the infrastructure – i.e. the collections, staff expertise and analytical facilities – at one of the 17 partner institutions. These institutions represent an unparalleled resource for taxonomic research offering collections amounting to 324 million natural history specimens, including 3.3 million type specimens, an internationally renowned taxonomic and systematic skill base, and chemical analysis, molecular and imaging facilities.

Recent advances in molecular and information technology research are already being implemented in natural history research and collections management, but there remains scope for coordinated 'quantum leaps' in both areas. SYNTHESYS will provide a sustainable framework for integration via the Joint Research and Networking Activities. The former will deliver new tools to enable Users to more efficiently extract DNA from valuable archive material. In addition, the Networking Activities will provide enhanced quality and quantity of online collections information to virtual users and will implement best practice benchmarks in collections care to raise standards and improve accessibility to European collections for all users. Training in collections management will also be provided to spreads best practice across Europe.

Biodiversity Heritage Library for Europe - Towards a global digital library of life

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The libraries of the European natural history museums and botanical gardens collectively hold the majority of the world's published knowledge on the discovery and subsequent description of biological diversity. This wealth of knowledge is currently available to those few people who can gain direct access to these collections .The body of biodiversity knowledge is thus effectively withheld from use for a wide range of scientific applications. The Biodiversity Heritage Library project has already digitised many million pages of biodiversity literature which are online through the BHL portal (www.biodiversitylibrary.org) A large number of small projects are digitising biodiversity material in numerous institutions across the EU to make access more open, but the corpus is still seriously fragmented. These projects, however, do not use common standards or interfaces and are not interoperable. In alignment with the EC i2010 initiative and co-funded by the eContent plus programme of the European Commission, BHL-Europe will further develop, expand and enhance the Biodiversity Heritage Library from May 2009 to April 2012 (www.bhl-europe.eu). As a Best Practice Network, BHL-Europe will not digitise literature, but manage the acquisition, digitisation, and hosting of the material contained in European institutions and improve the interoperability of European biodiversity digital libraries. Among other objectives, BHL-Europe will provide a multilingual access point for the search and retrieval of digital biodiversity

content through at least two portals, Europeana and BHL. We will implement for example more sophisticate search tools and functionalities to particularly facilitate the search for taxon-specific biodiversity information. We will also develop operational strategies and processes for long-term preservation and sustainability of the data produced by national biodiversity digitisation programmes. BHL-Europe is embedded in a number of other projects and initiatives driving the development and enhancement of the research infrastructure for taxonomists and a large number of other target users all over the world.

ViBRANT – A virtual infrastructure supporting the mobalisation, sharing, reuse and publication of biodiversity data

Ian J. Kitching
Natural History Museum, London

ViBRANT will…
- Integrate European biodiversity initiatives
- Build an integrated platform for biodiversity research
- Support interdisciplinary Virtual Research Communities
- Develop new tools and services

ViBRANT blends social and technical developments to build an integrated Virtual Research Environment for biodiversity researchers. Through the provision of data management, analysis and publication tools, ViBRANT seeks to change the nature of research collaboration and expand opportunities for stakeholders to engage in biodiversity science.

Impacts will include a direct route for stakeholders to access biodiversity data; Increased efficiency for managing ecosystems, biodiversity & natural resources; A self governed, standards based platform facilitating data integration and delivery of social change beyond earlier name and fact recording initiatives.

A Pan-European Species-directories Infrastructure (PESI)

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PESI is a joint initiative of two Networks of Excellence: EDIT and MarBEF, funded by the European Commission under the Seventh Framework Capacities Work Programme and is led by the University of Amsterdam. It was started in May 2008 and will last three years, involving 40 partner organisations from 26 countries and several non-contracted associated partners.

PESI defines and coordinates strategies to integrate the infrastructural components of four major community networks on taxonomic indexing and their respective knowledge (social and technical) infrastructures; those of marine life, terrestrial plants, fungi and animals, into a joint work programme.

The integration of the social expertise networks will result in functional knowledge systems of taxonomic experts and regional focal points, which will collaborate on the establishment of standardised and authoritative taxonomic data and the development of approaches for their long-term sustainability.

The technical integration of these checklists into a joint 'European Taxonomic Backbone' relies on the Common Data Model (CDM), a component of EDIT's Cybertaxonomy Platform, ensuring the proper conceptual mapping and merging of taxonomic databases.

PESI is also involved in supporting international efforts on the development of the 'Global Names Architecture' by building a common intelligent name-matching device in consultation with principal initiatives like GBIF and LifeWatch.

S46: Insect biochemistry and physiology, including their hormonal regulation II.

Room Maastricht

Neuroendocrine control of diuresis in *Rhodnius prolixus* (the vector of Chagas' disease)

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Diuresis in *Rhodnius prolixus* is under neurohormonal control via neuropeptides and serotonin. We have cloned and sequenced a number of neuropeptides that co-ordinate post-feeding diuresis. These neurohormones (including the CRF-related neuropeptide, RhoprDH) act on the anterior midgut and Malpighian tubules to stimulate salt and water transport. These diuretic hormones and other neuropeptides are also involved in a range of feeding-related physiological events, including cuticle plasticization, contraction of muscles of the digestive system, salivation, and increases in rate of heart-beat.

The cessation of diuresis, an essential phenomenon that prevents excessive loss of water and salts, has been less studied, but is under the control of the neuropeptide, RhoprCAP2b. This peptide transcribed from the CAPA gene is an anti-diuretic factor, inhibiting serotonin-stimulated absorption and secretion from anterior midgut and Malpighian tubules respectively. We have recently cloned the RhoprCAP2b receptor, and shown its expression in the digestive system, including the Malpighian tubules.

The overall control of events associated with gorging on a blood meal is complex, involving a range of neuropeptide families and serotonin that act upon a variety of tissues to bias them towards a new physiological state. The parasite causing Chagas' disease is transmitted during diuresis/excretion, and therefore neuropeptides and serotonin control the timing of transmission of this disease.

Supported by NSERC.

Characterization of the crustacean cardioactive peptide gene and its receptor in the blood-feeding bug, *Rhodnius prolixus*

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The blood-feeding bug, *Rhodnius prolixus,* is a major vector of Chagas' disease in Central and South America. Crustacean cardioactive peptide (CCAP) is a cyclic neuropeptide (PFCNAFTGCamide) that was originally isolated and sequenced from the neurohaemal pericardial organs of the shorecrab, *Carcinus maenas.* It has since been found in many invertebrates, including insects, suggesting that it is highly conserved during evolution. Crustacean cardioactive peptide has multifunctional roles in insects, and has been shown to stimulate visceral muscle and cardiac muscle contraction, and to be involved in ecdysis. In *R. prolixus*, the function of CCAP is unknown, and this study is a prelude to elucidating the role of CCAP in this important disease vector.

The CCAP gene (RhoprCCAP) and its receptor in *R. prolixus* have been isolated and cloned. The RhoprCCAP gene contains five exons and four introns, and encodes a 129 amino acid prepropeptide, which, following post-translational processing, produces CCAP. The predicted CCAP amino acid sequence is identical to that of crustaceans and other insects.

RhoprCCAP mRNA is observed in the central nervous system (CNS) using reverse transcriptase (RT) PCR, but not in the gut and salivary glands. *In situ* hybridization reveals that the expression of RhoprCCAP mRNA is localized to a small number of dorsally-situated bilaterally-paired neurons within the CNS, and anti-CCAP immunostaining supports the presence of the peptide within these neurons.

The receptor is a typical G protein-coupled receptor containing 7 transmembrane domains. *In situ* hybridization and RT-PCR are being used to identify target tissues in order to determine the physiological relevance of CCAP in this *R.prolixus.*

Supported by NSERC.

Characterization of peptide hormone processing in the fruitfly brain and midgut

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Peptide hormones play important roles in the regulation of many neuronal, physiological and developmental processes.

Recently, we characterized the peptide hormone complement of the neurohemal organs of *Drosophila* by direct mass spectrometric profiling. We now extended this work and report here on the first characterization of the midgut endocrine peptidome in *Drosophila* by capillary HPLC and off-line MALDI-TOF/TOF mass spectrometry.

Our results corroborate existing immunofluorescent data and show that midgut endocrine cells produce members of at least 6 families of regulatory brain-gut peptides. The amino acid sequences of the processed molecules are in accordance with peptides found in the nervous system. Thus, there seems to be an identical processing pathway in both neuroendocrine and gut endocrine tissue. *Drosophila* prohormone convertase 2 AMON appears as a key enzyme in this processing pathway. By immunofluorescent double stainings, we found *amon*-Gal4 driven GFP expression to be colocalized with peptide hormones in secretory neurons and midgut endocrine cells of 3rd instar larvae. Restrained AMON availability strongly affected peptide hormone signals in semiquantitative direct peptide profiling and LC/MS.

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Serotonin receptors in the American cockroach, *Periplaneta americana*

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Serotonin has been shown to control and modulate many physiological and behavioral functions in insects. These multifaceted actions of serotonin are mediated by binding to integral membrane receptors, which belong to the superfamily of G-protein-coupled receptors (GPCRs). These proteins share a common architecture characterized by seven transmembrane domains. Here, we focus on the properties of serotonin receptors of an insect that is highly amenable to neurobiological, physiological, and pharmacological studies, viz., the American cockroach (*Periplaneta americana*). In particular, the salivary gland of *P. americana* is a well-established model system for investigating excitation-secretion coupling in epithelia and the cellular actions of biogenic amines.

We have cloned and characterized a 5-HT$_1$ receptor of *P. americana* (Pea5-HT$_1$) with significant homologies to members of the 5-HT$_1$ receptor class. Receptor mRNA was present in various tissues including brain, salivary glands, and midgut. Receptor-specific antibodies showed that the native protein was expressed in a glycosylated form in membrane samples of brain and salivary glands. Immunohistochemical analysis has revealed the presence of the receptor protein in a specific subset of *pars intercerebralis* cells of the cockroach brain. When stably expressed in HEK 293 cells, the receptor inhibits the formation of cAMP with an EC_{50} of ~150 nM for serotonin. Most notably, we observed that the 5-HT$_1$ receptor was expressed as a constitutively active protein. Methiothepin acted as a neutral antagonist and WAY 100635 as an inverse agonist. Thus, this study marks the first pharmacological identification of an inverse agonist and a neutral antagonist at an insect 5-HT$_1$ receptor.

Energetic optimization strategies of sucrose foraging wasps (*Vespula sp.*)

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Foraging vespine wasps are highly endothermic. The high body temperature improves their ability of fast exploitation of food resources. Endothermy, on the other hand, means also higher costs. However, it is not known how these wasps use heat gained from solar radiation, for the improvement of muscular function or for the minimization of their own energetic expenditure.

We investigated the balancing of thermoregulation with energy gain of sucrose foraging wasps (Vespula vulgaris, V. germanica) in dependence on ambient temperature (Ta), solar radiation and profitability of the food source. Wasps were trained to collect sucrose solution from a small flow-through respiration measurement chamber. Thorax temperature (Tth) was measured with an infrared camera, simultaneously with CO2 production. Foraging conditions were highly attractive (1.5 M sucrose, unlimited flow) or poor (0.5 M sucrose, limited flow rate of 0.5 ml h-1).

Wasps used the heat gain from solar radiation to do both increase thorax temperature and reduce their costs (calculated from CO2 production). During poor feeding Tth was kept constant at a low level of 33.6 °C in the shade (<100 Wm-2; Ta: 21-31 °C). In sunshine (>500 Wm-2), by contrast, Tth increased from 32.8 to 37.6 °C. During attractive feeding Tth increased from 36.8 to 39.0 °C in the shade but was kept nearly constant in sunshine (39.1 to 39.4 °C). Reduction of costs per foraging stay was highest during foraging at low ambient temperature (~21°C) and poor reward. The calculated net rate of energy gain per stay revealed a great difference between foraging conditions. During poor feeding it was about 0.5 Js-1, independent of Ta and solar radiation. During highly attractive feeding the net rate of energy gain was much higher. As Ta increased from 21 to 31 °C it increased from 9.2 to 13.1 Js-1 in shade. In sunshine the net rate of energy gain was increased by another 2.2 to 1.1 Js-1, respectively.

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Metabolism of resting wasps (*Vespula sp.*) in dependence on ambient temperature

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Vespine wasps are known for their high endothermic capacity. However, the knowledge on their respiration is sparse and almost nothing is known about their resting metabolism.

To investigate the wasps' respiration they were placed in a flow through respirometer chamber where their CO_2 production was recorded overnight. Endothermic and behavioural activity was observed by infrared thermography.

Most resting wasps were ectothermic or only slightly endothermic (thoracic temperature excess against abdomen <0.6°C). Below 10°C some resting individuals maintained an elevated thoracic temperature up to 2.0°C higher than the abdomen. Above 30°C many wasps regurgitated liquid to cool their head by evaporation.

In the investigated temperature range (T_a = 2.8 to 43.5°C) mean CO_2 production rate of resting wasps increased according to a sigmoid function (11.98 nl s^{-1} at 2.8°C, 39.22 nl s^{-1} at 25.5°C, 264.02 nl s^{-1} at 43.5°C) until the upper lethal temperature at ~46°C.

Below 5°C wasps released CO_2 in a low frequency pattern of bursts with decreasing cycle frequency over the observation period (~12 h). From 5 to 30°C ambient temperature *Vespula* showed a discontinuous gas exchange pattern with flutter, open and closed phase. With increasing T_a first the closed phase and in succession the flutter phase was reduced. At a T_a higher than 30°C the closed and flutter phase vanished altogether. At T_a ≥40°C peaks merged completely. Emission of CO_2 often concurred with visible abdominal ventilation movements.

Supported by the Austrian Science Fund (FWF, P 20802-B16).

S47: Phylogeny of insects III.

Room Rome

Molecular dating of some major events in insect phylogeny

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The age of molecular systematics is reaching maturity as Sanger sequencing technology gives way to Next Generation Sequencing technologies and phylogenomics. Now is an appropriate time to look back on the past 20 years to see what we have learned about the evolutionary history of insects based on molecular data. It has become clear that to elucidate the basic phylogenetic relationships of taxa, more rather than less data are required, although the amount of data required is dependent on the phylogenetic distance of the taxa of interest. For example, two or three gene regions might give a robust estimate of relationships of species within genera, whereas at the family, order or class level, one has to generate data from 10 to 60 gene regions before estimated phylogenetic relationships are stable and well-supported. This realization goes hand in hand with using molecular data to estimate times of divergence, early attempts to do so at deeper levels were simply based on too little data. In the past five years there have been increasing numbers of studies published looking at the temporal scale of insect diversifications that are increasingly credible due to sufficient data and carefully chosen calibration points. These studies are broadening our understanding of how the most speciose clade of organisms has diversified. However, there is still much to do, and the next five years look to be exciting times for entomologists interested in the evolutionary history of insects.

The Strepsiptera problem: a never-ending story?

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Since the description of the Strepsiptera by Rossi in 1793 the phylogenetic placement of the order is one of the most enigmatic issues of ordinal-level insect systematics ("the Strepsiptera problem"). Recently, the phylogenetic placement centered around four major hypotheses: (1) as a subordinate group of polyphagan beetles, (2) as the sister group of Coleoptera, (3) as the sister group of Diptera, and (4) as the sister group of the remaining Endopterygota. The first mentioned hypothesis (1) was suggested by superficial similarities in the parasitic lifestyle and morphology with certain beetle groups and can be ruled out with reasonable certainty. Earlier analyses of morphological data suggest a sistergroup relationship between Coleoptera and Strepsiptera (2) (Coleopterida). Most recently this hypothesis was confirmed in analyses of comprehensive molecular and morphological data sets. This is in contrast to the Halteria-concept (3) (Strepsiptera + Diptera), which was supported in analyses of 18S rDNA. The position of Strepsiptera as the sister group of Endopterygota (4) is discussed mainly based on the presence of external wing buds in late instar strepsipteran larvae, the formation of compound eyes in the second instar larvae (not in the pupal stage, as in the remaining Endopterygota) and the presence of a well developed abdominal segment 11 in the first instar larvae. Even though recent analyses of single-copy nuclear genes and a very large morphological character set allow to reject the Halteria-concept, a fully satisfactory solution of the "Strepsiptera problem" has not been achieved yet.

Higher phylogeny of orthoptera using single and combined data matrices of continuous and discrete morphological data

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The order Orthoptera contains two suborders, Ensifera and Caelifera. Like for most other groups within the Hexapoda, there is no general agreement on the taxonomy of the order. Here, phylogeny of the orthopterans is studied using 56 discrete and 41 continuous morphological characters. The datasets of 30 taxa belonging to seven superfamilies, seven families and also their subfamilies, representing most major groups within the order are organized and analyzed both separately and combined. The mantid *Iris oratoria* (Mantidae: Dictyoptera) was used as outgroup. Parsimony analyses were conducted via TNT Ver. 1.1 without weighting of any of the characters. For the continuous and discrete-continuous datasets, the analyses were performed for each suborder independently. The robustness of the clades were examined via bootstrapping test (1000 rep and 33% del). The result emerging from this study and from a literature review showed monophyly of the suborders and also two main grades of grylloids and tettigoniids within the Ensifera. Monophyly of the Decticini-Tettigoniini and Acridini-Truxalini were supported. However the Stenopelmatoidea is given family rank (Stenopelmatidae), the Dericorythidae are proposed to be downgraded to subfamily rank (Dericorythinae), while the tribe Barbistini is upgraded to subfamily rank (Barbistinae). Moreover, the results shows that the Teratodinae, Calliptaminae and Eyprepocnemidinae that are traditionally classified as subfamilies within the Acrididae can be grouped together in a clade that is here treated as the family Teratodidae.

Testing diversification processes within anotalaia via character evolution in the Caucasus endemic genus *Phonochorion* (Orthoptera: Tettigoniidae: Phaneropterinae)

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Anatolia has high levels of diversity and endemicity for Orthopteran lineages of montane forms such as Phaneropterinae and Pamphaginae. This begs the question of where these cold preferring lineages (assumed to be glacial relicts) came from and what are the mechanisms driving this

high level of diversity. Recent studies conducted on several Tettigoniidae genera indicate that numerous genera have evolved from native Anatolian forms and that the high amount of diversity is the result of rapid diversification/speciation via reinforcing selection caused by successive range shifts of montane species during glacial and interglacial cycles.

The objective of this paper is to test the above outlined hypotheses by evaluating the patterns of character evolution within the Caucasus endemic genus *Phonochorion* (which is assumed to be a glacial relict) and to search for patterns of reproductive character displacement which is predicted to arise from such micro-evolutionary processes as reinforcement.

Character evolution of the genus *Phonochorion* was evaluated by detailing the patterns of character state changes along a phylogenetic tree and by maximum likelihood and Bayesian estimates of ancestral character states. The presence of reproductive character displacement (RCD) was tested using the subgenital plate of males. The subgenital plate is a useful trait for assessing RCD as it is an important character for reproductive isolation especially in Phaneropterinae where it can play an active role in spermatophore transfer.

Maximum likelihood, bayesian, and parsimony analysis of character evolution supports the hypothesis that ancestral stocks of the genus originated from Anatolia as the most parsimonious character states (relative to the outgroups) were found within Anatolian lineages and maximum likelihood and Bayesian analyses give strong support for the ancestral position of character states within Anatolian lineages. Detailed analysis of shape of the subgenital plates of males revealed a pattern of diversification in accordance with reproductive character displacement with sympatric populations showing a significantly greater degree of divergence than allopatric populations with respect to ancestral lineages.

Character evolution within the genus *Phonochorion* gives support to the proposed mechanisms of evolution of glacial endemics within Anatolia one that they have evolved from ancestral stocks within Anatolia and the second that the high amount of diversity is the result of rapid speciation via reinforcing selection. This is also the first research specifically testing for signals that might have been left by reinforcing selection and detailing a clear pattern of reproductive character displacement which has been proposed as a general mechanism for evolution of several Tettigoniidae genera within Anatolia but till now has not been specifically tested.

Phylogeography of *Pityogenes chalcographus* (Coleoptera, Scolytinae) in Europe – Is *Wolbachia* involved?

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Since the 1970's, the spruce bark beetle, *Pityogenes chalcographus* poses a unique case in European entomology as populations revealed crossing incompatibility being divided into two major geographic groups – Scandinavia and Central Europe. Recently, a phylogeographic study of 42 European *P. chalcographus* populations based on mitochondrial markers confirmed this hypothesis. Additional crossing experiments, demonstrated that the crossing barriers are raised between mitochondrial cladotypes – haplotypes within a clade. Incompatibility however can also be caused by an array of endosymbionts. The most prominent one causing changes in the reproduction of the host is *Wolbachia*. A nested PCR technique was applied on several mitochondrially genotyped individuals of *P. chalcographus*. Despite the fact that 35.5% of the individuals were found infected by one to two *Wolbachia* strains, no distinct pattern of infection was revealed, since infections were detected in all clades. It can therefore be excluded that these two *Wolbachia* strains shaped the current distribution of genetic diversity among *P. chalcographus* populations in Europe.

S48: Landscape ecology and management II.

Room Copenhagen

Agricultural management intensity at regional scale as a missing variable to explain conservation biological control at landscape scale – meta-analysis

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There is an increasing recognition that promoting biodiversity and conservation biological control (CBC) in agro-ecosystems will require a landscape perspective. That non-crop habitats increase the biodiversity and/or the abundance of natural enemies in fields is largely recognized, but the enhancement of biodiversity in crops provides no guarantee for effective pest control. Further, although it may be inferred from classical ecology that increasing the surface area of a crop at the landscape level would favour populations of its pests, there is still a lack of consistent evidence on how cultivated and non cultivated areas affect pest abundance at landscape scale.

A literature survey was preformed to test two hypotheses:

1. More studies reporting increased abundance of pests by increasing surface area of the cultivated area at landscape scale

2. More studies reporting increased mortality of the pest due to predation and parasitation by the increasing surface area of the non-cultivated area at landscape scale

Published data from Web of Science was collected if the percentage or proportion of the cultivated and non cultivated surface area at landscape scale was related either to pest abundance or to mortality rate of pests due spontaneous colonization by natural enemies (CBC). 72 independent cases from 28 studies could be included between 1993-2008.

Only the evidence that non-cultivated area enhances CBC could be proved statistically. The main habitat for the effective natural enemies is the crop itself, but there are unsuitable periods when they need alternative habitats. The spontaneous colonization of fields by natural enemies might

depend on the amount of alternative habitats and on the management intensity of cultivated areas at landscape level.

Synergistic effects of climate change and habitat fragmentation on insect biodiversity in the Alps

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Considered globally as a key hotspot for biodiversity, at present, the Alps are threatened with intensification of habitat fragmentation's process, land abandonment, and the menace of climate change. In a modified landscape, species' survival will become more critical under altered temperatures, and even natural protected areas, habitually regarded as last refugia for wildlife conservation, will be not excluded from the negative effects of these two drivers of change. Distributional patterns of Carabid communities were tested in the field and then used to predict impacts of future climate change and fragmentation on the biodiversity of this epigeal group. Ground beetle diversity and density were studied using 447 pitfall traps placed along both horizontal and vertical transects in habitats that mainly included alpine grassland patches and coniferous forests. Transects were set up at a variety of altitude in the Stelvio National Park (Province of Trentino- Italy) during the growing season (June-October 2008). Results showed that carabids diversity and richness were higher among grassland than forested sites, whereas density exhibited an opposite pattern, declining with increasing distance from forest to grassland. Here, carabids showed a general decline of diversity, and density from lowest lands to higher altitudes. Further analysis revealed that predictors of climate change and fragmentation worked on ground beetles responses synergistically as well. Species richness was found to increase at middle and high elevations along the gradient from deep forests to meadow sites. Multivariate analysis displayed a differentiated and well-structured carabids community in accordance mainly with altitude, habitat type and along the gradient forest-grassland. What that emerge from this study is that some brachypterous species showing a patchy, and restricted spatial distribution will be more likely to local extinction due to the magnitude of fragmentation and climate change in this historical complex landscape. From this perspective, it is clear that effective forest management planning is very important. Conservation strategies should be oriented not only to preserve old-growth forests and the post-abandonment woodlands, but also the natural and semi-natural grassland systems view as high-value areas for ground beetles biodiversity.

On the use of apiformes and spheciformes populations as a management tool

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The creation of Protected Areas was one of the first measures taken for the protection of biodiversity and it is still the most widely used. The establishment of systems to evaluate the effectiveness of the management of these areas is crucial to validate their importance for conservation and guide the managers to their conservation goals. Apiformes and Spheciformes gather exception characteristics as bioindicators and are essential to the sustainability of any ecosystem. Apiformes and Spheciformes generic communities were sampled with Malaise traps in 8 habitats initially identified by habitat type (vegetation). These communities were evaluated to determine if the habitats could be differentiated based on their Apiformes and Spheciformes generic communities. Diversity provided limited differentiation between habitats but was able to differentiate the most disturbed habitat from a natural occurring habitat. In general, Apiformes and Spheciformes communities were different among the eight habitats. It was also possible to establish a relation between some genera and a specific habitat. These results suggest that Apiformes and Spheciformes communities are a suitable management tool for habitat evaluation.

Influence of chemical fertilizers on the life parameters of bug *Graphosoma lineatum* L.

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The main natural enemies of the important pest, the shield-backed bug *Eurygaster integriceps* Put. and the bug *Graphosoma lineatum* L. are hymenopterous egg parasites Telenominae. *Graphosoma* lays its eggs later than *Eurygaster.* Moreover *Eurygaster* are monovoltinous while *Graphosoma* may be bivoltinous. Hence the bug *Graphosoma* is a good additional host for Telenominae. unfortunately this bug is usually not abundant in agrolandscapes and we recommended to create habitat parcels with its food plants near the crop fields.

The aim of our work is to search for ways to increase the density of additional hosts for the parasites in the field.We applied onto 3 small parcels of meadow solutions of nitrogen or phosphorous fertilizers and water as a control. The meadows contained an abundance of *Anthriscus sylvaticus* (L) – a plant preferred by *Graphosoma* bugs.

Bugs collected from the field were placed in cages where they were supplied with plants collected from the experimental habitat parcels. The fecundity of bugs fed on plants regularly treated with nitrogen was twice as much as that on plants without added fertilizers. The results with phosphorous fertilizer were intermediate. Similar results were obtained for other parameters of the bug life-history but the differences were smaller.

This effect of nitrogen fertilizer was reported for some other herbivorous insects but we have not found any studies concerning *Graphosoma*. Therefore nitrogen fertilizer may be used for habitat management in agrolandscapes as a factor which can increase the density of natural enemies.

Biodiversity threats to insects associated with rice crop in the Punjab, Pakistan

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During a survey through face to face interviews of farmers mal-farming practices of rice farmers as threat to insect biodiversity associated with rice crop agroecosystem were investigated. Excessive use of agrochemicals and rice straw burning along with animal grazing were explored as major threats to insect biodiversity of this man made wet land. Rational use of agrochemicals and legislations about banning of rice straw burning and cattle grazing in harvested rice fields were proposed.

S49: Semiochemicals in agroecosystems II.

Room Brussels

Chemical ecology of *Tanymecus (Episomecus) dilaticollis* Gyllenhal (Curculionidae)

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The grey corn weevil *Tanymecus (Episomecus) dilaticollis* Gyllenhal is one of the most harmful coleopteran pests of maize, sunflower and sugarbeet in Eastern and Central Europe. The development of integrated pest management (IPM) system for this species requires better understanding of its intraspecies (pheromones) and interspecies (kairomones: pest–host/non-host plants, pest–natural enemies) interactions, as well as their integration. The recent results of our investigations on some of these components of *T. (Episomecus) dilaticollis* ecology will be presented. They include: behavioral evidence for pheromone communication, identification of host plant volatiles and compounds with putative pheromonal activity and establishing the behaviorally active components, development and field evaluation of new lures and suitable traps for this pest.

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Evaluation of different attraction traps as an alternative way of control of Scolytinae (Coleoptera: Scolytidae), an important pest of cocoa in Mérida, Venezuela

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The Criollo cocoas of Venezuela, so appreciated in Europe by their high quality, odour and flavour, are very sensitive to pests and diseases, and in consequence they are being replaced by more resistant varieties. The wood borer Scolytinae beetles are one of the most harmful pests of cocoa in Venezuela. They are also known as "ambrosia beetles" by their mutualistic association with ambrosia fungi that damage the cocoa plant. When adults search for a new host plant, they are attracted by odours given off by the wounded wood. In the present work, we tested the efficiency in catching Scolytidae of two kinds of traps, funnel traps and bottle traps with windows, baited with three different attractants: ethanol-methanol, ethanol-turpentine and turpentine pure. Traps were installed in a cocoa farm placed at south of Maracaibo lake, in Mérida state. Each trap type was tested with every attractant, so we had six treatments that were replicated four times along the farm. Traps were working for six months. All Scolytinae were sorted and identified. According to the results obtained, the funnel trap could be a pretty effective method to collect these beetles, and so, a good way to maintain their populations at normal, not damaging levels.

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Field evaluation of the Mediterranean Fruit Fly (Diptera, Tephritidae) in Montetenegro : comparison among female attractants and trap types

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Since the Mediterranean Fruit Fly *Ceratitis capitata* Wiedemann was established in Montenegro in 2002, different type of lures and traps have been used for population monitoring. For several years protein bait (*di-ammonium phosphate*+ h*ydrolyzed protein* Buminal) in Mc-Phail Traps was used as a standard. In 2008, for the first time, we used highly specific synthetic female-targeted attractant Biolure-Unipak (*putrescine, ammonium acetate, trimethylamine*). In term to compare efficacy of standard attractant with a new one, field trials were conducted in 2008 and 2009 along Montenegrin seacoast, in citrus and mixed fruit orchards (citrus, fig, kaki). For this, we used Tephri-Traps with synthetic female-targeted attractant Biolure-Unipak (set up dry) and Mc-Phail Traps with protein bait (set up wet). Traps were held up in orchards from the beginning of July until end of December and checked in 7 to 14 day intervals. The results obtained showed that synthetic female attractant was very effective at capturing females at low and high population level, as well. In both years, with this one, first flies were captured in the second half of July, a few weeks earlier than with protein bait. Depending on locality, total number of captured females in Tephri-Traps were from 7 to 89 times more (in 2008) and from 4 to 67 times more (in 2009) in comparison with McPhail-Traps. Our findings suggest that dry synthetic female-targeted attractant Biolure-Unipak in Tephri-Traps is recommended for replacement of wet protein bait in McPhail-Traps because is more efficient in very early medfly detection, caught higher number of flies (in standard intervals of checking and in total number) and is easier for handling.

Bio-activity of alfalfa (*Medicago sativa* L.) saponins towards aphid development

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Plants produce a variety of compounds that provide certain protection against insect attack. Many of these compounds affect aphid behavior, physiology, and metabolism, and, in consequence reduce aphid populations on resistant plants. Saponins are widely distributed among plants, and can act as protecting factors against generalist herbivores including phytophagous insects.

The aim of the research was to study variation in different growth stages of four alfalfa (*Medicago sativa* L.) cultivars, and to investigate the biological role of saponins in biochemical interactions with pea aphid, *Acyrthosiphon pisum* Harris. Saponins from alfalfa aerial tissues in different growth stages were extracted and analysed by thin layer chromatography (TLC). In addition, development of pea aphid that fed on the alfalfa plants at different plant developmental stages was measured.

The saponin extracts showed both quantitative and qualitative changes as the alfalfa plants developed, and number of the aphids increased. The TLC separation showed within aerial tissues of the studied alfalfa plants, the following compounds: 3GlcA, 28AraRhaXyl medicagenic acid, zanhic acid tridesmoside, soyasaponin I and soyasapogenol glycoside. Older alfalfa plants and those infested by the pea aphid showed higher level of the saponins. Significant difference in number of aphids on the alfalfa plants at different plant developmental stages was observed.

The results showed that the saponin composition in alfalfa changes with plant development and suggest that alfalfa saponins have effective biological role as defence components against pea aphid.

The role of secondary plant metabolites from cowpea (*Vigna unguiculata* [L.] Walp.) floral structures in resistance to the Flower Bud Thrips, *Megalurothrips sjostedti* (Trybom)

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Floral structures of six cowpea cultivars (*Vigna unguiculata*) were analysed for secondary plant metabolites to study their relationships with resistance to *Megalurothrips sjostedti* (Trybom). Polyphenols varied significantly ($p < 0.001$) among the floral structures of the cultivars however no significant differences were observed between resistant and susceptible cowpea cultivars when data for terpenoids and aglycones of flavones and flavonols were compared. Significant but negative correlations between polyphenols and each of damage indices ($r = -0.57$), mean adult counts ($r = -0.56$) and mean larval counts ($r = -0.64$) of resistant cowpea cultivars especially in the late season, indicating that polyphenols play a significant role in cowpea resistance to *M. sjostedti*. High levels of polyphenols obtained from resistant cultivars, Sanzisabinli and Sewe, with highly significant correlations with damage indices and thrips populations, indicate that these polyphenols could be inhibitors or deterrents. Terpenoids from IT90K-277-2, Sewe, Sanzisabinli, TVu1509 and KVx404-8-1 racemes; KVx404-8-1 and TVu1509 floral buds; IT90K-277-2, Sewe and Sanzisabinli flowers are biologically active and confer antibiosis resistance to cowpea against the larvae of flower thrips *M. sjostedti* and could be promising candidates for genetic transformation of cowpea.

Electrophysiological and behavioural responses of sweetpotato weevil, *Cylas formicarius* (Fab.) to sweetpotato semiochemicals

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Sweetpotato weevil *Cylas formicarius* (Fab.) is the most serious insect pest of sweetpotato (*Ipomoea batatas* L. (Lam.) worldwide. Sweetpotato volatiles play a significant role in the olfactory directed behaviour of *C. formicarius*. Sweetpotato weevil responded differently to hexane extracts of sweetpotato headspace volatiles collected from eight genotypes, namely, S-643, Howrah, 90/235, 90/693, SB-72/7, BX102, BP-2 and 1197, which have shown high degree of resistance (>90%) at field level evaluation. The female antenna of *C. formcarius* elicited highest electric potential (13.348mV) and the male antenna, the lowest (1.824 mV) to headspace volatiles of genotype 90/693. The genotype 90/693 attracted 43.75% females and 26.25% males in olfactometer studies and the tubers were damaged upto 40% in the field. Genotype Howrah found highly resistant to *C. formicarius* and its volatiles elicited an electric potential of 1.934mV with males and 5.613mV with females. Males of *C. formicarius* were less attracted (5.25%) than females (8.50%) to headspace volatiles of Howrah. The results revealed that the volatiles and extracts of sweetpotato were more attractive to females than males at a given point of time indicating that females use the volatiles of sweetpotato plants in decision making and further the damage to plants. Selection of resistant genotypes of sweetpotato to *C. formcarius* through this method can be called 'Volatile Assisted Selection' can be important for development of resistant sweetpotato plants to weevil and increase the food and nutritional security.

Wednesday poster session

WE 1-7: Landscape ecology and management

WE 1
Pollinators and predators: different functional groups benefit from agricultural landscape matrix in different ways

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Species associated to agroecosystems depend on seminatural habitat quality, habitat area and habitat structure, which in many cases have been fragmented or destroyed by land use intensification. These areas provide complementary resources for different functional groups. Trap-nesting bee and wasp communities play an important role in ecological functions (pollination and biological control by predation) and include species with different habitat requirements. Using landscape analysis, we studied how crop system intensification (low intensified vs. high intensified) and its associated landscape parameters and structures (percent cover of cropped land, percent cover of seminatural habitats, percent cover of manmade and secondary habitats and habitat diversity) affect trap-nesting pollinator (bees) and predator (spheciform and eumenid wasps) populations, in three Mediterranean crops (vineyard, cereal and vegetable crop areas), attending to their biological parameters.

Trap-nesting wasp communities are strongly affected by the presence of seminatural and natural habitats into the matrix. Wasp communities seem to profit from low intensified systems in vineyard and cereal crops, characterized by a high percent of field margins, smaller field size and low percent of cropped land. Secondary habitats affect wasp diversity and richness, so they could buffer the lack of suitable habitats. Nonetheless, trap-nesting bee communities seem to respond to different variables. Crop system is decisive in these communities in the case of vineyard and cereal, where a low intensified system guarantees seminatural habitat presence

and associated resources. However, bee communities seem to benefit from vegetable crop areas (policulture crop) because of their high temporally and spatially resource availability. Other different natural and secondary habitats are important for bee diversity and richness in Mediterranean agricultural landscapes.

WE 2

Comparison of three models for predicting emergence patterns of the olive moth, *Prays oleae* Bern. (Lepidoptera: Yponomeutidae) in two regions of Croatia

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Olive moth (*Prays oleae* Bern.) is an economically important pest of olive trees throughout Mediterranean region, including Croatia. In Croatia olives are growing across the Adriatic coast from the south (Dalmatia) and in Istria what is the most northern area of olives growing. Geographical position and climatic factors have an important role on olive moth distribution. The goal of the research was to compare three models: degree-day accumulation, olive tree phenology and pheromone trap catches for predicting emergence patterns of olive moth in two regions of Croatia. The research was conducted from 2007 to 2009 in two regions: Dalmatia and Istria. Each region included 5 olive growing sites. The population dynamics was monitored using pheromone traps (Csalomon). Traps were set up at mid April and monitoring lasted until November. Traps were inspected once per week. Climatic conditions about air temperature and rainfall were taken from the nearest meteorological stations. Starting with January 1st by the use the lower developmental temperature of 10.85°C the degree-day accumulation was calculated. The data on olive tree phenology were collected at each trap inspection date. We will analyze the differences in appearance of each generation among the models and regions. The accuracies of degree days and olive tree phenology models will be described in terms of mean absolute error and the most appropriate model will be suggested.

WE 3

Trophic variability of nestedness in beetle assemblages along pollution gradient of meadows and forest in the Copper Smelter "Głogów" environs, S-W Poland

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The energy taken by heterotrophic organisms is distributed to all processes, also detoxication. In permanently polluted ecosystems, the food limitation may be a key factor for distribution of animals. The impact of heavy metals concentration on degree of nestedness in various trophic assemblages: herbivorous weevils (*Curculionoidea*) and carnivore ground beetles (*Carabidae*), were tested. Beetles were sampled using pitfall traps and sweep nets (10 samples/2 week periods, from May-Oct.) in 5 forest and 6 meadow localities at different distances to the copper smelter near Głogów (S-W Poland). Concentration of copper varied between 9.5 mg/kg to 1160 mg/kg of dry humus mass. Carabids communities were significantly nested according to nestedness temperature calculator along localities gradients. The most important factor describing packed matrix ordering for both gradients, was copper concentration (r_{forest} = 0.48, $p < 0.01$, r_{meadow} = 0.39, $p < 0.05$). The matrix temperatures of weevil assemblages were higher than average temperatures of random distribution along investigated gradients, and there was no significant negative correlation with increasing pollution level. That copper concentration correlated positively with ordering matrix of carnivore Carabids is possible of limited food availability and higher sensitivity to starvation on the most polluted sites. However, higher level of pollution doesn't reduce availability of plants for herbivorous weevils.

WE 4

Effect of field size on the abundance and species richness of bumble bees

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Bumble bees are important pollinators in agricultural and natural ecosystems. In recent decades their numbers have been declining due to the intensification of agriculture and establishment of large homogenous fields. The aim of this research was to study the effect of field size on the abundance and species richness of bumble bees in Estonian agricultural landscape. The data was collected from 66 farms located in different regions of Estonia. Bumble bee individuals were counted and species determined walking along the field transect of each farm. The relationship between field size and the number of bumble bees and bee species present was calculated. The results of our study show a negative correlation between the field size and the abundance and species richness of bumble bees: as the field area increased the number and species richness of bees decreased.

WE 5

Diversity of Banchinae (Hymenoptera: Ichneumonidae) from Ria Lagartos Biosphere Reserve, Yucatan, Mexico

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In this work we described the Banchinae (Hymenoptera: Ichneumonidae) diversity from one Protected Natural Area from México. The study was carried out in Ria Lagartos Biosphere Reserve, Yucatan, Mexico. We sampled with Malaise traps from June 2008 to August 2009 in protected core and buffer zones of three principal vegetation of this Reserve: coastal dune scrubland, savannah and dry forest. Banchinae was represented by 18 species with 235 individuals. The core zones of vegetation had most Banchinae individuals over buffer zones. Dry forest shows the highest species richness and was the vegetation with greater diversity. This subfamily was present along of this study, with abundance peaks in August. Nevertheless, species composition of community was change along the year.

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WE 6
The impact of hedgerow-forest connectivity on carabid beetle and spider communities in agricultural landscapes

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Agricultural intensification has caused decreasing landscape structural complexity and reduced between-habitat connectivity, negatively affecteing biodiversity. Hedges and forest remnants can counteract this negative trend by enhancing connectivity between forested habitats and providing habitat to many different organism groups. To get more knowledge about community composition, species richness and abundance of ground dwelling arthropods in relation to increasing isolation from forests, we sampled carabid beetles and spiders using pitfall traps in forest edges, hedges connected to forests and hedges isolated from forests. Results show that species richness and abundance of spiders were highest in forest edges, decreased in isolated hedges and were lowest in connected hedges, while carabid beetle abundance decreased with increasing isolation from forest and species richness was highest in connected hedges, followed by isolated hedges and forest edges. Results suggest that forest edges are important habitats for spiders, possibly due to high food supply and availability of reproduction habitats, followed by isolated hedges as important refuges where forest and openland spider species show concentrations. For carabid beetles, forest edges appeared to provide continuous habitats increasing carabid abundances, whereas high species richness in connected hedges has been possibly caused by a combination of forest and farmland species. In conclusion, ground dwelling arthropods showed different responses to isolation from forest. Hence, carabid and spider conservation in an agricultural landscape context needs a large scale and heterogeneous mosaic of hedges and forest remnants differing in isolation.

WE 7
Sampling of poison hemlock (Conium maculatum) as a possible method to indicate landscape effects on arthropods (Heteroptera, Coleoptera, Araneae) in the region Jászság

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Integrated pest management requires the better understanding the landscape issues of ecology, however there is a lack of appropriate methods to measure both population size and amount of habitat large scale. Orius leavigatus is used as a biocontrol agent against thrips (Thysenoptera) species in greenhouse sweet pepper production, while native Orius species are able to colonize greenhouses spontaneous. In this study a sampling method was developed to measure the abundance of Orius and other arthropod species related to landscape features.

The poison hemlock was sampled using an adopted sweeping net. The arthropods were conserved in ethyl-alcohol until identified. The samples were collected every week (in total 4 times) during the whole flowering period in 2007 at 3 different sampling sites in the region Jászság (Hungary). 3 sample if possible was collected from plants in every phenology stage (bud, flower, fruit) per sampling date and per site. The 3 sites differed in the amount of semi-natural habitats in a distance of 100m, 500m, 1000m around the sampling point. The amount of habitats was measured using GIS. The difference in the abundance and the diversity of the orders Heteroptera, Coleoptera, Araneae and the genus Orius was tested for the variables SITE, PHENOLOGY using ANOVA.

In our study we preformed the list of Heteroptera, Coleoptera, Araneae adult species living on the umbel of the poison hemlock in the region Jászság. The results indicated that the sampling of this plant is an appropriate method to study landscape effects first of all on Orius species. It is simple method and easy to standardize. The poison hemlock is a common species but specific for the ruderal plant communities near to roads, so the habitat at small scale is well defined, but it is easy to find at different points in the landscape. The flowering period is restricted to one month, which allows avoiding bias due to difference in time. The best stage to sample is the flowering stage.

WE 8-38: IPM challenges and prospects in annual and perennial

WE 8
Linking tomato phenology with antixenosis and antibiosis-based resistance to *Bemisia tabaci* Gennadius (Hemiptera: Aleyrodidae)

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Tomato *Lycopersicon esculentum* L. is very important crop, specially in Mediterranean areas. One of the limiting factors affecting the success of this crop is the whitefly *Bemisia tabaci,* which causes serious damage not only through phloem feeding but also by the transmission of plant diseases. The use of plant varieties resistant to insect pests is increasing in many countries. The tomato gene *Mi-1* is responsible for the resistance to *B. tabaci,* but a definitive study lacked to specifically investigate whether this resistance is developmentally regulated. We have carried out two sets of antixenosis and antibiosis assays with the Q-biotype of *B. tabaci* under greenhouse and laboratory conditions. To study the effect of plant age, 3-, 5- and 8-week old tomato plants of the cultivars Motelle (with *Mi-1*) and Moneymaker (without *Mi-1*) were grown under 24ºC, L16:D8, and 60% R.H. To investigate the effect of plant size we used 8 week-old plants with two different sizes, as they were grown at normal (24ºC) or reduced (19ºC) temperature. In the antixenosis assays, plants were regularly distributed in the greenhouse and infested by releasing undetermined number of adults. After 6 days, adults on every plant were recorded daily and pupae and new adults were counted at the end of the biological cycle. Parameters related to host suitability, life span of insects and pupae production were obtained. In the antibiosis assays, 5 adult females were confined into a clip-cage attached to one leaflet per plant. After 6 days, eggs laid on every plant were recorded. At the end of the assays, the numbers of N3, N4 and new adult whiteflies were counted. From these studies, a relationship between tomato resistance to *B. tabaci* and plant phenology has been obtained.

WE 9

The Ber pests (*Ziziphus* spp) in Khuzestane province

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Ber (Ziziphus spp) is the hardest fruits tree to drought and salinity and can play an important role in developing of arid region agriculture. Different parts of this tree (fruit, leaf and root) have numerous medicine applications. Many insects attack these trees as well as other plants. In order to identify Ber Injurious insects, a research has been carried out in different areas of province for three years. Sampling were conducted by captured directly, Aspirator and sweeping nets. All materials collected after sorting and coding were studied taxonomically. Identification of insects was done with cooperation of plant pests and diseases research institute of Iran. Important insects of Ber trees in Khuzestan include:

Lepidoptera order
1) Euzophera sp. Near bigella (Pyralidae: Phyctidae)
2) Saturnia SP (Sturnidae)

Coleoptera order
3) Alcidodes cf. Willcoksipic (Curculionidae)
4) Phradonoma sp (dermestidae)
5) Trogoderma SP (Dermestidae)

Homoptera order
6) Acadaleyrodes rachipora Singh (Aleyrodidiae)
7) A. citri Priesner& Hosny (Aleyrodidiae)
8) Parlatoria crypta Mckenzie (diaspididae)

Hymenoptera order
9) Megachila SP (Megachilidae)

Diptera order
10) Carpomyia vesuiana A. Costa (Tephritidae)

WE 10

Biological characteristics of *Helicoverpa armigera* (Lepidoptera: Noctuidae) on seeds of different soybean cultivars

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The development, adult longevity and survivorship of *Helicoverpa armigera* on seeds of ten soybean cultivars including: Clark, Gorgan3 L17, M7, M4, M9, Sahar, Sari, Tellar and Zane were evaluated at 25 ± 1ºC, 60 ± 5 % RH and 16:8 (L:D) h. Time to complete immature development ranged from 49 d on L17 to 32 d on Clark, Adult and total longevity of males and females were higher on L17 in comparison to others. The highest immature survival rate was 67 % on Sari and the lowest was 36 % on Gorgan3, similarly, pupal and adult weight (mg) varied among cultivars. We also measured the duration of preoviposition, oviposition and postoviposition. Results suggest that L17, Sahar, M4 and Gorgan3 are relatively resistant to this pest.

WE 11

"Efficacy of egg parasitoid, *Trichogramma chilonis* and the predator aphid lion, *Chrysoperla carnea* in present of seven selective Insecticides for Controlling the American bollworm. *Helicoverpa armigera* on Cotton."

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The current study included egg parasitoid *Trichogramma chilonis* and the predator *chrysoperla carnea* in presence of seven selective insecticides and was carried out at the field experiments of the University of Agriculture, Faisalabad, Pakistan 2003 – 2005. The goal of the study is to cheek the efficacy of the boil- control agents as well as the selective insecticides for controlling or reduce the population density of the major pest on cotton *Helicoverpa armigera.*

The results showed that the population counts of *H. armigera* and *C.carnea* per 25 plant and percent parasitization by *T. chilonis* prior to the first spray were ranged from, 0.66 to 3.67, 3.33 to 7.66 and from 24.30 to 40.00 for *H. armigera*, *C. carnea* and parasitization rate by *T. chilonis* in present of all the selective insecticides, respectively.

The results also indicated that the number of the pest and boil- control agents after the first spray with the selective insecticides were ranged from 0.66 to 2.66, 1.00 to 4.66 and 10.00 to 23.00 for *H.armigera*, *C.carnea* and parasitization rate by *T.chilonis*, respectively, while the data of the current study also showed that the number of boil-control agents and the pest *H.armigera*, after second spray were fluctuated between 0.00 to 3.66, 1.00 to 6.00 and from 8.00 to 51.33 for *H.armigera*, *C.carnea* and parasitization rate by *T. chilonis*, respectively. Finally, data regarding the population of the test insects and yield per acre from each treatment after third spray with the same insecticides showed that the population of *C. carnea* were increased in all treatments after third spray except Endusilfau treated plots, while parasitization rate by *T. chilonis* increased in all treatment except Profenofos were reduced from 12.00 percent to 8.00 percent after third spray. Yield of seed cotton was found maximum 3200 Kg/ hectare in these plots where Thiodicarb and Spinosad were applied, next highest yield was obtained in Indoxacarb and Cypermethrin treated plots, showing a yield of 2800 Kg and 2400 Kg/ hectare, respectively. Finally the results showed that there was no difference in the yield of seed cotton between Endosulfan and Profenofos, treated than control plot

WE 12

Monitoring of oilseed rape pests with different visual baits

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Oilseed rape in Croatia is grown on about 15 000 ha with average yield about 3,01 t/ha. The most important autumn pests are *Phyllotreta* spp., *Athalia rosae*, *Psyliodes chrysocephala* and *Ceutorhynchus picitarsis*. Dominant spring pests are *Ceutorhynchus napi*, *Ceutorhynchus pallidactylus* and *Meligethes aeneus*. In 2007/08 investigations were conducted on three localities (Voloder, Maksimir and Dragalić) in order to determine the population abundance for the mentioned pests, with different visual traps: yellow sticky traps (YST), yellow traps – oval (YTO) and yellow traps (Syngenta) (YTS). In Voloder site, YST, YTO and YTS were used during the period from 24th September to 22nd November 2007 and from 28th February to 17th April 2008. In Maksimir site, YST, YTO and YTS were used during the period from 6th March to 24th April 2008. In Dragalić site YTS were used during the period 28th September to 3rd November 2007 and from 10th March to 21st April 2008. In Voloder site the dominant pests collected with YST were *A. rosae* and *M. aeneus*. In Maksimir site the dominant pest collected with YTS was *M. aeneus*. In Dragalić site the most abundant pests collected with YTS were *P. chrysocephala* and *M. aeneus*. According to obtained results, the best method for monitoring of oilseed rape pests are YST. These traps are used in all west European countries and according to them the thresholds for the most important oilseed rape pests are determined.

WE 13
Monitoring raspberry cane midge *(Resseliella theobald* Barnes*)* in Hungary

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The raspberry cane midge, which is widespread across Europe, is present in Hungarian raspberry plantations with high number of individuals and several generations. The commercialization of the sex pheromone trap of the species allows new possibilities to monitor the pest more thoroughly.

Our experiments were carried out in a raspberry plantation (cvs. Autumn Bliss and Fertõdi zamatos) in Berkenye, Hungary, between 2006 and 2009. The irrigated plantation was maintained according to the rules of ecological cultivation and no pesticides were applied (in the plantation) during the period of the study.

To monitor raspberry cane midge adult male flight, we used sex pheromone traps developed by the East Malling Research and the Natural Resources Institute. Adult males caught on the sticky inserts changed weekly were counted using stereomicroscope. An automated soil and air thermometer (TGP-4510) was used inside the plantation, and it recorded the data of the soil (10 cm under the surface of the soil) and air temperatures (at a height of 0.5 m). every half hour

The first raspberry cane midge males appeared after reaching 164 day °C accumulated effective temperature in the second part of April every year and flew until the beginning of October. Many generations could be distinguished during the vegetation period, and usually the number of males of the first two generations were the highest. The next generations during summer didn't separate sharply. The number of males caught in the two raspberry cultivars did not show significant difference.

Our results show that the number of males was lower in the traps in the warmer summers of 2007 and 2009 compared to the relatively colder summers in 2006 and 2008, probably because of the different temperatures.

WE 14
Comparative toxicity of some pesticides on the two-spotted spider mite *Tetranychus urticae*.

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Two-spotted spider mite *Tetranyhus urticae* Koch (Acari: Tetranychidae) is a very polyphagous pest. It has a worldwide distribution on a large number of host plants, including many agronomically important crops. In Morocco, *T. urticae* is one of the most important pests of strawberry cultures, causing an important yield reduction when its population densities are high. Currently, the control of this pest relies almost exclusively on acaricides. Unfortunately, this mite species has developed resistance to most of the available acaricides because of its intensive use during the growing season. This loss of efficacy is a major problem in the Integrated Management of this pest. Moreover, insecticide and fungicide treatments are responsible for the reduction or suppression of many of natural predators.

Laboratory tests were conducted to evaluate the relative toxicity of some pesticides against various spider mite populations collected from strawberry field in the Loukkos region, located in the North of Morocco. Eight pesticides were used: two acaricides (abamectin and bifenthrin), two insecticides (lambda cyalothrin and chlorpyriphos-Ethyl) and two fungicides (mancozeb and wettable cooper).

Our results reveal that the use of recommended dose of abamectin (9 ppm) was able to eliminate all *T. urticae* individuals (100% of mortality) whereas only 56% of mortality was registered when recommended dose of bifenthrin (50 ppm) was applied. Similarly, the application of insecticides induced approximately 50% of mortality in the treated mites. Compared with acaricides and insecticides, fungicides were much less toxic to *T. Urticae* (40% of mortality). Among the two fungicides tested, mancozeb proved to be the most toxic on *T. urticae*.

WE 15
Influence of pesticides and application methods on pest and predatory arthropods associated with transgenic (Bt Cotton) and non-transgenic cotton plants

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Influence of different insecticides (five Neonicotinoids , one Ketoenole, one Insect Growth Regulator, one Phenyl Pyrazole) and the method of their application (stem and foliar application)on pests (leaf hopper, *Amrasca biguttula biguttula*, white fly, *Bemisca tabaci* and thrip, *Thrips tabaci*) were investigated in transgenic (Bt) and non-transgenic cotton (Non Bt) agro ecosystem in 2008 and 2009. The transgenic and non-transgenic cotton did not differ significantly in the population of sucking pests, however in the methods of application, foliar application reduced significantly more sucking pests over stem application. But the population of predators (spiders, lady bird beetle, *Coccinella septumpunctata* and lace wing, *Chrysoperla carnea*) was less disrupted by stem application. Among the different systemic insecticides and IGR used Imidacloprid decreased maximum (42.96 & 46.66 % at 1 and 7 day after application) leaf hopper population, clothiadinin decreased maximum (58.43 and 54.81% after 1 and 7 day after application) whitefly population and for thrips clothiadinin (48.32 and 47.23% reduction after 1st and 3rd day of application) reduced maximum population. No significant difference was recorded in population of predators between transgenic and non-transgenic cotton, however, the method of application significantly differ in reduction of predators (spider, lady bird beetle, and lace wing) where stem application was found significantly safer to the predators. Among the different treatments, all the insecticides like thiomethoxam 25WG followed by clothianidin 50 % WDG ,acetamiprid 20 SP ,imidacloprid 70% WG, imidacloprid 200 SL, spirotetramat 150 Od, fipronil 5%SC and buprofezin 25%SC (ascending order)were found toxic to natural enemies in comparison to control.

WE 16
Anystis baccarum: The need for correct identification in UK apple orchards

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Integrated pest management (IPM) programmes are very important in the control of invertebrate pests within apple orchards. Many current IPM strategies concentrate on specialist predatory species. However, generalist beneficial insects, such as several mite species, must also be fully

researched for their potential in controlling pests. Research has shown that the generalist predatory mite *Anystis baccarum* (Linnaeus) can offer much potential in controlling invertebrate pests within Northern Irish apple orchards. However, apple growers have been mis-identifying this beneficial species as the economic pest European fruit tree red spider mite, *Panonychus ulmi* (Koch). As a result, unnecessary pesticide applications have been applied against what has now been confirmed as a beneficial species. To aid apple growers in the identification of *A. baccarum*, identification cards were produced. Positive uptake of the cards by many apple growers has resulted in correct identification of *A. baccarum* from *P. ulmi,* and therefore, a reduction in chemical pesticide applications. The benefits of *A. baccarum* within orchard ecosystems is discussed.

WE 17

Meteorological elements which influence the abundance of *Agriotes ustulatus* Schall.

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Recently investigations indicated that *A. ustulatus* is much more abundant and frequent in North West Croatia than it was stated in old literature. We hypothesized that temperatures and rainfall in the year when the flight of species is recorded as well as the temperatures and rainfall at the time of egg and larval development, influence the abundance of these species. During five years, five most important *Agriotes* species were monitored by pheromone traps (Csalomon) in two fields in North West Croatia. Based on the total individual number of all species and the individual number of *A. ustulatus,* the dominance index was calculated for each field and year. Climatic conditions about air temperature and rainfall were taken from the nearest meteorological station. Meteorological elements: average air temperature and total amount of rainfall in given year, mean temperature in April and May and amount of rainfall in April and May of given year, mean temperature and amount of rainfall in August and September of year when egg and larval development started; were correlated with the dominance indexes. Correlation coefficients between all elements except average yearly temperature and dominance indexes are medium to very strong. Our findings confirmed that temperatures and rainfall in the year when the flight is recorded as well as the temperatures and rainfall at the time of egg and larval development, could be used for prediction on the abundance of these species in certain field.

WE 18

Using mating disruption technique for control of European Grapevine Moth (*Lobesia botrana*) in Bozcaada, Turkey

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Turkey is suitable for viniculture because of its climatic conditions. Viniculture is originated from ancient times in Çanakkale, where is between Asia and Europe continents and known as Dardanelles in those times. Most of Çanakkale's history has traces of viniculture and making vine. Tenedos (Bozcaada), which known for its suitable climatic conditions for viniculture, continues to preserve this property. Bozcaada, which is located at 12 miles south of Çanakkale Strait and northeast of Aegean Sea on the coordinates of 39 49 N 026 02 E, is an island with a 37,6 km^2 surface area. The island, which is quite exposed to north winds because of its location at the exit of Çanakkale Strait, is also open to south winds as well. Vineyards cover 32% of the island's surface. Because of construction of new vineyards, wine sector is constantly developing and becoming an important part of the island's economy. Bozcaada Cavusu is an endemic cultivar of this island and receives its quality from island's unique climatic conditions. Also Karasakız and some other cultivars are source of good quality wine.

Location of Bozcaada and economic value of good quality grape highlighted the idea of improving viniculture on the island. The efficiency of mating disruption technique on control of European Grapevine Moth (*Lobesia botrana* Den.-Schiff., Lepidoptera: Tortricidae) (EGVM), main pest of vine, was investigated between the years 2006 and 2008. The technique was performed by hanging Isonet L dispensers coated with 172 mg 7Z,9E-Dodecadienly acetate on vine stocks in producer vineyards with 2138, 3835 and 4000 decares areas in 2006, 2007 and 2008 respectively. Adult emergence of EGVM was monitored by using 8 pheromone traps in treated and 4 traps in untreated vineyards for every year. Adults in traps are counted in weekly periods and then numbers of adults were recorded. As a result, limited number of adults was caught at the beginning of season and EGVM did not cause an important damage in economical sense throughout the production season. Total mean number of adults in traps in 2006, 2007 and 2008 was 43, 1,5 and 6,5 in treated vineyards and 62, 16 and 53 in untreated vineyards, respectively. Population of the pest was found to be low between the years 2006-2008 and did not reach the population density of the years before the study. It was determined that the pest EGVM develops 3 generations per year. The cultivars of Bozcaada Cavusu and Karasakız are protected form the pest through production season because of the 150 days of Isonet L dispenser's efficiency period. This situation removed the need for extra control applications, which decreased the production costs and became an advantage in protection of natural balance. In conclusion mating disruption technique is successful in vineyards of Bozcaada.

WE 19

Flight patterns of peach twig borer and oriental fruit moth in Hungarian apricot and peach orchards

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The Peach twig borer (*Anarsia lineatella* Zeller) and Oriental fruit moth (*Grapholitha molesta* Busck) are important fruit pests of apricot and peach orchards. Despite this fact, data about the phenology of emergence, stretching through the whole vegetation period, is not at our disposal in Hungary. Thus, in order to establish the basis of environmentally friendly pest control suitable for damage prevention, we studied the phenology of emergence in apricot and peach orchards.

Between 2008 and 2009, the flight patterns of the Peach twig borer and Oriental fruit moth were investigated in two different peach and apricot orchards (Heves, Pomáz). In order to trap the two moths, we used Csalomon 6 and Csalomon 9 sex pheromone traps made by MTA NKI.

On the basis of sex pheromone trap catches, the emergence of the first generation of Oriental fruit moth took place from the middle of April until the beginning of May. It was followed by the first generation of Peach twig borer from mid-May until the end of June. The consecutive generations of the two pests flew at same time during the vegetation period in the orchards. While the flight activity of the Peach twig borer finished at beginning of September, Oriental fruit moth males flew until mid–October, depending on the average daily temperature. Neither the generations, nor the peaks of emergence, which are important regarding the timing of sprayings, can be clearly distinguished on the basis of the trap catches. The number of Peach twig borers and Oriental

fruit moths found in traps inside the plantations and the flight patterns of the two pests were both affected by the surrounding vegetation.

WE 20
Current trends in dynamics of tea pests in Northeast India & strategies for their management

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Tea (*Camellia sinensis* (L.)O.Kuntze is a perennial crop grown as a monoculture in North East India. The State of Assam alone produces about 55 percent of the tea produced in entire India and about 1/6th of the tea produced in the world. The environment of this tea growing region is conducive to more than one hundred species of arthropod pests belonging to different categories like leaf eaters, leaf suckers and bark, wood and root borers. *Helopeltis theivora*, *Taeniothrips setiventris, Scirtothrips dorsalis*, *Empoasca flavescence, Buzura suppressaria, Eterusia magnifica*, *Oligonychus coffeae,* and *Brevipalpus phoenicis* are the major pests in tea in Northeast India. Foliar density and bush canopy provide appropriate microclimate for different pests, which co-exist in their respective niches within and around the tea bushes. About one hundred indigenous natural enemies including predators, parasitoids and pathogens of tea pests are also recorded. Current pest management strategy aims at conservation of bio-diversity and production of quality tea through integrated management of pests. Adoption of suitable cultural practices, pertinent to the management of shade, soil, drainage, weeds and pruning operations are adopted for suppression of pest activities during various seasons with concomitant production of quality crop. Emerging trends in dynamics of the common pests and strategies for their eco-friendly management are discussed.

WE 21
Laboratory Investigations of *Prostephanus truncatus* (Horn) (Coleptra: Bostichidae) infestation on dried cassava chips, its effect on nutritional and anti-nutritional contents status

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Prostephanus truncatus, the larger grain borer, is an alien invasive post harvest pest, with wide spread population all over African regions. Since its introduction two decades ago it has become a devastating pest of dried cassava chips with a high percentage weight loss and high breeding rate in the stored products. This research work focus on the nutritional, anti-nutritional and pest status of the pre-infested and post-infested dried cassava chips by *Prostephanus truncatus,* after an infestation period of 10 weeks in the laboratory. Proximate analysis was conducted using standard methods to determine the hydrogen cyanide, saponin, tannin, trypsin inhibitor, oxalates, alkaloids and phytate contents of the substrate for the nutritional and anti-nutritional status, while rate of weight loss in the substrate, emergence and mortality rate of P. truncatus were estimated to determine the pest status. Proximate analysis revealed increase in only alkaloids content in post-infested substrate, while all other contents were reduced when compared to the pre-infested substrate. Measurable weight loss was recorded due to boring and feeding activities of the emerged off springs. With time mortality set in to put the pest population at carrying capacity of the storage facility. *P. truncatus* pest activities and some other factors beyond the scope of this research have been found to have great negative impact on the infested substrate.

WE 22
Evaluation of effect of chemical control of weeds in sugarcane fields on stalk borers, *Sesamia* spp. population and their egg parasitoid, *Telenomus busseola*e

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Chemical control of weeds is conducted in vast area of sugarcane fields in Khuzestan province of Iran. Stalk borers, *Sesamia cretica* and *S. nonagrioides* that impose significant damages on crops annually. *Telenomus busseolae* Gahan wasp releases in sugarcane fields for controling of the stalkborers. In this study, effect of chemical control of weeds in sugarcane fields on the pest and its parasitoid wasps were considered in field and laboratory conditions. Field test was conducted in compeletely random desien with three replications on CP69-1062 variety. Test plots were included control (without herbicide) and treatment consuming common herbicides in sugarcane. Assessment indexes in test plots were included dead heart and bored internod percent. In the bioassay test, the effect of hebicides was considered on wasps and larvae of pest. Statistical analitical results showed that percentage of dead heart percent. In control (mean 0.33%) and in herbiside treatment (mean 5.23%) have a significant difference ($P<0.01$). In bioassay test, all wasps died in the all herbiside treatments, whereas larval mortality of pest was observed less than 20 percent. Therefore it could argue that one of the resons of high dead heart percent in herbicide treatment is high mortality of wasps in these plots. Bored internode in control and herbicide treatment did not show any significant difference which probably is due to time interval between herbicide consumption and sampling time and it is imposible to consider both of them on small scale, because of pest and its parasitoid movemement. Therefore, based on this study results, applying herbisides in spite of effective weed control lead to increase stalk borers population due to high wasp mortality.

WE 23
The pest status of citrus scale insects in Khuzestan province, SW Iran (1989-2009)

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During recent 20 years (1989-2009) several research projects were carried out on scale insect pests of pesticide-free citrus orchards in Khuzestan province by Department of Plant Protection at Shahid Chamran University of Ahvaz.

The mealy bug *Nipaecoccus viridis* (New.) (Pseudococcidae) was reported in 1991 for the first time from Khuzestan and was rapidly expanded its distribution in citrus orchards as well as on many other host-plants. Seven species of hymenopteran parasitoids and coccinellid predators, which have been recorded in the area, are the main natural enemies that help to maintain this pest below economic threshold level. However, it is occasionally causing considerable damage in some orchards. Results of 3 years experiments indicated that released *Cryptolaemus montrouzieri* Mul. (Coccinellidae) was able to control the mealy bug in spring; but, as the temperature increased its

reproduction and activities suppressed in July. Apart from the hot summer, eleven species of symbiotic ants adversely affect the biological control of the mealy bug by *C. montrouzieri.*

In 2003 the cottony cushion scale, *Icerya purchasi* Mask. (Margarodidae), was appeared in high density in 1042 of 5000 ha citrus orchards of north Khuzestan. During 3 years, this scale was successfully controlled by importing its effective predator, *Rodolia cardinalis* Mul. (Coccinellidae). At present, it is considered as a minor pest. As a conclusion, the situation is made difficult if new pests will arise and require pesticide treatments during period of scales' natural enemies activity. Therefore conserving scales' natural enemies through probable use of pesticides will be a continuing challenge in the future.

WE 24
Resistance of Czech pollen beetle to pyrethroids

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Resistance of pollen beetle from different parts of the Czech Republic to five different active substances of pyrethroids from class I: deltamethrin, lambda-cyhalothrin, cypermethrin, bifenthrin and from class II: etofenprox and one active substance of organophosphates: chlorpyrifos was evaluated in bioassay by topical application method on adults. In 2009, 12 field populations of pollen beetle from west part of the Czech Republic were tested. LC_{50} and LC_{90} values were calculated using probit analysis. Resistance ratios (RR) to the tested insecticides were determined for all the populations of pollen beetle as a ratio of LC_{50} of the tested population and LC_{50} of the most sensitive field population. Field population from Karlstejn locality was the most sensitive from the tested populations to all the insecticides (LC_{50} of deltamethrin 7.06, lambda-cyhalothrin 5.17, bifenthrin 162.03, cypermethrin 48.99, etofenprox 77.4 and chlorpyrifos 173.83). Resistance to some of the tested pyrethroids was detected in all of the tested populations of pollen beetle. High difference was detected in efficacy of pyrethroids against pollen beetle populations from different localities. Resistance ratios in range 1.8 – 13.0; 1.2 – 3.0; 1.9 – 14.2; 1.4 – 12.6 and 1.5 – 13.6 were detected for deltamethrin, lambda-cyhalothrin, etofenprox, cypermethrin and bifenthrin, respectively. Correlation in resistance was detected only for deltamethrin and lambda-cyhalothrin. No difference in efficacy was found between the pyrethroids from class I and II. Except of one population of pollen beetle, no resistance was detected to organophosphate chlorpyrifos. Suggestions for resistance monitoring and antiresistant strategies for pollen beetle will be discussed.

WE 25
Potential use of ozone for controlling of angoumois grain moth, *Sitotroga cerealella* (Lep, Gelechiidae)

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The angoumois grain moth, *Sitotroga cerealella*, is a destructive pest of stored grain. Due to insect resistance to current fumigants, ozone application has increased to control pests of stored products in recent years. Ozone has a very short half life (20-50 minutes) and decomposes to oxygen molecules leaving no residue on the product. In this study, the effect of ozone on mortality of eggs and adults of *Sitotroga cerealella* was measured. Four ozone concentrations (5780, 2737, 1767 and 1295 ppm) in three time periods (30, 60 and 120 minutes) were used. Ozone was produced from dry oxygen by an ozone generator and was conducted in a plexiglass cylindrical chamber. Insects were placed in the netting cages and suspended in the center of the ozonation chamber. Experiments were carried out in three replications each with 20 insects. The effect of ozone on germination of wheat seeds was also measured. The results showed that two hours of ozonation with high concentrations (5780 and 2737 ppm) resulted in approximately 100% mortality in adults, 90% and 80% mortality in eggs respectively. Lower concentrations (1767 and 1295 ppm) for two hours resulted in lower mortality rate ranging from 74.9% to 95% in adults and 42.7% to 66.3% in eggs. Furthermore, 5780 ppm of ozone for two hours decreased germination of seeds significantly, while no significant difference was observed with 2737 ppm of ozone compared to control in the same time. Conclusively, ozone in 2737 ppm for two hours could be effective for controlling of this pest in stored wheat without any adverse effects on seed germination. These findings justify further work for the development of the ozone technology.

WE 26
Oviposition preferences and larval parasitisation rate of *Meligethes aeneus* Fab. and *Ceutorhynchus obstrictus* Marsh. in different cruciferous plants

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Meligethes aeneus and *Ceutorhynchus obstrictus* are the major pests of oilseed rape in Europe including in Estonia. Host plants play a vital role in pest population dynamic and this is applicable in the trap crop strategy. Trap crop strategy is the manipulation of the pest behaviour particularly that involved in host plant location. To ascertain suitable host plants for using as trap crops, we conducted a small scale experiment to determine the oviposition preferences of *M. aeneus* and *C. obstrictus* in *Brassica napus* (spring oilseed rape), *B. nigra*, *Raphanus sativus var. olifera* and *Eruca sativa*. Additionally, the larval parasitism rates of both pests were assessed. We found the most *M. aeneus* larvae from *B. nigra* flowers. The second plant of preference was *B. napus* and *R. olifera* was the most unattractive host plant. The overall oviposition activity of *C. obstrictus* was low and the larvae damaged only the pods of *B. napus* and *B. nigra*, whereas the first was by far more attractive than the latter. Larval parasitism rates of *M. aeneus* in different cultures varied from 9% to 30% and were correlated with egg laying preferences. Parasitoids of *C. obstrictus* emerged only from the pods of *B. napus.* These results allow us to conclude that *B. nigra* could be a feasible trap crop for spring oilseed rape to attract both *M. aeneus* and *C. obstrictus* away from the main crop.

WE 27
Toxicity of five insecticides and mineral oil to white peach scale, *Pseudaulacaspis pentagona* Targioni in adult stage

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White peach scale, *Pseudaulacaspis pentagona*, as a main pest of peach, has become the most important pest of peach in Iran. This test was carried out with the effect of five insecticides including, diazinon, azinphosmethyl, chlorpyrifos methoxyfenozide, spinnosad as well as mineral oil, on the adult stage of white peach scale under laboratory conditions. Bioassay results showed that chlorpyrifos had high toxicity on white peach scale. The LC_{90} values were 11636.94, 12243.03, 14181.02, 17254.60, 21603.60 and 30954.77ppm for chlorpyrifos, diazinon, azinphosmethyl, mineral oil, spinosad and methoxyfenozide, respectively.

WE 28

Life table parameters of *Rhopalosiphum padi* (L.) (Homoptera: Aphididae) on different barley cultivars

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Life table parameters of the bird cherry-oat aphid *Rhopalosiphum padi* (L.) were studied on various commercial Iranian barley cultivars including Nosrat, Valfajr, Reihan03, Fajr30, Zarjoo and Kavir to determine susceptibility or resistance of the cultivars. The stock colony was established by aphids collected from barley, *Hordeum valgare* L. fields in Tehran, centeral part of Iran. All experiments were carried out under laboratory conditions at 26±1ºC, 65 ±5% RH and photoperiod of 16 L: 8 D hours using plastic clip cages. For each cultivar tested in this work, 30 newly emerged nymphs were selected as cohort and monitored at 24 h intervals to record nymphal developmental time, reproduction, longevity, mortality and fecundity. Nymphal developmental time (from first instar to adult emergence) was longest on Nosrat (6.09 days) and lowest on Kavir (6.67 days) cultivars. The nymphal survivorship varied from 71% to 88 % on the cultivars tested; feeding on Nosrat reduced the total fecundity of the aphid (55.95 offspring/aphid). The intrinsic rate of natural increase (r_m) ranged between 0.305 and 0.363 females/female/day. The range of other life table parameters was from 1.37 to 1.44 for finite rate of increase (λ), 1.89 to 2.17 days for doubling time (*DT*) and 10.28 to 11.87 days for mean generation time (*T*). Accordingly, analysis of the biological parameters of *R. padi* on different barley cultivars indicated Valfajr as the least susceptible cultivars while Reihan03 were considered as the most sensitive. The outcome of the present paper is likely to collate required information to anticipate the trend of population growth and consequently to organize the integrated pest management project.

WE 29

Effects of the juvenoid pyriproxyfen on the pistachio green stink bug, *Brachynema germari* Kol. (Hem.: Pentatomidae): biology and energy metabolism

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The use of juvenoids offers selective control of pests without killing the beneficial and innocuous species, and minimal chemical contamination of the environment. These disrupt the hormonal balance of insect's body and slowly act on sensitive stages of the insect life stages. Biological parameters of last larval instar, percentage of egg hatching and adults longevity and oviposition of the pistachio green stink bug, *Brachynema germari* Kol (Hem.: Pentatomidae) were tested by different concentrations of pyriproxyfen (Admiral, 10 EC). Survival and time needed for beginning metamorphosis were different in treated insects. There was a significant decrease in longevity of the adults and egg hatching. In general, it can be concluded that *B. germari* as a pentatomid important pest can be affected by the juvenoid in all developmental stages which can be considered in integrated pest management program when a juvenile hormone agonist is a candidate.

WE 30

The efficacy of kaolin on damage reduction of pomegranate fruit moth, *Ectomyelois ceratoniae* (Lep.: Pyralidae), in pomegranate orchards

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Pomegranate fruit moth (PFM), *Ectomyelois ceratoniae* (Lep.: Pyralidae), is the most important of pomegranate in Iran. Application of the kaolin particle film (Sepidan® WP) might be an alternative for control of the pomegranate fruit moth and reduction of pomegranate sunburn. To assess the impact of kaolin on damage of pomegranate fruit moth, trials were conducted in the fields during spring to summer 2009 in 3 regions of Iran (Saveh, Garmsar and Qom). The different concentrations of kaolin (2.5, 5 and 10%) were sprayed over the whole canopy and fruits four times at 4–5-week intervals from early May to early September. Based on the field studies, the infection rates of PFM were 10 and 3.4% for control and kaolin treatment (at 10% concentration), respectively. Sunburn damage of fruits was reduced from 15% in untreated control to 6% in the kaolin WP-treated fruits. Also the result showed that, the flower & fruit drop, fruit cracking, aphids and mites damage was reduced in kaolin treatments. Therefore, naturally occurring products, such as kaolin, could be used successfully to reduce biotic and abiotic harmful agents on pomegranate.

WE 31

Impact of Thrips on Cowpea

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Thrips have been documented as a major insect pest of cowpea in much of the world especially Africa. They damage cowpea plants by feeding on both foliage and blooms. In the U.S. common species include the flower thrips, *Frankliniella tritici* (Fitch); soybean thrips, *Sericothrips variabilis* (Beach); and tobacco thrips, *F. fusca* (Hinds). Flower thrips damage cowpea blooms by directly feeding on the flower and pollen. Soybean and tobacco thrips feed on foliage resulting in discoloration and distortion of the leaf tissue. Although damage from thrips feeding on foliage is common and appears substantial, recent studies have demonstrated little impact on cowpea yield. Caging up to ten *F. fusca* per cowpea seedling failed to significantly reduce seed number, seed weight or yield when compared to cowpea seedling caged with no thrips. Also, no significant differences in the days to initial flowering were detected among the treatments, i.e., 0, 2.5, 5 or 10 thrips per seedling. A caging system was developed to hold different numbers (0 to 5) of *F. tritici* on individual cowpea flowers. Again, no significant differences were detected among the treatments for number of seed per pod, seed weight per pod or weight per seed. Thus, data indicate that the impact of thrips on cowpea produced in the U.S. is likely less than previously thought. Yield increases resulting from insecticides applied for thrips management on cowpea may be due to interactions between the insecticide and the plant.

WE 32
Insecticide resistance and its management in the sweetpotato whitefly *Bemisia tabaci* (Homoptera: Aleyrodidae)

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Sweetpotato whitefly, *Bemisia tabaci* (Homoptera: Aleyrodidae), is a key pest of cotton, vegetables and summer legumes, and it also transmits about 50 gemini viruses in South Asia. Insecticide resistance was monitored in Pakistani field populations of B, tabaci from 1992 through 2009 by using a leaf-dip bioassay. The resistance was high to conventional chemistries such as organophosphates, carbamates and pyrethroids during 1992-1995, which was successfully encountered in the next 10 years owing to the introduction of new chemistries, particularly neonicotinoids, with novel modes of action that had no cross-resistance to the existing insecticides. Recently the resistance has been developing and increasing to all the above chemistries including neonicotinoids since 2006. Based on the extensive monitoring of insecticide resistance over the past two decades, an insecticide resistance monitoring strategy is proposed that emphasizes a rotation of still-effective insecticides of different chemical classes in conjunction with other integrated pest management tactics.

WE 33
Using of the thermal requirements knowledge of some snakeflies species (Raphidioptera, Raphidiidae) in IPM orchards

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Snakeflies (Raphidioptera) are a small and marginalized taxon of predators, which are relatively abundant in forests, forest steppes, alleys, parks and extensive or unsprayed orchards, but very scarce in sprayed orchards. On various fruit trees and shrubs in the Czech Republic and Slovakia have been collected following species: *Dichrostigma flavipes, Xanthostigma xanthostigma, Phaeostigma major, Phaeostigma notata, Subilla confinis, Venustoraphidia nigricollis, Raphidia ophiopsis and Parainocellia braueri.* The first two of species mentioned above are sometimes being collected in the IPM orchards. It is probable, that all species will be able to increase their abundance when the spraying scheme will be compatible with targeted selectivity for their most sensitive developmental stages during their occurence in orchards. Most sensitive to pesticides are unsclerotised adults, L1 and L2. It is possible to use a distance method (degree-days summation) to predict their occurence in orchards. Consequently, it is possible to adapt the spraying regime for the compatibility with surviving of these predators. In this presentation are presented and discussed experimental results.

This research was supported by the grant No. QH91254 from the Ministry of Agriculture of the Czech Republic.

WE 34
Characterization of the eggs phenology of the codling moth, *Cydia pomonella* and eye-spotted bud moth, *Spilonota ocellana* (Lepidoptera, Tortricidae) and its using in the IPM orchards.

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The moth eggs have several characteristic stages from oviposition to hatching during the embryonal development., which are good visible and described by many authors. These stages are differently sensitive to some factors impact e.g. temperature, pesticides with different mechanism of effect etc.

The degree-days intervals for each of eight specific stages (transparent eggs to white spot, white-ring, red-ring, eyes pigmentation, madibles sclerotization, grey-head, black-head and hatching) were assigned for codling moth and eye-spotted bud moth eggs.

In this presentation are presented the experimental data and their using for correct timing of insecticides application with ovicidal or larvicidal effect disscused .

This research was supported by the grant No. QH91254 from the Ministry of Agriculture of the Czech Republic.

WE 35
Some phenological observation of the garden chafer, *Phyllopertha horticola* (L.) (Coleoptera, Rutelidae)

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The garden chafer (*Phyllopertha horticola*), has been recorded as a pest on the turfs and in orchards in many localities of the Czech Republic and other european countries. Some basic phenological data were obtained by catching of adults into pheromone traps and rearing of the eggs and L1 in constant temperatures. Knowledge of the degree-days requirement for adults' emergence, starting of their feeding on the fruits, as well as their eggs development and L1 occurence in the soil can be used for correct pest management and for accurate choice of measures, including biological control agents application (e.g. entomopathogenous namatodes and fungi). The observed phenological characteristics are presented and discussed in this presentation.

This research was supported by the grant No. QH91254 from the Ministry of Agriculture of the Czech Republic.

WE 36
Assessing the first generation adults emergence of parasitoid *Scambus pomorum* (Ichneumonidae) by a distance method (summation of degree-days)

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The parasitoid *Scambus pomorum* is natural enemy of the apple blossom weevil (*Anthonomus pomorum*). It is moderately abundant in the extensive or unsprayed orchards, but very scarce in sprayed orchards. This is probably a result of the spraying orchards with pesticides harmful to adults of this parasitoid, which is it's most sensitive developmental stage. A measurement of heat unit requirements (degree-days) for development was used for prediction of their occurrence and arrangement of spraying regime in apple or pear orchards. Parasitoid and its host were reared together in constant temperatures. The emergence of the apple blossom weevil adults was used as biofix for starting of effective temperature summation. This point was also used for assessing of parasitoid's threshold temperature (basic temperature) for all parasitoid's stages, which developed in host between unparasitized host adults' emergence and parasitoid adults' emergence from parasitized ones.

In this presentation are presented and discussed results of this untraditional method of temperature constants assessing.

This research was supported by the grant No. QH91254 from the Ministry of Agriculture of the Czech Republic.

WE 37
Evaluation of cowpea cultivars for resistance to *Megalurothrips sjostedti* under insecticide applications

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Investigations on integration of host-plant resistance with insecticide applications for the management of the flower thrips *Megalurothrips sjostedti* on cowpea were carried out at IITA, Ibadan, Nigeria. Three resistant cultivars and one susceptible check were evaluated under unprotected and two protection levels. Unprotected plots gave very low yields due to their exposure to entire cowpea insect pest complex. Results showed that *M. sjostedti* larval mean population density is not enough to categorise cowpea cultivars as resistant or susceptible. Also, when cowpea was exposed to *M. sjostedti* infestations alone, the resistant cultivars performed best with low damage indices ranging from 2.6 to 3.3 ($p < 0.001$). Although grain yield potential of Sewe under full protection was low (485.1 kg/ha), factors conferring its inherent resistance to *M. sjostedti* could be further exploited. Higher grain yields obtained from Sanzisabinli plots (1679.1 kg/ha) under *M. sjostedti* infestation and low, negative cost-benefit ratios (1.5 and –6.0 respectively) obtained for IT90K-277-2 and Sanzisabinli respectively suggests that these cultivars actually possess significant measure of resistance to *M. sjostedti* and there is no need to protect them against thrips infestations, thereby minimizing insecticide applications and consequently reducing environmental hazards.

WE 38
Assessing the impact of site-specific spraying on control of *Eurygaster integriceps* (Hemiptera: Scutelleridae) damage and two natural enemies

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Eurygaster integriceps Puton is the key pest of wheat and barley in Iran. In this study, the impact of site-specific spraying on control of this pest and density of two general natural enemies was compared with whole-field spraying method. Three plots were assigned to each spraying method. Two other plots were left untreated as control. The plots were gridded into 11×11 m cells. Adults of *E. integriceps* were sampled with distance-walk method. Nymphs of this pest, adults of coccinellids, larvae and adults of *Chrysoperla carnea* were sampled using sweep net. Whole-field spraying was carried out when the mean number of adults and nymphs of *E. integriceps* in plots, exceeded economic threshold. In site-specific spraying method, insecticide application was done in grids with density above economic threshold. Spatial analysis of datasets was done using Geostatistical Analyst extension of ArcGIS 9.3. The spatial analysis indicated that overwintering adults and 2nd and 3rd instar *E. integriceps* had aggregated distribution in space and site-specific spraying was applicable. Site-specific application reduced the insecticide input by 40%. Density of *C. carnea* and coccinellids was higher in site-specifically sprayed plots compared with whole-sprayed plots. Percent mortality caused by decamethrin in nymphs was not significantly different ($P<0.01$) in whole-field and site-specifically sprayed plots 24 and 72 h after treatment. Percent damaged grain was below 2% in all treated plots. It can be concluded that site-specific spraying had the potential to control *E. integriceps* at an acceptable level along with reducing the amount of insecticide used. It also conserved natural enemies in untreated refuges.

WE 39-47: Semiochemicals in agroecosystems

WE 39
Deterrent of Taiwanese indigenous djulis (*Chenopodium formosanum*) on three phytophagous insect pests

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This study aims to investigate the deterrent effect of leaf and seed crude extract from djulis (*Chenopodium formosanum*, a traditional crop in the southern Taiwan) to *Plutella xylostella*, *Myzus persicae* and *Bemisia tabaci* which are the common agricultural pests. We evaluated the methanol extract from 0.0016% to 1% concentration for anti-feeding and anti-oviposition efficiency by using choice and no-choice bioassay. For larvae of diamondback moth, adult of whitefly and nymph of aphid, the deterrent activities of leaf extract were more efficient than that of seed. The leaf extract of djulis was further partitioned into ethyl acetate, butanol and water layer by different polarity of solvents for deterrent assay. The result showed that the deterrent activities of water layer to larvae of diamondback moth, adult of whitefly and nymph of aphid were more efficient than that of ethyl acetate and butanol layer. A total of 15 and 20 compounds accounting to 88.8% and 79.85% in the seed and leaf extract respectively were identified by gas chromatography coupled to mass spectrometry (GC-MS). Three unique components from the leaf extracts 2,4-ditert-butylphenol, 7,9-di-tert-butyl-l-oxaspiro(4,5)deca-6,9-diene-2,8-dione and 1-Heptadecanol were further explored for repellent investigation. In conclusion, leaf crude extract of djulis have efficiency of both anti-feeding and anti-oviposition on *P. xylostella*, *M. persicae* and *B. tabaci,* indicating the potential candidacy of the djulis as a new repellent plant to agricultural pests.

WE 40
Insecticidal activity of phytohemagglutinin (PHA) towards grain aphid

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Plant lectins have been tested as alternative resistance factors against polyphagous aphids. Phytohemagglutinin (PHA) the lectin from *Phaseolus vulgaris* is a tetrameric protein with molecular weight of 120 kDa and sugar specificity for D-galactose/ N-acetyl-D-galactosamine residue.

The aim of the present research was to examine the effect of PHA lectin on development, fecundity and mortality of *S. avenae*. In addition, the following aspects of lectin toxicity were investigated: (1) the effect of PHA lectin on activity two enzymes (α -glucosidase and alkaline phosphatase) involved in sugar and phosphorus metabolism and (2) the effect of PHA lectin on feeding behavior of adult *apterae* grain aphid.

Experiments were conducted under laboratory conditions, with application of liquid diets (that mimics a phloem and xylem phase) or sucrose-agarose gels (that corresponded to penetration of plant epidermis and mesophyll) contained several concentrations of the PHA lectin.

The obtained results showed that PHA added into the liquid diet prolonged the aphid pre-reproductive period, decreased its fecundity and increased mortality of adult *apterae* compared to the aphids fed on control diet. The aphids exposed to PHA in liquid environment also showed longer average time of generation development and smaller values of intrinsic rate of natural increase. The aphids fed on sucrose-agarose gels with higher concentrations of PHA lectin did not show any typical phloem activity. Total number of the gel penetrations was reduced and duration of the pathways prolonged by higher concentrations of the PHA lectin. In additions adult *apterae* exposed to PHA reacted by reduction in activity of α -glucosidase and alkaline phosphatase.

The presented results suggest the lectin PHA had multi-mechanistic mode of action towards the grain aphid and thus might be used in the integrated pest management of cereal crops.

WE 41
Biochemical markers of oxidative stress within tissues of pea aphid *Acyrtosiphon pisum*

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Reactive oxygen species (ROS) such as superoxide anion radical (O_2^-) and hydrogen peroxide (H_2O_2) are involved in the defence of plants against pathogens attack. Additionally, some of the plant pro-oxidant compounds upon photochemical or metabolic activation may also generate reactive forms of the oxygen. ROS can react with biomolecules such as DNA, RNA, proteins and lipids causing alterations within their structures. In insects, lipid peroxidation is potentially very harmful since lipids are not only components of cell membranes, but also play important role in developmental and reproductive physiology. Hitherto most of the research related to oxidative stress within herbivores have focused mostly on leaf-chewing insects, but little is known about this process in sucking-percing insects including aphids.

The aim of the research was to to determine the indices of oxidative stress within pea aphid, *Acyrthosiphon pisum* Harris (Homoptera: Aphididae). The oxidative stress was assessed with generation of the superoxide anion, hydrogen peroxide, content of total and protein thiols and the lipid peroxidation products (TBARS.

Results of the study demonstrate that Fabaceae plants clearly affected content of biochemical markers of oxidative stress within the pea aphid tissues. The higher level of superoxide anion, hydrogen peroxide, TBARS and thiols was recorded for morphs that fed on broad bean. Among studied aphid morphs the highest content of superoxide anion and hydrogen peroxide was noted for the wingless females and the lowest for larvae. Opposite tendency was observed for TBARS content that was the highest within winged migrants tissues. Among the studied aphid morphs the highest level of total thiols was found for apterae. Different results were obtained for the protein thiols, where apterae as well as larvae reared on the broad bean had comparable content of protein sulfhydryls.

The influence of the host plants on induction of oxidative stress within the pea aphid species is discussed.

WE 42
Influence of selected plant amines on feeding behaviour of bird cherry-oat aphid (*Rhopalosiphum padi* L.)

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Polyamines are common components of living cells, where their content is ranging from hundred micromolars to a few millimolars. Higher concentration of these biomolecules is toxic to living cells and often induce programmed cell death (PCD). It is well known, that the amines are important part of plant responses to pathogens. However, its participation in plants defense to phytophagous insects is not clear. The present paper reports on effect of common plant polyamines and tyramine on bird cherry-oat aphid (Rhopalosiphum padi L.) feeding behaviour.

The aphid's feeding behaviour was performed on sucrose-agarose gels with addition of 1 or 10 mM · dm-3 of agmatine, cadaverine, putrescine, spermidine, spermine and tyramine and followed by EPG (electrical penetration graphs) registration.

Obtained results showed, that all analyzed amines, applied in 1 mM concentration, caused inhibition of the aphid sieve element salivation (E1). It was accompanied by an increase in duration of non-probing (Np) and decrease of duration of total penetration (ABC+G+E1). Cadaverine and tyramine increased a number of Np periods, and in case of cadaverine a number of total pathways (ABC). Moreover, the aphid activity corresponded to xylem sap ingestion (G) was notpresent after application of agmatine and cadaverine at 1 mM concentration and the all analyzed amines at 10 mM level. The highest concentration of the tested compounds also elevated number and total duration of Np patterns. At this level, agmatine and spermidine increased number of ABC activity, and all amines reduced duration of total plant tissues penetration by aphids.

The polyamines and tyramine participation in plant defense responses to R. padi through disturbance of its feeding behaviour is discussed.

WE 43
Olfactometer-assessed responses of bird cherry-oat aphid *Rhopalosiphum padi* to bird cherry VOCs

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The bird cherry-oat aphid, Rhopalosiphum padi (L.) (Hemiptera: Aphididae) is one of the most important cereal aphid in the Northern and Central Europe. It is an oligophagous species that alternates between wooden and herbaceous host plants. The primary host is the bird cherry, Prunus padus (L.) and secondary ones belong to grasses.

It is well known that injured plant tissues emit various volatile semichemicals. Such phenomenon also occure while the herbivorous insects feeding on their host plants. This report enquires profile of the volatile compounds emitted by primary host of R. padi, and behavioural responses of the bird cherry-oat aphid in an olfactometer study. The volatiles were trapped in the field while the aphid spring migration and were identified by HS-SPME/GC-(EI)MS method. The emitted volatiles were as follows: (Z)-3-hexen-1-ol, benzaldehyde, benzyl alcohol, methyl salicylate and farnesene.

The bird cherry-oat aphid response to the trapped volatiles and their potential role in the spring host alternation selection is discussed.

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WE 44

Effect of triticale surface compounds on growth and development of grain aphid

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Although it is already known that the cuticle plays an important role in protecting the plant from water loss, chemicals and biotic factors, many aspects of cuticle biology and function are still obscure. The present paper reports on effect of the surface compounds on growth and development of the grain aphid Sitobion avenae (Fabricius, 1775).

Selected winter triticale genotypes, waxy covered (RAH 122, RAH 116), and wax-less (RAH 325, RAH 366) were used in the experiments. The population tests were performed at IHAR Radzikow experimental plots, and were conducted in Plexiglas cages with a cheese cloth cover. The adult apterous females of grain aphid were caged individually on flag leaves and ears to deposit nymphs. After 24h, only one nymph remained on each single plant, other offspring and the adult were removed. Development time (from birth until maturity) and reproduction of the individual apterous females were observed daily until death. The experiments were run in 20 independent replicates for each genotype of the studied winter triticale.

The population tests showed that waxy covered triticale prolonged the grain aphid maturity, decreased fecundity and reduced values of the intrinsic rate of population increase (r_m), net reproduction (R_0) and multiplication rate of population increase (λ). In addition, T value (mean time of generation development) was prolonged. The results presented here suggest that chemicals occur in the epicuticular waxes of the triticale play an important role in its acceptance by grain aphid.

WE 45

Study on the synergy effect of different parts of host plant on the attraction and trapping date palm fruit stalk borer *Oryctes elegans* Prell. (Col.: Scarabaeidae) using pheromone traps

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Date palm fruit stalk borer (DPFSB), *Oryctes elegans* is one of important pests of palm in Iran and Asia.One experiments on improvement of attraction and trapping of DPFSB were carried out in date palm groves of Saravan during 2006. The experiments realized according to randomized complete design and four fallowing treatments in 4 replicates were used:1- 800 gr of date palm core2- 800 gr of stem priphery of date 3- 800 gr of date petiol4- 800 gr whaet bran.Dispensers were made of polyethylen films (ALPLAST, France) with 200 µm thicknesses and were prepared with 20 * 30 mm sized and each dispenser was filled with 0.7 ml pheromone solution. Then dispensers with different plant hanged of lid of plastic bucket and 2% detergent solution was poured into traps. Plant baits were changed every 9 days and pheromone. Analysis of results showed that there was a significant difference among treatments ($P<0.01$). Date palm core, stem periphery of date and whaet bran were equally attractive. So these plant baits have high synergistic effect on aggregation pheromone of DPFSB, because date petiol with pheromone attract significantly less beetle than the other treatments.

WE 46

Wheat bulb fly (*Delia coarctata*) larval response to constituents of host-plant root exudates.

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Wheat bulb fly (WBF) (*Delia coarctata* (Fallén) (Diptera: Anthomyiidae) is a pest of commercial importance in wheat, barley and rye, with attacked crops failing to produce full potential yields while severely infested crops may require re-drilling. Control methods in the UK are restricted. Two of the three approved insecticides are organophosphates and are currently limited to one application per season, with a high risk of being withdrawn from use altogether in the future. WBF oviposit in bare ground, similar to that found in fields of potatoes and vegetables that often precede winter wheat in crop rotations. By ovipositing in bare soil in summer, the larvae are able to infest vulnerable wheat seedlings, when over wintering eggs hatch in January. As eggs are not laid in association with a host-plant, prompt location of a suitable host is critical to the survival of the newly hatched larvae. WBF larvae exhibit a positive chemotactic response to wheat and other host-plant seedlings and their root exudates. The objective of this study was to conduct choice test bioassays to assess the attraction of WBF larvae to the hydroxamic acids DIMBOA (2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one) and MBOA (6-methoxy-benzoxazolin-2-one), constituents of WBF host-plant exudates. The response to four concentrations of DIMBOA and MBOA were tested in arena bioassays. Analysis using a Rayleigh test of uniformity of the final larval resting positions of twenty larvae in response to DIMBOA and MBOA indicated attractancy to both these compounds. These results give the potential to develop lure and kill/push-pull strategies for the control of WBF utilising these attractant compounds to reduce dependence on the current organophosphate focused control.

WE 47

Biotechnique method attract & kill to control moth pests in Romanian orchards and vinards

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This paper presents the results from studies carried out during 2006-2009 in different Romanian apple orchards and vineyards to control codling moth (*Cydia pomonella*), summer fruit tortrix moth (*Adoxophyes reticulana*) and grapevine moth (*Lobesia botrana*) by *Attract & Kill* biotechnique. Romanian products which consist of specific pheromones of the pests and a pyrethroid, developed by Research Institute for Chemistry "Raluca Ripan" Cluj-Napoca, were used. The formulations were applied by hand, twice in the season – first time just after noticing first moths in pheromones traps and the second one about 6 weeks later. Males contacting a drop die within a few hours, reducing the reproduction and the level of populations.

The results showed good efficacy of the products formulated for *Attract & Kill* method with the percents ranging: 73.88-90.77% for codling moth, 84.6-91.81% for summer fruit tortrix moth, 73.0-89.37% for grapevine moth.

This strategy can be recommended in small orchards or vineyards where it can be applied by hand.

WE 48: Phylogeny of insects

WE 48
Morphology and the earliest splits within the hexapod lineage: Refinement of morphological concepts to chose among conflicting hypotheses

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Despite of numerous morphological and molecular studies, the earliest splits within the hexapod lineage remain to date a controversial issue. For a long time morphologists broadly agreed with Hennig, in that the earliest split is between Ectognatha and Entognatha. Within the latter clade Diplura is usually thought to be the sister group of Ellipura (Collembola+Protura). More recently a number of authors proposed a sister group relationship of Diplura and Ectognatha, abandoning the monophyly of Entognatha. Other authors pointed out that the morphological support for monophyletic Ellipura is but very weak. Additional hypotheses are based so far solely on molecular data, like the proposed sister group relationship of Diplura and Protura, in a taxon coined Nonoculata.

In morphological research ambiguities in potential synapomorphies can be explained by a number of problems in character conceptualization, including:

(i) ambiguous character polarization due to

(a) uncertainties to which character state the outgroup may be assigned (including problems of inapplicability for outgroup representatives)

(b) a priori polarization (partly caused by unscrutinized traditional concepts of character evolution)

(ii) characters conceptualized as incomplete transformation series (underestimation of number of character states)

(iii) erroneous ground-pattern coding

These problems will be exemplified in the present contribution on the various characters, mentioned to support monophyly of a distinct clade of basal hexapods. Moreover, new characters will be proposed, which turn the balance among the conflicting phylogenetic hypotheses.

WE 49-87: Insect biochemistry and physiology, including their hormonal regulation

WE 49
Physiology of Diapause in Overwintering larvae of the Pistachio twig borer, *Kermania pistaciella* Amsel (Lepidoptera: Tineidae) in Rafsanjan.

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The Pistachio twig borer, K*ermania pistaciella*, is a devastating pest of pistachio trees in the pistachio producing zone of Rafsanjan; it overwinters as last larval diapausing instar. In this study, physiological changes in relation to environmental temperature were investigated in field collected larvae. Carbohydrates (glycogen, trehalose and glucose), whole body lipids and proteins were measured. The content of glycogen decreased with a fall in the environmental temperature from 19°C in October to 8.5°C in December. This decrease in glycogen content was proportional to the increases in trehalose and glucose contents. In December, glycogen content (26 mg/g fresh weight) was at its lowest level whereas glucose (26 mg/g fresh weight) and trehalose (65 mg/g fresh weight) were at highest levels; thus, trehalose and glucose contents rose as the temperature decreased from 19°C to 8.5°C. At the same time, whole body protein and lipid contents (4.6 and 7.3 mg/g fresh weight, respectively) were also at their lowest level. Total body lipids decreased during diapause and reached lowest level in fully developed diapause larvae. In conclusion, trehalose may play a role to survive the winter, and to adapt the pistachio twig borer to cold and to provide the cryoprotection against harsh environmental conditions. Probably, diapausing larvae of pistachio twig borer have the ability to reserve energy in the form of lipids and utilize them during overwintering.

WE 50
Serotonin receptors in the salivary gland of *Calliphora vicina*

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The salivary gland of the blowfly, Calliphora vicina, has been used extensively as a model system for hormone-induced IP3, Ca2+ and cAMP signaling and the regulation of V-ATPase activity. Salivation is hormonally regulated by the biogenic amine serotonin (5-HT), which is believed to activate at least two different membrane-bound G-protein-coupled receptors. Stimulation of these receptors with serotonin leads to an increase in the intracellular concentrations of the second messengers Ca2+ and cAMP. A lot of research was done to elucidate the mechanisms of intra- and intercellular Ca2+ signalling as well as on the crosstalk between cAMP and Ca2+ signaling pathways. Surprisingly, the molecular identities of the 5-HT receptor subtypes involved in the activation of saliva secretion have not been identified so far. However, their molecular identification as well as their functional and pharmacological characterization are crucial for the full comprehension of intracellular signaling pathways activated by serotonin in the salivary gland.

Using a strategy based on PCR with degenerate primers followed by RACE-PCR experiments, we obtained cDNA fragments encoding for two putative 5-HT receptors of *C. vicina* (*Cv5-ht2* and *Cv5-ht7*). The deduced amino acid sequences display the major characteristics common to all G-protein-coupled receptors in general and 5-HT receptors in particular. The tissue-specific expression pattern of the receptor mRNAs has been investigated by RT-PCR. In order to clarify the functional and pharmacological properties of the cloned 5-HT_7 receptor, we are currently studying a HEK 293 cell line, heterologously expressing the Cv5-HT_7 receptor protein.

This work was supported by the DFG (Grant Wa 463/9-6).

WE 51

Effects of fungal infection by the entomopathogen fungus *Paecilomyces lilacinus* on haemolymph protein profile of the host flour moth *Ephestia kuehniella* larvae

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The effects of the entomopathogenic fungus *Paecilomyces lilacinus* on the hemolymph protein profile of the flour moth *Ephestia kuehniella*'s larvae were investigated using an immersing method. Fungal suspensions of $1.0x10^6$ conidia/ml were used on *Ephestia kuehniella* last instar larvae. Haemolymph proteins were analyzed using spectrophotometry and sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE). The gel was subsequently scanned using an Uvitec Gel Documentation (BioLab) system and the optical densities (OD) of the bands were analyzed by Gel-Pro Analyzer. Each assay was repeated three times. The quantities of proteins from fungal infected larvae were slightly reduced 24, 48, 72 and 96 hours after infection when compared with controls. Of the fifteen different protein bands detected at a range of 7.2-199.6 kDa in the haemolymph, there were only changes in OD values of bands following fungal infection. SDS-PAGE analysis revealed that the quantities of all proteins were found to be increased at 24h post infection whilst all proteins were decreased in concentration in the haemolymph of infected larvae at 48, 72 and 96 h post infection compared with haemolymph of control larvae. Therefore, the results showed that quantitative changes were only significant in the plasma proteins of *E. kuehniella* larvae infected by the entomopathogen fungus *P. lilacinus*.

WE 52

Effects of 20-hydroxyecdysone and juvenile hormone on octopamine metabolism in females of *Drosophila* under normal and stress conditions

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The influence of 20-hydroxyecdysone (20HE) on activities of the rate-limiting enzyme of octopamine (OA) synthesis, tyrosine decarboxylase (TDC), and enzyme of OA catabolism, arylalkylamine N-acetyltransferase (AANAT) in *Drosophila virilis* and *D. melanogaster* wild type females under normal and heat stress (38°C) conditions was studied. Increase of 20E titre (feeding with enzyme) was found to lead to a rise of TDC activity and decrease of TDC response intensity (stress reactivity) on heat stress in both species females. At the same time AANAT activity doesn't alter under 20E treatment of females of both species. Thus 20E regulates OA metabolism at synthesis level.

Influence of OA titre increase (feeding with OA) on ecdysone-20-monooxygenase (E20MO), converting ecdysone to 20E and determining to a considerable degree 20E titre, in *D. virilis* wild type females was studied. OA treatment was found to provoke the increase of E20MO activity and 20E titre in females. The influence of a decrease in OA level on 20E metabolism was estimated after measurements of E20MO activity and 20E titre in the octopamineless females of the strain $T\beta h^{nM18}$, in females of the strain P845 (precursor of $T\beta h^{nM18}$ strain) and in wild type females, *Canton S*, of *D. melanogaster*. It was established that the absence of octopamine leads to a considerable decrease in the enzyme activity and in 20E titre. Thus E20MO occupies a key position in the regulation of 20E titre under the conditions that lead to changes in OA levels.

WE 53

Determination of sugars and polyols in lab-reared and overwintering larvae of beet armyworm, *Spodoptera exigua* (Lepidoptera: Noctuidae)

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The beet armyworm, *Spodoptera exigua* (Hübner), is a highly polyphagus insect that feeds on many crop plants and weeds. Although this pest has no known induced diapause mechanism, it is able to overwinter successfully in cold regions of Iran. To understand this ability, overwintering larvae of beet armyworm were collected from November 2008 to March 2009 and the major cryoprotectants of these and lab-reared larvae were measured by HPLC. Five identified compounds were trehalose, glucose, myo-inositol, glycerol and sorbitol, respectively. In the lab-reared larvae, glucose was the most common sugar (3.5±0.57 mg/g fresh weight). Trehalose and other components were present in trace amounts (0.3-0.6mg/g). The major carbohydrate in overwintering larvae was trehalose. It was present in low concentration in November (0.99±0.28 mg/g) but gradually increased to a peak of 3.9±0.55 mg/g in January. Glucose was, inversely, present in relatively high concentration in November (3.3±0.46 mg/g) but dropped to 0.32±0.13 mg/g in January. It suggests that trehalose is the major cryoprotectant in overwintering larvae of beet armyworm during winter and glucose (in addition to glycogen) might be converted to trehalose during cold months.

WE 54

Changes in the hemolymph protein profile of *Galleria mellonella* L. (Lepidoptera: Pyralidae) parasitized or envenomated by the endoparasitic wasp *Pimpla turionellae* L. (Hymenoptera: Ichneumonidae)

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It is well known that parasitoids regulate the physiological state of the host for the successful development of their progeny. Calyx fluid and/or venom injected into the host along with the parasitoid egg are important factors in the regulation of host hemolymph protein milieu. This situation is most studied for koinobionts but not well documented for idiobionts. Therefore, the effects of dose-dependent envenomation by and parasitization of idiobiont endoparasitoid *Pimpla turionellae* L. (Hymenoptera: Ichneumonidae) on the hemolymph protein profile of its host *Galleria mellonella* L. (Lepidoptera: Pyralidae) pupae are investigated. Hemolymph proteins were analyzed using spectrophotometry and sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE). SDS-PAGE (10% acrylamide) was carried out with the method described by Laemmli. The gel was subsequently scanned using an Uvitec Gel Documentation (BioLab) system and the optical densities (OD) of the bands were analyzed by Gel-Pro Analyzer. Each assay was repeated three times at 4, 8, and 24 h post-treatments. The quantities of proteins from parasitized and envenomated host pupae did not differ much when compared with those of unparasitized, null- or PBS-injected controls. Of the seventeen

different protein bands detected at a range of 19.6-181.12 kDa in the hemolymph, there were only changes in OD values of bands at 23.418, 24.714, 32.434, 34.811, and 45.385 kDa following envenomation and parasitism. Parasitization and envenomation lead up- or down- regulation of few proteins. There were also no qualitative changes in term of novel protein bands in the hemolymph of parasitized or venom injected pupae. We suggest that host regulation of *G. mellonella* by parasitism or envenomation of *P. turionellae* involves significantly quantitative changes in the host plasma proteins and does not lead to the up-regulation of novel proteins.

WE 55

Cytotoxic effects of parasitism and application of venom from the endoparasitoid *Pimpla turionellae* L. (Hymenoptera: Ichneumonidae) on hemocytes of the host *Galleria mellonella* L. (Lepidoptera: Pyralidae)

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In parasitoid species devoid of polydnaviruses and virus-like particles, venom appears to play a major role in suppression of host immunity. Venom from the pupal endoparasitoid *Pimpla turionellae* L. (Hymenoptera: Ichneumonidae) has previously been shown to contain a mixture of biologically active components, which display potent paralytic, cytotoxic, and cytolytic effects toward lepidopteran and dipteran hosts. The current study was undertaken to investigate if parasitism and/or envenomation by *P. turionellae* affects the frequency of apoptotic and necrotic hemocytes, hemocyte viability and mitotic indices in *Galleria mellonella* L. (Lepidoptera: Pyralidae) pupae and larvae. Our study indicates that parasitism and experimental envenomation of *G. mellonella* by *P. turionellae* resulted in markedly different effects on the ratio of apoptotic hemocytes circulating in hemolymph depending on the host developmental stages. The ratio of early and late apoptotic hemocytes increased more than 100% in *G. mellonella* pupae and larvae upon parasitization and at high doses of venom when compared to untreated, null and PBS injected controls. In contrast, an increase in necrotic hemocytes was only observed in parasitized pupae at 24 h and no difference was observed in larvae. The lowest hemocyte viability values were observed with pupae as 69.87, 69.80, and 72.47% at 4, 8, and 24 h post-parasitism. The ratio of mitotic hemocytes also decreased in pupae and larvae upon parasitization and at high doses of venom. Staining of hemocytes with annexin V-FITC revealed green fluorescent 'halos' along the plasma membranes of venom treated cells within 15 min following exposure to venom. By 1 h post venom-treatment, the majority of hemocytes displayed binding of this probe, indicative of early stage apoptosis. These same hemocytes also displayed a loss of plasma membrane integrity at the same time points as evidenced by accumulation of propidium iodide in nuclei.

WE 56

Developmental hormones control dopamine metabolism in *Drosophila* females under normal and heat stress conditions

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Dopamine (DA), as neurohormone, is involved in the regulation of levels of insect developmental hormones, juvenile hormone (JH) and 20-hydroxyecdysone (20E) (Woodring, Hoffmann, 1994; Granger *et al*., 1996; Hirashima *et al*., 1999; Rauschenbach *et al*., 2007). It was demonstrated that JH and 20E, in their turn, control DA level (Gruntenko *et al*., 2003; Gruntenko, Rauschenbach, 2004). The DA content at any moment is determined by the ratio of its synthesis and degradation. The rate of synthesis depends on the pool of precursor and the activity of synthesizing enzymes. We measured the effects of exogenous JH and 20E on the activities of alkaline phosphatase (ALP), defining at least in part the level of DA precursor, tyrosine, and tyrosine hydroxylase (TH), the first enzyme in DA synthetic pathway, in young females of *D. virilis* and *D. melanogaster* under normal and heat stress conditions (38°C). 20E level was raised by feeding the flies with exogenous hormone. It was shown that an increase in the 20E titre lead to a rise in the activities of ALP and TH under normal conditions. JH application also increased activities of both enzymes under normal conditions. A rise in JH and 20E levels was found not to prevent the response of TH and ALP to heat stress, but to change the intensity of theirs response to the stress exposure. Putative mechanisms of control of DA level by 20E and JH in *Drosophila* females are discussed.

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WE 57

Immune reactions of *Galleria mellonella* larvae during bacterial infection by *Bacillus thuringiensis*

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Bacillus thuringiensis (Bt) is one of the best known agents of bacterial diseases. Pathogenic action of *Bt* on insects is mediated by toxins and other bacterial metabolites. Parasporal δ-endotoxin is one of the most important toxins for the pathogenic process. δ-endotoxin is inducing gut infection which destroyed midgut epithelial cells. Different components of the insect's immune system take part in defense reactions against penetration and developing of pathogens.

We studied the cellular and humoral immune response of *Galleria mellonella* (*Gm*) larvae during bacterial infection by low (mortality 15% of insects, LC15) and high (mortality 50% of insects, LC50) concentration of *Bt* ssp*. galleria*. On the second and third day after peroral infection of *Gm* larvae by low concentration of bacteria *Bt.*, the activity of phagocytes and the rate of encapsulation was 1,5 – 2 fold increased which was significant ($p \leq 0,05$). We also show that the infected insects have a higher activity of phenoloxidase in the haemolymph as the control. Probably, the enhanced immune reaction results from penetration of some inductors into the haemocoel after the midgut epithelial cells are damaged by the toxins (Dubovskiy et al., 2008). We studied also the immune response of insects after treatment by higher concentration of *Bt* (LC50). The infected insects had a significantly decreased rate of encapsulation and of phenoloxidase activity in the haemolymph on the second and the third days of bacteriosis. Probably the depressed immune reaction is associated with the process of damage in midgut of insects by the higher concentration of toxins.

WE 58

Body temperature of hornets (*Vespa crabro*) and wasps (*Vespula sp.*) at the nest entrance

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The hornet (*Vespa crabro*) is the largest species of vespine wasps in Middle Europe. The thermoregulatory capacity of some insect groups is related with their body mass. Therefore we investigated the body temperature of hornets

in comparison with two other smaller vespine wasps (*Vespula vulgaris, Vespula germanica*). By means of infrared thermography the surface temperature of thorax (T_{th}), head (T_{hd}) and abdomen (T_{ab}) was measured before departure and after arrival at the nest entrance.

At the departure the mean T_{th} of *Vespula* decreased slightly from 40.4°C to 39.0°C as the ambient temperature (T_a) increased from 18 to 35°C. However, the T_{th} of the hornets showed a strong dependence on T_a and increased from 33.7°C to 43.7°C. At the arrival at the nest entrance after foraging flights the T_{th} of both, wasps and hornets was quite similar and increased linearly with T_a. The slope was somewhat steeper in the hornets (T_a=18°C: *Vespula* T_{th}=35.0°C, hornet T_{th}=35.2°C; T_a=35°C: *Vespula* T_{th}=40.6, hornet T_{th}=42.2°C). The thorax temperature excess (T_{th}-T_a) as a measure of the endothermic activity decreased strongly with T_a in both. It was a little bit lower at arrival. The decline of the landing temperature excess with increasing T_a shows that both *Vespa* and *Vespula* are able to regulate body temperature in flight. Despite the big difference in body weight of *Vespa* (458.2±50.5 mg) and *Vespula* (64.4±11.3 mg) they exhibited astounding similarities in the thermoregulative behavior during arrival and departure at the nest entrance.

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WE 59
Specificity and localization of lipolytic activity in males of *Bombus terrestris*

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The study of fat metabolism in insects has received considerable attention over the years. The properties of lipases from insects and their importance are, however, poorly investigated. Fatty acids stored as triglycerides in the fat body serve as precursors in multiple processes including energy production and synthesis of cellular components. In bumblebees, lipases can participate in addition to the hydrolysis of storage lipids, in the biosynthesis of different fatty acids, which serve as pheromones for very specific sexual communication of this species. We detected lipase activity in fat body, labial gland and midgut of *Bombus terrestris;* we performed experiments to characterize these novel enzymes. Different lipase activities were present in various tissues of the bumblebee. The specificities of the lipases were tested by hydrolysis of *p*-nitrophenyl esters with different chain lengths (from C8 to C18). The enzymes were active to a wide range of fatty acid esters of *p*-nitrophenol, but preferentially showed the strongest specificities to short-chain fatty acids esters (C8 and C10). The pH optimum of crude lipase extracts from labial gland, fat body, and midgut, detected with *p*-nitrophenyl laurate, was 8.3. Lipases from labial gland and fat body displayed temperature optima at 50 °C, and the activity of midgut lipase was not dependent on temperature in the range from 4 °C to 55°C. According the SDS electrophoresis, the molecular weight of lipases from labial gland and fat body was 67 kDa and that from midgut was 30 kDa.

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WE 60
Role of stress in the evolution: opportunity of experimental evaluation.

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Over two years we had an opportunity to observe changes in Colorado potato beetle adult's life span after the toxic stress. In 2009 presence of resistant to organophosphate, pyrethroids, neonicotinoids, nereistoxines and phenylpyrazoles overwintered adults in 19 excerpts from Bashkortostan (Russia, South Urals) has been revealed in laboratory conditions. In total excerpt (2725 adults) we found 88 treated ones with the life span exceeded by 30-50 days the control groups of adults. Share of "long-livers" in total excerpt was 3.2%. Nevertheless, it seems to be important that these individuals were capable to survive under lethal doses of all insecticides. Phenomenon of *Leptinotarsa decemlineata* Say expansion continued in Eurasia and unpredictably fast resistance development cannot be explained only by the effect of positive selection. Our results allow concluding that adult's life span changes mean of no small importance in transformations of native populations phenotypic and genotypic structure.

Similar results we drew in series of experiments with house fly laboratory strains. Life span and reproduction period extension effects in all strains caused by impact toxic stress were observed during 4 to 6 succeeding generations. So, we observe active adaptations process and life span seems to be reliable characteristic of population microevolutionary transformations.

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WE 61
Relationship between feeding on different plants and hibernation physiology in *Mamestra brassicae* L. pupae

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To determine the influence of food plants on diapause intensity, larvae of the cabbage moth *Mamestra brassicae* were reared either on white cabbage (*Brassica oleracea* var. *capitata* f. *alba*), ornamental cabbage (*Brassica oleracea* (L) var. *acephala)*, rutabage (*Brassica napus* (L) var. *Napobrassica)*, nasturtium *(Tropaeolaceae majus* L.) or mignonette (*Reseda odorata* L.) at 20ºC under 12 h light: 12 h dark (short daylength). Laboratory experiments showed that there was a significant effect of host plant on larval survival and pupal body mass, with the performance being lowest on mignonette and nasturtium. Pupae of the mignonette and nasturtium treatments also had a higher standard metabolic rate and lost greater mass per day than those reared on ornamental or white cabbage variants. Based on larval survival, mean pupal weight and loss of body, it appears that on a poor quality host plant the intensity of diapause is lower than on a good quality food plant. The results suggest that the difference in diapause intensity would, at least in part, account for the higher levels of overwintering mortality of pupae from larvae reared on less suitable food plants under field conditions.

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WE 62

Concentration of free intracellular Ca^{2+} during the insect's cell immune response.

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It is known that calcium regulates cell metabolism, functional activity and development. Calcium takes part in activation of the encapsulation of foreign bodies and haemolymph coagulation. We have studied the dynamics of $[Ca^{2+}]$ in the haemolymph of the greater wax moth *Galleria mellonella* larvae during encapsulation and phagocytosis. Changes in the quantity of free cytosolic $[Ca^{2+}]$ in blood cells of the greater wax moth have been determined by a fluorescence marker (fura 2 AM). An increase of the free $[Ca^{2+}]$ was detected in the cytosol of haemocytes 30 minutes and 1 h after injection of an implant. After 4 h of implantation, however, the free $[Ca^{2+}]$ in the cytoplasm was decreased. To test the effect of phagocytosis, we injected a suspension of dead cells of *Escherichia colli* (10^8/larva) into the haemocoel of *G. mellonella*. At 1,5 hours after injection of the suspension, we measured an increase of free $[Ca^{2+}]$ in the cytosol. We observed a decrease of free $[Ca^{2+}]$ up to control level 2 hours after injection ($p \leq 0,05$). We suppose that the key role of calcium in the modification of haemocytes cytoskeleton and activation of prophenoloxidase system could result in the increasing of $[Ca^{2+}]$ concentration during initial stages of phagocytosis and encapsulation.

WE 63

***Myo*-inositol, a major cryoprotectant of the overwintering elm leaf beetle, Xanthogaleruca luteola (Coleoptera: Chrysomelidae)**

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The elm leaf beetle, *Xanthogaleruca luteola* (Muller) overwinters as an adult in reproductive diapause. Diapause in this beetle begins in October and terminates in May. To identify major cryoprotectants existing in this insect and to investigate the relationship between polyol content and the insect's cold hardiness, polyols were identified by high performance liquid chromatography (HPLC) and their effects on survival at low temperature were monthly measured from October 2008 to May 2009. Five polyols consisting of *myo*-inositol, glucose, trehalose, sorbitol and glycerol were identified from overwintering field populations. *Myo*-inositol showed the greatest seasonal pattern between diapausing and non-diapausing adults. *Myo*-inositol was increased in diapausing populations until January (6.4 mg/g fresh body weight) and thereafter decreased to significantly lower levels in non-diapausing populations in May (0.4 mg/g fresh body weight). Survival at -15 oC was 65% in January whereas it decreased to 17% in May. These results indicate that *X. luteola*, a freeze susceptible species, is a cold tolerant insect with elevated *myo*-inositol content.

WE 64

Rapid cold hardiness process in *Brevicoryne brassicae* (L.)

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The ability of insects to respond rapidly to a sudden decline in temperature is an important factor to increase survival at low temperatures. Rapid cold hardiness is a process that insects increase their survival at sub-zero temperatures following a brief exposure to 0 and 5 °C. Because of the short life span and continuous reproduction of aphids, rapid cold hardiness is likely to be more important for them. The cabbage aphid, *Brevicoryne brassicae* (L.) is a major pest of plants in the family Brassicacae and makes large populations on winter cabbages. In this study we investigated rapid cold hardiness of winter populations of *Brevicoryne brassicae*. The collected insects were transferred directly to a series of sub-zero temperatures for 2 h to determine the temperature at which approximately 20% survival occurs (discriminating temperature). Aphids were exposed to 0 °C for 1 to 4 h, and then transferred to the discriminating temperature. The survival rate was increased from 21.5% in control to 55% when aphids acclimated at 0 °C for 2 h prior to exposure at -12 °C. Surprisingly, the survival rate was enhanced to 92% when aphids were acclimated for 3 h at the same condition. These results suggest that rapid cold hardiness may protect *B. brassicae* against cold shock injury, and the resulting increased survival has an important role to play in determining the size of the following spring population.

WE 65

Effects of low temperature on adult longevity and fecundity of *Pimpla turionellae* L. (Hymenoptera: Ichneumonidae)

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The ichneumonid pupal endoparasitoid wasp *Pimpla* (= *Coccygomimus*) *turionellae* L. attacks a broad range of lepidopteran pupae. In laboratory conditions, it is possible to rear *P. turionallae* on pupae of the great wax moth *Galleria mellonella* (Lepidoptera: Pyralidae). In this study, *P. turionellae* larvae were exposed to low temperature and effects of low temperature on adult longevity and fecundity were determined. *G. mellonella* pupae parasitised by *P. turionellae* females were exposed to 4 or 10 ºC for 5- 10 or 15 days after leaving at 25 ºC for 1- 3 or 5 days. Adult longevity and fecundity of emerged adult wasps were determined after each treatment. Since adult emergence was very low, adult longevity and fecundity of the group exposed to 4 ºC were found less. Results showed that while longer period of low temperature acclimations affected longevity and fecundity negatively, keeping longer at 25 ºC before low temperature treatments had positive effect on longevity of females.

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WE 66
Effects of low temperature on loss weight, total lipid and total fatty acid contents and fatty acid ratios of *Achroia grisella* L. (Lepidoptera: Pyralidae) pupae

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Achroia grisella (Lesser Wax Moth) is widely used as a host for many parasitoid species. Parasitoids and their hosts can be stored at low temperature conditions for mass rearing studies. Low temperature exposures may cause some physiological damages. Under long cold exposure, insects face a great challenge in maintaining both water balance and energy reserves. Lipids are known to be used as energy source in insects. Maintenance of cold- hardiness is expected to be energy- dependent. The aim of this research was to study loss weight, lipid content and fatty acid ratios associated to the cold- hardiness.

In this study, effects of low temperature (4 ºC) on loss weight, total lipid and total fatty acid contents and saturated (SFA), monounsaturated (MUFA) and polyunsaturated fatty acids (PUFA) ratios of *A. grisella* pupae were investigated. *A. grisella* pupae were exposed to low temperature at 4 ºC for 5, 10, 15 and 20 days. After treatments, while loss weight of pupae increased significantly with cold storage duration, total lipid and total fatty acid ratios reduced. With the exception of the 10 day low temperature acclimation group, SFA, MUFA and PUFA ratios of all the groups were found similar.

Body weight loss may be associated not only with water loss but also with consumption of lipid and carbohydrate reserves and can be a significant factor of low temperature survival. Lipid and fatty acid contents also declined during cold exposure. Body energy reserves, particularly from fat body, may be lost during low temperature exposure. Low temperature related changes in fatty acid composition have been reported in some species of Lepidoptera. In contrast to most previous studies indicated that proportions of unsaturated fatty acids (UFAs) increased after low temperature exposure, in this study low temperature had only a minor effect on the fatty acid composition. Our results show that physiological responses such as changes in fatty acid composition due to low temperature exposure can be different among insects.

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WE 67
Influence of neonicotinoid bioassay on fertility life table parameters of the cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae)

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Impact of imidacloprid and thiametoxam on fertility life table parameters of the cotton aphid, *Aphis gossypii* was assessed using three bioassays including; residual, starvation and FAO dip methods. In residual bioassay, aphids were transferred on the sprayed leaves with potter tower; in starvation method petri dishes sprayed with the neonicotinoids and then aphids were transferred to the petri dishes without any food and water supply and in FAO dip method, insects dipped for 5 seconds in pesticide solutions and then transferred to the fresh leaves. In starvation and residual methods, LC_{50} values were respectively 15 and 11% (in the case of imidacloprid) and 22 and 18% (in the case of for thiametoxam) more than FAO dip method. The LC_{50} value in starvation method was obtained 3% more than the residual method. Imidacloprid at concentration of LC_{50} obtained from the starvation and residual methods respectively caused 160 and 34% increase in intrinsic rates of increase (r_m) and net reproductive rate (R_0) in comparison with FAO dip test. Generation time (T) and doubling time (DT) were respectively obtained 59 and 62% less than those in FAO method. In contrast, thiametoxam at the concentration of LC_{50} of starvation method caused 9 and 67% increase in r_m and R_0 respectively compared to FAO dip method. However T and DT were respectively obtained 65 and 92% less than those in FAO dip method. There was not any significant difference between fertility life table parameters obtained from residual and starvation bioassays.

WE 68
Impact of host plant on energy reservoirs of the cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae)

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In the present investigation, the impact of host plant (squash, greenhouse cucumber var. Sultan and var. Turkey) was studied on susceptibility of *Aphis gossypii* to a neonicotinoid insecticide, imidacloprid. Two strains of the aphid with different susceptibility (susceptible and resistant) to the pesticide were chosen for the experiments. The resistant strain was 1700 times more resistant than susceptible resistant to the pesticide. Total protein, total lipid and total carbohydrate content were assessed as the biomarker. The results revealed that energy consumed in susceptible strain exposed to imidacloprid was 2.84 times more than resistant strain on squash. In contrast, consuming energy in resistant strain was 1.8 and 1.41 times more than susceptible strain reared on greenhouse cucumber var. Sultan and var. Turkey respectively. Total protein content in resistant strain reared on squash, greenhouse cucumber var. Sultan and var. Turkey were respectively 1.46, 2.23 and 1.73 times more than susceptible strains reared on the host plants. The highest total lipid content was observed in the resistant strain reared on squash, greenhouse cucumber var. Sultan and var. Turkey and was respectively 2, 6 and 1.43 times more than susceptible strain reared on the host plants. The amount of sugar consumption in susceptible strain was respectively 2, 6 and 4.5 times more than resistant strain reared on squash, greenhouse cucumber var. Sultan and var. Turkey.

WE 69
Distribution and different effects of a fungal lectin of *Xerocomus chrysentron* (XCL), on *Acyrthosiphon pisum* aphids: specific sugar binding activity induced changes in insect responses

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Xerocomus chrysentron lectin (XCL), presenting a specific linkage to galactose and N-acetyl-D-galactosamine was compared to the well-known mannose-glucose lectin, Concanavalin A (ConA) for insecticidal activity against an important aphid, *Acyrthosiphon pisum* Harris. Aphid mortality was observed during 4 days by ingestion assays using an

artificial diet containing 0.1% of XCL or ConA as a conventional aphicidal lectin. Significant differences of aphid susceptibility were found, the fungal XCL was more toxic than the ConA. To understand the action mechanism of lectin, a range of histochemical and biochemical techniques (SDS-PAGE followed by western blot) were used to elucidate the distribution of the lectin in the aphid intoxicated lectin. Significant amounts of XCL were found in the digestive tract and hemolymph compared to presence of lectin in the honeydew of this aphid. Immunobloting assays of *A. pisum* intoxicated with 0.1% ConA lectin as a control showed that ConA was only present in digestive tract of this aphid but not traced in haemolymph and honeydew. These observations suggested that the particular sugar specificity of XCL changed its binding on the glycosylated receptor of the aphid gut epithelial cells allowing the lectin to cross this biological barrier to penetrate more efficiently in the aphid hemolymph. Immunolocalisation assays on aphid sections revealed that the XCL was more abundant than the ConA in the hemocoel region. The differential distribution of the lectins in aphid was discussed in relation to its susceptibility to these lectins, their feeding behaviour and the potential use of lectin to control crop pests.

WE 70

Digestive polygalacturonase activity in two stored coleopteran pests: Callosobruchus maculatus (Col.: Bruchidae) and Trogoderma granarium (Col.: Dermestidae)

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The cowpea weevil, *Callosobruchus maculatus,* and Khapra beetle, *Trogoderma granarium*, are important pests of stored legumes and cereals, respectively, causing drastic economic damage annually. In this study, polygalacturonase activity was determined in digestive system of the adult and the last instar of cowpea weevil and Khapra beetle, respectively. The alimentary canals were removed and the resulted homogenates were centrifuged. The homogenates were used as the source for enzyme assays. Polygalacturonase activity was determined using the sensitive agarose plate assay and Ruthenium red and HCl as the visualizing reagents. Optimal pH for polygalacturonase activity was determined using universal buffer with pH set at 3, 4, 4.5, 5, 5.5, 6, 7 and 8. The results showed that the optimum pH polygalacturonase activity occurs at pH 6 and 5.5 in the case of cowpea weevil and Khapra beetle, respectively. Enzyme activity increased steadily from pH 3 to 6 for *C. maculatus*, and from pH 3 to 5.5 for *T. granarium* Everts, then decreased with increasing pH above 6 and 5.5, respectively. The effect of temperature on stability of the enzyme activity was determined by pre-incubating the reaction mixture at 20, 30, 40, 45, 50, 55, 60, 65, 70, 80, 90 and 100°C for 30 min. The result showed that polygalacturonases can be active at up to 55ºC. The residual activity was decreased at the temperatures above 55ºC.

WE 71

Biochemical characterization of midgut digestive carbohydrases from carob moth, *Ectomyelois ceratoniae* (Lepidoptera: Pyralidae)

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The carob moth, *Ectomyelois ceratoniae* Zeller (Lep.: Pyralidae), is a serious pest of pomegranate in Iran and a well known pest of many fruits from a wide range of plant families. However, there are few studies concerning the digestive system of this insect and in order to reach to a better control of this pest and develop optimal management strategies, it is important to understand how the digestive enzymes function. In this study digestive carbohydrases including α- glucosidase, β-glucosidase and α-amylase activities were investigated. Optimal pH for α- and β-glucosidase activity was determined using universal buffer with pH set 3 to 10 and for α-amylase with pH at 5 to 12. Results indicated optimal pH for activity of α- glucosidase, β-glucosidase and amylase takes place at 6-7, 7 and 10 respectively. Zymogram analysis at native-PAGE condition showed at least two distinct amylase activity bands from first to five larval instar. Characterization of digestive enzymes especially effect of inhibitors on enzyme activities could be useful in one hand for better understanding of enzyme roles in nutrition physiology of the insect and on the other hand to reach safe and useful controls of insect pest.

WE 72

Proteinase and carbohydrase activity in the digestive system of the predatory mite, *Allothrombium pulvinum* Ewing (Acari: Trombidiidae)

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Parasitengona mites are important biological control agents. *Allothrombium pulvinum* Ewing is an important predatory mite capable of controlling many pests especially aphids. In the present study protease and carbohydrase activity in digestive system of the mite was determined. Adults were collected from the fields, dissected and their guts were removed. Homogenates from the gut were centrifuged and the supernatants were used as the source of enzyme. For determining pH of gut, eight pH indicator dyes were used. Gut pH was determined to be acidic (pH 4). Hemoglobin was used as substrate for determining of total proteolytic activity at pH range of 2 to 12. Optimal proteolytic activity occurred at pH 4.5 suggesting the presence of cysteine proteases. The presence of the cysteine protease was confirmed by inhibition by E-64. In gel assay (native-PAGE zymogram), proteolytic activity was detected as at least 4 separate proteolytic bands. Two bands were almost disappeared in pre-treating with E-64. No α-amylase activity was detected using starch and glycogen as the substrates. Maximum activity of α- and β-glucosidase occurred at pHs 3.5 and 4 respectively. This information can be useful in elucidating tri-trophic interaction of plant, pest and predator in integrated pest management.

WE 73

Cold-hardiness of the carabid beetle affected by alpha-cypermethrin

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Predacious carabid beetle *Platynus assimilis* Payk. is an important component of biological control. In this study we tested synthetic pyrethroid Fastac 50, the commercial formulation of alpha-cypermethrin (a.i. 50g l^{-1}), on adult beetle under laboratory conditions. Cold-hardiness (measured by supercooling point SCP) was determined 2 weeks after exposure to pesticide treated-food. Food was treated by dose 0.15% based on recommendations for field spraying. The beetles (n=52) were divided into 2 groups: control (28 beetles) and test (24 beetles). For measuring SCP carabid beetles were anesthezised by ether. The beetles positioned so that its integument (thoracic tergit) was contacted with the copper-constantan thermocouple, placed in a glass vial, and then transferred to the circular bath

(Ministat 230w-2, Huber, -33°C to +200°C). SCP was determined using a 0.5°C min^{-1} cooling rate). The mean SCP on treated group was higher than on control group. Control group mean SCP was -5.5°C and treated group mean SCP -5°C (P□0.05). The study demonstrated that alpha-cypermethrin had decreased cold-hardiness of the *P. assimilis*. The current research was supported by projects ESF7130, ESF6781 and SF170057s09.

WE 74
A novel class of lepidopteran chitin-binding proteins in the peritrophic matrix

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The peritrophic matrix (PM) is a protective pseudo-membrane that lines the invertebrate midgut. Its basic components are chitin, proteins and glycoproteins, some of them possess characteristic chitin binding (peritrophin A) domains.

To get more information about the protein composition of the lepidopteran PM, we performed an immunoscreening of a midgut λ–ZapII cDNA library from *Manduca sexta* using polyclonal antibodies against the PM purified from larval guts. From this screening we obtained 19 positive phage-clones, whose cDNA inserts were sequenced. A blastp database search revealed positive hits for midgut proteins such as trypsin or chymotrypsin. Most strikingly, three proteins showed similarities to putative cuticle proteins from *Bombyx mori*. One of these proteins we termed valine-rich peritrophic matrix protein 1 (VR-PMP1) due to its high valine content (19%). VR-PMP1 is a secretory protein of 21.7 kDa, which lacks cysteines and correspondingly a peritrophin A domain.

A PCR study revealed significant gene expression in the median and posterior region of the larval (5^{th} instar) midgut, but no expression in the epidermis, fat body, Malpighian tubules, trachea or salivary glands. Expression was high in starving but low in feeding stages. Immunofluorescence microscopy performed with antibodies to the recombinant protein revealed that VR-PMP1 is expressed by columnar cells. Moreover, we could immunodecorate VR-PMP1 in the PM isolated from posterior midguts, where it was enriched when the larvae were starved. Finally, we performed chitin binding studies showing that recombinant VR-PMP1 binds to chitin beads. From our results we postulate a novel class of lepidopteran PM proteins exhibiting chitin binding properties.

WE 75
Identification of glycerolipid biosynthesis pathway in *Rhodnius prolixus*

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Glycerolipids are important biomolecules, acting as structural and signalling agents and as energy supply. The synthesis of these lipids, including triacylglycerol and glycerophospholipids, occurs by the phosphatidic acid pathway and begins with the acylation of glycerol-3-phosphate with long-chain fatty acyl-CoA, a rate-limiting step catalyzed by glycerol-3-phosphate acyltransferase (GPAT). In spite of the well established knowledge about this biosynthesis process in mammals, no satisfactory information is available for insects. We identified in the genome of *Rhodnius prolixus* the genes that code enzymes required by this pathway. Their expression was confirmed by search in transcriptome databases and by RT-PCR. The transcription of acyl-CoA synthetase (ACS), GPAT, and diacylglycerol acyltransferase (DGAT) were upregulated in midgut and fat body after feeding, in a time-specific manner. In addition, *GPAT* expression levels accompanied the lipid synthesis rates already described for this insect. These results indicate that the phosphatidic acid pathway contributes for the biosynthesis of lipids in *R. prolixus* and that GPAT appears to be transcriptionally regulated according to the physiological status of the animal.

WE 76
Circadian rhythm of neuroblast proliferation in the brain of moth *Spodoptera littoralis*

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It is well established that neurogenesis occurs in adult insect`s brains. Neuroblasts have been shown i.e. in moth *Agrotis ipsilon* [1]. Many studies focus on newborn neurons functions and factors which regulate this process, both internal and environmental.

In this study we tried to prove the presence of the circadian rhytm of neurogenesis in the brain of the Egyptian cotton leaf worm, *Spodoptera littoralis* (Lepidoptera, Noctuide). Moths (females and males) were injected with S-phase specific proliferation marker, 5-bromo- 2` deoxyuridyne (BrdU) in six "zeitgeber" time points (ZT). After injection insects were kept in normal condition for 4 hours and dissected. To visualize cells dividing after BrdU treatment tissues were labeled immunohistochemically using anti-BrdU antibody.

Our data indicate that neurogenesis is more intensive in males that in females, however, in both shows a circadian rhythm with a peak at ZT 12 - the beginning of the dark phase. This is an endogenous rhythm because it is maintained also in constant darkness (DD). These results indicate that the endogenous clock can be an important regulator of the neuroblast divisions.

[1] Dufour MC, Gadenne C. „Adult neurogenesis in a moth brain"

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WE 77
Regulation of H^+-ATPase activity by the biological clock in male reproductive system of *Drosophila melanogaster*

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Our purpose was to characterize the proton pump (H^+-ATPase) expression and function in the male reproductive tract of fruit fly, *Drosophila melanogaster*. Expression level of gene coding B subunit of H^+-ATPase was analyzed by qRT-PCR and changes of corresponding B protein level were determined by Western blot. To characterize functions of the peripheral oscillator in proton pump regulation, the seminal vesicles (SV) from wild type flies (CS) and clock mutant flies per^0 were cultured *in vitro* and daily profile of the culture medium pH was determined using colorimetric assay.

No rhythmic changes of B subunit transcript level in seminal vesicles of CS flies were observed. However the B protein expression analysis revealed robust rhythm with peak during light and through during dark phases respectively. In per^0 mutant flies both: transcript and protein levels changed daily.

The intraluminal pH of seminal vesicles from CS males in LD conditions reach highest level during dark phase and lowest at night. Similar pattern was observed when insects were kept for 6 days in constant darkness and described rhythm was completely abolished when flies were exposed to continuous light.

Our data provide new insights into the function of peripheral clock present in male reproductive tract of fruit fly, which influences seminal vesicles milieu probably by regulation of H^+-ATPase expression and activity.

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WE 78
Gene expression of the Acyl-CoA-Binding protein (ACBP) gene family in *Rhodnius prolixus*

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Acyl-CoA-binding protein (ACBP) binds acyl-CoA esters with high affinity and specifity, and is thought to be involved in regulation of cellular lipid metabolism. *Rhodnius prolixus* genome codes five ACBPs with different molecular masses and conserved domains. However, their functions remain unclear. Expression analysis by qPCR showed that ACBP genes are differently expressed in insect organs. *RpACBP-2* was most expressed in flight muscle and induction of 1 hour flight caused a reduction in this gene expression when compared to resting insects. *RpACBP-3* expression did not show significant difference between organs. *RpACBP-4* had a high expression level in ovary and showed variations during follicle development. It decreased as the follicle grew in size. At last, *RpACBP-5* showed a high expression level in posterior midgut as it had already been demonstrated to *RpACBP-1*. These results, together with further experiments, will be important to elucidate roles of ACBP gene family in insect metabolism.

WE 79
Effects of low temperature on fatty acid composition of *Galleria mellonella* (Lepidoptera: Pyralidae)

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Lipids are known to be used as energy source in insects. In cold temperature conditions, insect metabolism relies exclusively on body energy reserves. Cold exposure may affect insects in many ways. Adaptive changes in the composition of cellular lipids are widespread feature of thermal adaptation in ectothermic animals. Fatty acid compositions are not fixed in insects and can change seasonally to perform special functions that may be critical for survival.

In this study, effects of low temperature (4ºC) on fatty acid composition of the greater wax moth *Galleria mellonella* pupae were investigated. *G. mellonella* pupae were exposed to 4ºC for 5, 10, 20 and 30 days. Treatments were repeated three times at different times and 10 pupae were used for each group. After all treatments, pupae were extracted using the methods of Folch et al. (1957) and fatty acids were methylated with the method of Moss et al. (1974). The fatty acid methyl esters were analyzed with a Shimadzu GCMS-QP5000 gas chromatograph.

The most abundant fatty acids of all groups were oleic acid (18:1), palmitic acid (16:0), linoleic acid (18:2) and stearic acid (18:0). The increase in the ratio of oleic acid and the proportions of total monounsaturated fatty acids (MUFAs) observed with cold exposure duration.

Previous studies indicated that proportions of unsaturated fatty acids (UFAs) increase after acclimation to low temperature. Increased proportions of UFAs help to maintain the integrity of cellular membranes that is vital for the functioning of cells. In similarity to most other reports, our results showed that the proportion of unsaturated fatty acids increased during cold exposure.

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WE 80
Evaluating effects of essential oils from labiates family on digestive enzyme activity of *Spodoptera exigua* and *Helicoverpa armigera*

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In this study effect of leaf essential oils of *Thymus vulgaris*, *Mentha longifolia* and *Salvia officinalis* on midgut alpha-amylase and lipase activity of *Spodoptera exigua* and *Helicoverpa armigera* was evaluated. Studied insects were reared on artificial diet under controlled laboratory conditions. Sixth larval instars of both species were used for assays. Midgut of larva after dissection was homogenized then centrifuged (10000 Rpm) and supernatants used as enzyme sources. The essential oils of studied plants extracted by hydrodistilation method using clevanger aparatus. Enzyme activity and inhibitory activity measured using special diagnostic kits (Pars Azemon- Iran) and an auto analyzer system. This study showed that extract of *T. vulgaris* plant caused 76% inhibition of total lipase activity in *H. armigera* also *Mentha longifolia* and *Salvia officinalis* leaf essential oils caused 30.4 and 15.5 % inhibition, respectively. The essential oils of *T. vulgaris*, *M. longifolia* and *S. officinalis* plants inhibited 16.4, 4.2 and 2.4% of lipase activity in *S. exigua,* respectively. This study also showed that alpha-amylase activity of neither species was influenced by studied plants' leaf essential oils, but a minor increase in alpha amylase activity was observed in presence of these essential oils.

WE 81
Chemical characterization of peptide hormones in the fruit fly midgut

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Peptide hormones are important signalling molecules for the regulation of growth, metabolism and food intake.

With regard to mammals, several peptides produced by endocrine cells of the digestive tract and other body regions are known to influence the central nervous system. Together with neuropeptides they are involved in signaling circuits which maintain energy balance by modulating food intake and satiety.

Also in insects, metabolism and food intake are regulated by neuropeptides, some of which are both structurally and physiologically homologous to vertebrate peptides. Nevertheless, we only have fragmentary knowledge about the functions and structures of regulatory peptides from endocrine cells of the insect gut, and whether these molecules have an effect on the nervous system similar to the situation in mammals.

Recent immunofluorescent studies and data from the Fly Atlas demonstrate the expression of several regulatory peptide precursor genes in the gut of *Drosophila melanogaster*. However, the final chemical identities of the biologically active peptides, which result from specific processing pathways, still need to be uncovered.

We have chemically characterized the peptidome of gut endocrine cells in *Drosophila melanogaster*. Peptides were separated via capillary RP-HPLC and analyzed by MALDI-TOF/TOF mass spectrometry. Members of several families of regulatory brain-gut peptides (e.g. Ast-A, MIP, Ast-C, TK, sNPF, DH31) could be detected in extracts of larval and adult midgut tissue. Our findings agree with existing immunofluorescent data.

Besides *Drosophila*, we started to analyze regulatory peptides of gut endocrine cells in other dipteran species.

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WE 82
Development, morphology, and function of the calyx cells in the endoparasitic wasp *Glyptapanteles liparidis* (Hymenoptera: Braconidae)

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The braconid species *Glyptapanteles liparidis* is an endoparasitic wasp that develops in young gypsy moth (*Lymantria dispar*) larvae. This wasp carries a polydnavirus (PDV) that replicates only in the calyx cells of the female ovary. During oviposition, the co-injection of PDV particles and venom along with the eggs is a prerequisite for successful parasitoid development; both factors are involved in the developmental arrest of the host and interference with the host's immune reaction. In this study, ultrastructural and histological analyses as well as molecular genetic and physicochemical methods are applied to investigate the development and differentiation of the female reproductive system of *G. liparidis* wasps during pupal-adult development. The main focus of the present work is to identify the particular stages, when replication of the virus in the calyx cells begins; viral envelopes appear in the cell nuclei; mature virions with nucleocapsids occur; and cells finally disintegrate to release the virions into the oviduct lumen. The DNA content of the nuclei and the viral genome size are analyzed, and the virions are characterized according to morphological features. Furthermore, we correlate the maturation of the female reproductive tracts with the externally visible, progressing pigmentation pattern during the development from freshly molted pupae to adult wasps.

WE 83
How many neurons does the smallest winged insect *Megaphragma* (Hymenoptera: Trichogrammatidae) have?

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The genus *Megaphragma* includes the smallest winged insect: body length of *M. caribea* is only 170 µm, *M. mymaripenne* – 200 µm. The investigation of the external and internal morphology of this extremely small insect is important for understanding effects of miniaturization in animals. In the course of studying the anatomy of *M. mymaripenne* it was found that the central nervous system (CNS) contains only several hundred nuclei of neurons. The question arose: how many neurons are in the CNS of *Megaphragma* and/or what's happened to nuclei of neurons? The study of the CNS of *M. mymaripenne* with histological sectioning, transmission electron microscopy, 3D-computer reconstruction has shown just 250-350 nuclei of neurons in the brain, but relative volume of the brain is distinctly higher than in other insects. Results from the current study also show that the ultrastructure of the neuropile is not significantly different from that of large insects. Parts of cells and nuclei of neurons in various stages of lysis were found in the cortical layer of the *Megaphragma* brain. The most probable theory for this observed phenomenon is that the neuron body lyse after formation of the brain in the pupa stage for economy of volume. We conclude that *Megaphragma* has a normal number of neurons for small insects (roughly 10^4) but the adult brain consists of neuropile only with sporadic bodies of neurons.

WE 84
The peculiarities of the structure and ultrastructure of the brain of the smallest insects (Coleoptera: Ptiliidae; Hymenoptera: Mymaridae) as a result of miniaturization

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Miniaturization is one of the main trends observed in the morphological evolution of the insects. The extreme small size of the body influences the morphology, physiology and life history. With the decrease in body size, the essential transformation of all organ system occurs. Concerning nervous system, oligomerization and concentration of ganglion, as well as decrease of neuron size take place. From three-dimensional computer reconstructions of the brain of miniaturized insects, relative values of the brain and some of it characteristics were analyzed. Our data show a very high level of conservatism in structure and relative volume of brain regions. This recent data about the number and size of neurons in the brain of Ptiliidae and Mymaridae confirm and complete the hypothesis about the factors limiting miniaturization of insects. Based on the extremely conserved data of our study, it seems that the important limitation in the decrease of body size lies with the size of the nervous system, on the one hand, and the size of neurons and diameter of the axons on the other hand.

WE 85
Effect of temperature on population growth parameters of *Trissolcus vassilievi*, an egg parasitoid of Sunn pest, *Eurygaster integriceps*

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Trissolcus vassilievi (Hymenoptera: Scelionidae) is an important egg parasitoid of Sunn pest, *Eurygaster integriceps* (Hemiptera: Scutelleridae), a common pest in the wheat fields of Iran. The influences of six constant temperatures (17, 20, 25, 30, 35 and 37°C) on the population growth parameters of *T. vassilievi* were evaluated in laboratory. The combined data on the immature and adult stages were used to construct life tables for the calculation of several population growth parameters: the intrinsic rate of natural increase (r_m), net reproductive rate (R_o), mean generation time (T), finite rate of natural increase (λ), and doubling time

(*DT*). The population reared at 37°C failed to develop or reproduce. The obtained results revealed significant differences among all calculated parameters at various temperatures. The average net reproductive rates of females ranged from 2.53±0.44 to 152.15±7.84 (females/female/generation) at 35 and 25°C, respectively. Rising temperatures generally caused the r_m to rise to reach a value of 0.457±0.007 (females/female/day) at 30°C followed by a decline at 35°C. The mean generation time decreased with increasing temperatures from 39.05±0.33days at 17°C to 7.23±0.17 days at 30°C. Greatest finite rate of increase, 1.58±0.01, occurred when *T. vassilievi* was maintained at 30°C. The estimated doubling times ranged from 1.52±0.02 days at 30°C to 6.69±0.06 days at 17°C. The obtained data in this study are important for the mass-rearing of this wasp as biological control agent for the Sunn pest and suggest that the optimal range of temperature for *T. vassilievi* population growth is 25-30°C.

WE 86
Influence of nitrogen fertilization on biology of *Aphis gossypii* (Hemiptera: Aphididae) reared on *Chrysanthemum indicum* (F: Asteraceae)

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The effect of different nitrogen levels on biology and life table parameters of the cotton aphid, *Aphis gossypii* Glover reared on *Chrysanthemum indicum* Kitan was studied. The fertilizer treatments consisted of 0, 25, 50, 100 and 150% of agronomic recommended concentration. The aphids were collected from greenhouses in Mahalat and transported to the pots. The different nitrogen fertilizer levels didn't show specific effect on leaves potassium and phosphorus content. The intrinsic rate of increase and net reproductive rate ranged from 0.173 to 0.225 and 15.47 to 28.28, respectively at different tested fertilizer levels. The aphids showed the significantly lowest mean generation time and the highest finite rate of increase when fed on chrysanthemum fertilized by 150% fertilizer level. The aphids' fecundity and survival showed a positive correlation by increasing the fertilizer concentration. On the contrary, the highest life expectancy was obtained for the aphids fed on chrysanthemum with 25% of nitrogen level. The present data suggest that plant nitrogen content is an important factor contributing to the increase severity of the cotton aphid as a pest of chrysanthemum.

WE 87
Potential of Sophora alopecuroides L. (Fabaceae) seed extracts for inhibiting Helicoverpa armigera Hübner (Lep., Noctuidae) midgut protease activity

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Leguminous seeds are an important source of protein and also proteinase inhibitors. Proteinase inhibitors from plants as natural plant defense mechanism against herbivorous insects have gained special attention. In this study inhibitory effect of *Sophora alopecuroides* L. (Fabaceae) seed extracts' against *Helicoverpa armigera* digestive protease were investigated. Insects were reared in controlled condition and midgut homogenate of last larval instars were used for enzyme assays. Dry seeds of *S. alopecuroides* were ground to fine powder, defatted and depigmented with washes of n-hexane and acetone. Total proteinase inhibitors from seed powders were extracted in six volumes of distilled water over 4 hours shaking in ice water bath. For ammonium sulfate precipitation different percentages of (NH4)2SO4 fraction (0-20%, 20-40%, 40-60%, 60-70% and >60%) were used. Total protease activities carried out by azocaseinolytic assay method and *BApNA* were used as substrate for trypsin assays. The results revealed that 23.63% of total protease and 49.50% of midgut trypsin were inhibited by 100 µl of *S. alopecuroides* total extract. In cotton bollworm, 2.42, 37.19, 19.33, 11.95 and 22.09% of total protease and 7.41, 69.94, 11.32, 8.79 and 10.11 % of trypsin activity were inhibited by different ammonium sulfate precipitation fractions including 0-20%, 20-40%, 40-60%, 60-70% and >70 % respectively. More over the second fraction of seed extract (20-40%) inhibited cotton bollworm's total protease and trypsin activity more than others.

WE 88-96: Miscellaneous arthropod studies

WE 88
Efficacy of transgenic Bt cotton containing Cry1Ac against beet armyworm larvae (Lepidoptera: Noctuidae)

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Cotton insect pest management in Pakistan is mainly dominated by the use of broad-spectrum insecticides, which disrupt the beneficial insect fauna, leading to pest resurgence and outbreaks of secondary pests, as well as risk to human health and environment. One option to reduce the insecticide use on cotton is the exploitation of transgenic Bt cotton as an important component of integrated pest management. The transgenic Bt cotton containing crystalline proteins from *Bacillus thuringiensis* Berliner sp. *kurstaki* is cultivating throughout the cotton growing areas of the world to manage lepidopterous insect pests. Growing of transgenic cotton is a new technology in Pakistan agriculture. There has been concern over the effectiveness of Bt cotton against beet armyworm, which is a polyphagous insect pest and in case of severe infestation has caused significant loss to cotton crop in Pakistan. For this purpose field and laboratory experiments were carried out to examine the efficacy of transgenic Bt cotton containing Cry1Ac against beet armyworm. The field experiments were conducted for two cotton seasons from 2007-08 at Postgraduate Agriculture Research Station (PARS), Faisalabad, Punjab, Pakistan (31º 21.52 North and 72 º 59.40 East), where wheat and cotton are commonly intercropped. The experimental fields were laid out in a randomized complete block design (RCBD) consisting of four treatments each with four replications. A plant inspection method was used and larval population was recorded on weekly basis by selecting 15 plants at random in each replicate plot. The results showed that *S. exigua* larvae had low susceptibility to Bt cotton, as there was no significant differences in larval densities between transgenic Bt and conventional cotton under unsprayed conditions and insecticides were used to control the population in sprayed Bt and non-Bt cotton plots. The lab experiments were laid out in a randomized complete block design (RCBD) with four replications, with 25 larvae in each replicate. The treatments included were; a) larvae fed on leaves of non Bt cotton, b) larvae fed on leaves of Bt cotton, c) larvae fed on flowers of

non-Bt cotton until the third instar, then fed with young bolls of non-Bt cotton, d) larvae fed on flowers of Bt cotton until the third instar, then fed with young bolls of Bt cotton. Larval mortality was recorded in all instars and cumulative mortalities were calculated. The result showed that there were no significant impacts of Bt cotton plant structures (leaves and flower-bolls) on certain biological parameters (larval mortality & development time and pupal weight) of *S. exigua* larvae compared to conventional non-Bt cotton. In general, survival remained high in all treatments (84-87%). The inhibitory effects of Bt cotton on the growth of larvae were more obvious than the lethal effects. Larvae that were fed on non-Bt cotton, completed development faster than those fed on Bt cotton. A comparison of average larval period indicated that larval period increased on Bt cotton leaves and flower-bolls (17.75 and 17.52 days respectively) compared with non-Bt cotton leaves and flower-bolls (14.82 and 14.57 days respectively). Pupal weight was reduced and the average pupal weight was significantly higher on non-Bt cotton leaves (0.139 mg) compared to average pupal weight on Bt cotton leaves (0.098 mg).

WE 89
Microgastrinae (Hymenoptera, Braconidae) in an heterogenous acidofilous forest in Artikutza (Navarra, Spain)

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The distribution of Braconidae was investigated by means of six Malaise traps in two adjacent vegetation series, mixed pine forest and beech forest, in the reserve of Artikutza (Navarra). Here we present data on taxonomic composition of the subfamily Microgastrinae and the seasonal variation of 10 genera based on 535 individuals captured over a two year period. The information presented is both the first record from Spain and the most Southern Palaearctic record of genus *Paroplitis* Mason, 1981.

WE 90
Alysiinae (Hymenoptera: Braconidae) community analysis from Pyrenees.

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Alysiinae subfamily is a wide taxon composed by 1500 species described in the world. Nowadays two tribes are recognized: Alysiini and Dacnusini. The members of Alysiini use a wide range of cyclorrapha hosts while the members of Dacnusini are almost exclusively confined to leaf-miners hosts, such as Agromyzidae, Ephydridae and Chloropidae.

Alysiinae communities are studied from two sites in the Pyrenees: Santa Coloma in Andorra and Natural Reserve of Artikutza in the Natural Park Peñas de Aia in Navarre. These two locations are characterized by typical Pyrenean habitats: mixed forest and beech forest. The mixed forest is a forest with pines, sessile oak and beech, and the beech forest is composed of beech and oak.

The sampling was done by Malaise traps. The collected specimens are analized by statistical analyses. With these results it can be conclude that Alysiinae communities from the Andorran Pyrenees and the Navarre Pyrenees did not show significant differences. Therefore, it is possible to consider that their composition is similar.

WE 91
Cerambycidae (Coleoptera) from Natural Park of Font Roja (Alicante, Spain).

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Some studies have been done about Cerambycidae fauna in the Comunidad Valenciana (Spain) during the last years. These studies have identified 99 species. During the years 2004-2009 samplings have been done to identify the beetles fauna from the Natural Park of Font Roja. This park has an area of 2298 ha and a maximum altitude of 1356 m. The mountain orientation, united with the steep and rugged relief, allows for difference landscape vegetation, such as deciduous forest, shady holm oak forests, sunny thicket, pine forests and crops.

The collection of the specimens was done by direct methods on the plants found in the sampling points and indirect methods through light traps and Malaise traps.

The existence of the undisturbed forest and the presence of different landscape units favor the presence of the great diversity of saproxylic beetles. Until now, from the specimens collected, 20 species belonging to 5 subfamilies (Cerambycinae, Lamiinae, Lepturinae, Prioninae, Spondylidinae) have been identified. The data about the biology, phenology and affinity among the species collected and the plants are given. Among the species collected, highlight *Cerambyx cerdo* for possessing the protection status and *Stenurella melanura* for being the most abundant species with 73%.

This work was supported by the research project CGL-2004-02711, cofinanced by the Ministry of Science and Technology and the European Union (European Funds for Regional Development).

WE 92
Ecology of Cerambycidae (Coleoptera) from Natural Park of Lagunas de la Mata-Torrevieja (Spain)

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The Natural Park of Lagunas de La Mata-Torrevieja is one of the most relevant wetlands of international importance because it is included in Ramsar Convention, in the areas SPAs (Special Protection Areas for birds), in the network Natura 2000, in the catalog of wetlands in the Comunidad Valenciana area and are regarded as SCI (Interest Sites of Community). These lagoons have an area of 3700 ha, of which 2100 are water sheets and the rest surrounds the water. They are characterized by saline soils in which are possible to differentiate salt marsh areas, grass areas, Mediterranean forest areas and growing areas.

To better understand the Cerambycidae fauna in these areas, among the years 2004-2009, specimens were collected by direct methods on the plants found in the sampling habitats and by indirect methods through light traps and Malaise traps.

The data about the biology, ecology and phenology from 13 species of Cerambycidae collected in the park are given.

This work was supported by the research project CGL-2004-02711, cofinanced by the Ministry of Science and Technology and the European Union (European Funds for Regional Development).

WE 93

Entomological inventory of Atlantic Islands National Park (Galicia, Spain): Main findings, its value as early warning system for biodiversity and climate change

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The first entomological inventory of Atlantic Islands National Park (Galicia) was conducted between 2006 and 2008. 39 species of Ropalocera has been identified in the Park. Comparing with a previous assessment of *Papilionidae* conducted in the Ons and Cies archipelago (south part of the National Park) in 1973 and 1983, six species have not been captured in the area and eight in Cies/Ons. Possible causes could be linked with the length of the assessment period, with land use changes and / or with pesticides treatments. Absence of *Carcharodus alceae*, *Melitaea deione* y *Melanargia lachesis* could be attributed as an early warning indicator of biodiversity and climate change in the context of the National Park.

In the other side four new species have been appointment in Ons: *Cacyreus marshalli*, *Polyommatus icarus*, *Lycaena alciphron* and *Polygonia c-album*.

Main result is the first catalogue of diurnal Lepidoptera of the Atlantic Islands of Galicia National Park (Cíes, Ons, Sálvora and Cortegada). Adding this study to the previous quoted, the total amount are 43 species.

WE 94

Is harlekinkatica (Harlequin ladybird) a proper Hungarian common name for *Harmonia axyridis*?

András Bozsik

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The multicoloured Asian ladybird beetle (*Harmonia axyridis* (Pallas, 1773)), a former successful biological control agent in the USA and Western Europe became an invasive alien species threatening the diversity of native aphidophagous insects through competition and praying, a horticultural pest consuming various fruits and adversely affecting the wine quality and a human nuisance when occurring at high densities in buildings. Due to this dubious fame, attention has been paid to it also at national level which made inevitable to find for it a fitting name in different languages. In some cases and countries a version of the English name has been chosen however, regarding the meaning of this translated term in Hungarian, the try cannot be called fortunate. The objective of this contribution is to stress the function of common animal names in the Hungarian Sprachraum and to find a right and proper alternative with the help of etymology, mythology, classical literature, art (painting) and the experiences of Hungarian fruit and grape growers.

WE 95

Saprininae of the Australopacific region-victims of isolation or victims of man?

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The Australopacific region (including Australia, New Guinea, New Zealand and Oceania) is home to a mere 32 native species of the subfamily Saprininae (Coleoptera: Histeridae). This represents a small fragment of the total Saprininae: the Palearctic region has more than 180 species, Afrotropical region about 90, Nearctic region around 80 and Neotropical region more than 100 species. Only the densely forested Oriental region is similar, with approximately 50 described species, but since Saprininae are typical inhabitants of open, dry landscapes and are generally almost absent from moist mesic regions this is hardly surprising. Saprininae are predators of other insects, mostly cyclorrhaphan flies that undergo their larval development in the dung of large herbivorous mammals or on carcasses. So, why are there so few native species there?

In the case of large islands like New Guinea or New Zealand this can be explained by the fact that these islands were (or even are, in the case of New Guinea) covered with lush dense forest and house very few large native herbivorous mammals - these conditions are unwelcoming to Saprininae speciation. However, the continent of Australia has supported large sand deserts and inland salt lakes for at least 5 Mya. This environment and amount of time, together with the former megafauna, would surely have been sufficient to increase the number of species of Saprininae. It is hypothesized that many species went extinct with the extinction of the large Australian megafauna, due to the human predation some 47.000 years ago; the same thing happened with many large Australian Scarabs. Alternatively, the paucity of Australian Saprininae may be attributed to the long-standing isolation of the continent.

WE 96

New records of Ophioninae genera (Hymenoptera, Ichneumonidae) from Peru

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Ophioninae (Hymenoptera, Ichneumonidae) is a moderately large subfamily of Ichneumonidae of worldwide distribution and very rich in tropical regions. They are koinobiont endoparasitoids of larval Lepidoptera, mostly Noctuidae, Geometridae, Lymantriidae, Saturnidae, Arctiidae and Sphingidae, showing crepuscular and nocturnal habits exception of some diurnal species. The subfamily comprises 34 genera, of which 13 are represented in tropics. In Peru, only 4 genera and 34 species are reported: *Enicospilus* Stephens 1835, *Ophion* Fabricius 1798, *Pretrophion* Townes 1971 and *Thyreodon* Brullé 1846. Studied material was collected using Malaise traps, placed in three representative ecosystems of Peru, along one year: rain forest, mountain and coastal desert. In this work the genera *Alophopion* Cushman 1947, *Stauropoctonus* Brauns 1889 and *Simophion* Cushman 1947 are recorded for first time. In all of them new species are diagnosed. New distribution data of other reported genera from Peru are also reported.

This study was supported by Project A/013484/07 of AECID (Ministerio de Asuntos Exteriores y de Cooperación, Spain).

Plenary lecture 5

Hungarian Nature History Museum

Why lice are nice

Lajos Rózsa
Anim Ecol Res Group of HAS-HNHM

The order of lice (Phthiraptera) is the largest taxon of truely parasitic exopterygotes. They originated from free-living Psocopterans, though their monophyly has been seriously challenged recently. They complete their whole life-cycle on the body surface of their bird or mammal hosts, and mostly transmit through direct body-to-body contacts. Most of their >3000 described species live an unexplored way of life, while the few ones that inhabit humans and domestic animals are intensively studied. The 3 species exploiting humans may carry information about the origin of humankind and they have also influenced human history and culture by means of pathogenic microbes they transmit. They are widespread across kindergardens, homeless shelters etc. in all modern societies. Unlike other contagious pathogens, lice are accessible by the methods of natural history; their species can be identified, their behaviours observed, their numbers counted by traditional ways. This makes them ideal subjects of basic research in pathogen evolution and ecology studies. Indeed, new bio-statistical methodologies for quantifying host-parasite cospeciation rates, or those for quantifying and comparing levels of infestation were firstly developed and tested to study animal lice. Not only are they of interest for the theoretical biologists, but they also cause considerable economic loss in the animal breeding industry and pose human health risk and nuisance to several hundred millions of people. Not surprisingly, a powerful pharmacology industry works to save us from lice, while lice evolve drug-resistance to minimise its effects. At the same time, some conservation biologists already have raised questions about the extinct and endangered species of lice.

Thursday, 26 August

Plenary lecture 6

Room Copenhagen

Root feeding insects – an ecosystem perspective

Scott Johnson
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Research on plants and their insect herbivores has traditionally been dominated by studies looking at interactions occurring aboveground and the mechanisms and processes underpinning herbivory have been explored in almost all terrestrial ecosystems. By comparison, belowground insect herbivores have been less well studied. Given that there is ample evidence from diverse ecosystems that more than 50% of net primary productivity is frequently allocated to the roots, which can approach 90% in some cases, this seems to be paradoxical at first sight. However, there is little doubt that root herbivores can be of considerable importance within an ecosystem. For example, root-xylem feeding cicadas in deciduous forests of North America have the highest collective biomass of any terrestrial animal when considered in terms of biomass per unit area. The realisation that root feeders play key roles in many ecosystem processes has undoubtedly invigorated interest in root herbivores. This talk will address the latest approaches to studying root feeding insects, and in particular, the use of X-ray tomography to non-invasively study soil-dwelling insects *in situ*. This approach has been used to demonstrate how the clover root weevil (*Sitona lepidus*) locates root nodules on its host plant using a combination of general (e.g. carbon dioxide) and specific (e.g. isoflavonoids) chemical cues. Some of the effects of root feeding insects on organisms living aboveground are well known, but only recently has the subject area being approached with meta-analysis. General trends will be considered, in addition to specific examples of intra-specific conflicts and facilitation between parental insects living aboveground and their root-feeding offspring.

S51: Insect biochemistry and physiology, including their hormonal regulation III.

Room Maastricht

The PK/PBAN family of insect neuropeptides

Ada Rafaeli
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Reproductive behavior involves the integration of physiological and behavioral events that synchronize male and female encounters. Receptivity in most female moths is broadcasted by the release of a unique blend of volatile sex-pheromones when they assume typical calling behaviours. This blend of sex-pheromones is derived from downstream products of fatty acid biosynthesis in the pheromone gland, situated between the ultimate and penultimate terminal segments of the abdomen. Regulation of biosynthesis of these sex-pheromones is due to a photoperiodic release of Pheromone Biosynthesis Activating Neuropeptide (PBAN), a member of the Pyrokinin (PK)/PBAN neuropeptide family characterized by a common amino acid sequence FXPRLamide motif in the *C*-terminus. PBAN activates pheromone production through its binding to a PBAN-Receptor (PBAN-R) and subsequent up-regulation of the fatty acid biosynthetic pathway. The PBAN-R gene was identified as a member of the G-protein coupled receptor family (GPCR), classified with the vertebrate subfamily of Neuromedin U receptors and putative binding sites are predicted through biochemical and *in silico* mutagenesis studies. Differential expression studies reveal localization in pheromone glands, neural tissues and male aedaegi, a tissue homologous to the pheromone gland. Pheromone production is age-dependent and temporal differential expression levels of the PBAN-R reveal up-regulation at a critical period during pupal-adult development. The role of Juvenile Hormone and the presence of the PBAN-R in males are discussed. Questions are raised concerning the evolutionary role of the PK/PBAN receptors belonging to the GPCR family.

Molecular analysis of sex pheromone production-related gene in the silkmoth, *Bombyx mori.*

Ken'ichi Moto, Shogo Matsumoto
RIKEN Advanced Science Institute, Wako, Saitama, Japan

Many species of female moths produce sex pheromones to attract conspecific males. The C_{10}-C_{18} unsaturated, acyclic, aliphatic compounds that contain an oxygenated functional group (alcohol, aldehyde, or acetate ester) are a major class of sex pheromones produced by female moths. The female moths usually produce sex pheromones as multi-component blend in which the ratio of the individual components is precisely controlled, making it possible to generate species-specific pheromone blends. In the biosynthesis of these pheromone components, various combinations of limited chain-shortening and regio- and stereospecific desaturation reactions significantly contribute to the production of a vast number of the specific pheromone components in Lepidoptera. However, many of the cloned genes involved in the sex pheromone production had not been functionally characterized.

Bombykol, (*E,Z*)-10,12-hexadecadien-1-ol, was the first chemically identified pheromone from organisms and is the major sex pheromone component produced by the domesticated silkworm, *Bombyx mori*. Biosynthesis of bombykol involves two consecutive desaturation steps followed by one fatty-acyl reduction. To characterize the genes involved in the production of bombykol, we prepared pheromone gland cDNA libraries of the silkmoth. We isolated a number of genes that are tissue-specific and expressed in the pheromone gland of the silkmoth. Our presentation will include recent results focusing on some of the key genes involved in the sex pheromone production.

The PK/PBAN family of insect neuropeptides: Progress toward the design of novel insect control agents

M. Altstein, M. Davidovitch, O. Ben-Aziz, A. Hariton
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The PK/PBAN family is a multifunctional family of peptides that plays a major role in the physiology of insects. The family comprises of peptides such as PBAN, melanization and reddish coloration hormone (MRCH), pyrokinins, myotropins, pheromonotropin (Pss-PT) and diapause hormone (DH) - which have been found to control a variety of functions such as: stimulation of sex pheromone biosynthesis in adult female moths, cuticular melanization in moth larvae, contraction of the locust oviduct, myotropic activity of the cockroach and locust guts, egg diapause in the silkworm, and acceleration of pupariation in flesh-fly larvae. Despite of the intensive studies of the bioactivity of this family, very little is known about the molecular and cellular basis that underlies the functional diversity of the PK/PBAN family. In the past few years our studies focused on a detailed characterization of the structure activity relationship (SAR) of the PK/PBAN family, on characterization of the PK/PBAN receptor, and on the bioavailability and penetration of PK/PBAN neuropeptides and analogs through the insect cuticle. A summary of our results on these topics, their contribution to studies of the mode of action of the PK/PBAN family and their integration in our strategy for the generation of PK/PBAN antagonists and rationally designed insecticide prototypes will be presented.

Bacterial flagellin as an elicitor of the immune response in the insect *Manduca sexta*

Christophe Fleury, Stuart E. Reynolds
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Among the different MAMPs (Microbial-Associated Molecular Patterns), the potential of bacterial flagella and its major component Flagellin (fliC) as an immune elicitor have been extensively studied in mammals and in plants. However, in insects little has been reported about reactivity to bacterial flagellin. Here we show that flagellin is recognised by the tobacco hornworm *Manduca sexta* immune system *in vivo* and leads to activation of the antimicrobial peptide (AMP) pathway.

We investigated the effect of flagellin from different bacteria on immune responses in fifth instar larvae of *Manduca sexta*. Injection of 10 µg/ml of recombinant *Salmonella typhimurium* flagellin caused an up to 10 fold increase in the mRNA levels in fat bodies of two AMPs, Moricin and Attacin and also the recognition protein Hemolin. Injection of truncated recombinant flagellin as well as synthetic peptide will help us to localize the active peptide recognised by the immune system of the insects.

S52: IPM challenges and prospects in annual and perennial crops I.

Room Brussels

Framework for the sustainable use of pesticides across the EU Member States: challenges and opportunities for implementing IPM

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According to the new Directive 2009/128/EC of the European Parliament, establishing a framework for Community action to achieve the sustainable use of pesticides, the implementation of eight general integrated pest management (IPM) principles becomes mandatory as of 2014. Member States must develop a National Action Plan, including targets, measures and timetables to reduce pesticide risks and hazards, as well as dependence on pesticides. The National Action Plan must describe how they will ensure the implementation of the principles of IPM, with priority given wherever possible to non-chemical methods of plant protection and pest and crop management. This implies a huge challenge as current pest management practices vary widely between different Member States and IPM is established in only some of them. In addition, even in the latter countries, there is uncertainty as to what qualifies an applied system as IPM. Thus, an important but challenging task is the harmonization of IPM across Europe, while ensuring the environmental and economic sustainability of food production in each Member State. A robust conceptual framework, including among other things considerations of research and advisory systems, is urgently needed for the successful implementation of standardized, area-wide IPM. This presentation will focus on apple production within and outside of the EU and highlight the most urgent challenges and requirements for IPM implementation across the Member States.

Transition to sustainable pest management in Bulgaria by example of the key pest in apple – the codling moth, *Cydia pomonella*

Jörg Samietz[1], Hristina Kutinkova[2], Vasiliy Dzhuvinov[2], Patrik Kehrli[1], Denis Pasquier[1], Heinrich Höhn[1], Penka Peeva[3], Pierre-Joseph Charmillot[1]
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In order to establish sustainable orchard IPM systems, a variety of methods for pest control can be used and combined with monitoring and forecasting in order to avoid any treatment that is not necessary in terms of pest phenology or economic threshold of a pest population. Between 2005 and 2009, the implementation of such novel methods in Bulgaria was investigated for the codling moth, *Cydia pomonella* (L.), as the most important pest of apple in South-Eastern Europe. First, status of codling moth resistance to insecticides traditionally used in Bulgaria was established from samples taken in a variety of regions. The results showed a dramatic level of resistance, especially to pyrethroids and organophosphates. Field trials were set up in 2006, 2007 and 2008 across several fruit growing regions of Bulgaria to test alternative novel methods to those insecticides including pheromone-based mating disruption with classic dispensers, microcapsules, and in high density (false-trail-following), pheromone-based attract-and-kill, selective use of insect growth regulators, and finally virus-based biological insecticides. Field trials were associated with monitoring codling moth during hibernation and by pheromone traps both as modelling pest phenology in order to optimize timing of management. Most of the novel methods tested led to very good results and very well protection against codling moth damage in comparison to control orchards with conventional pest management, the latter being treated in fixed spraying plans with up to around 30 insecticides applied through harvest – sometimes 3 products in approx. weekly treatments. The most promising methods for codling moth control were combinations of mating disruption and applications of granulosis virus products. The results of our study show that sustainable integrated pest management may be established even with a limited number of pesticides due to insecticide resistance and under high population densities by (1) specific monitoring, (2) the right choice of innovative measures and (3) precisely timed application.

Biology and ecology of false codling moth *Thaumatotibia leucotreta*, (Meyrick) (Lepidoptera: Totricidae), in deciduous fruit orchards of the Western Cape Province, South Africa

Nyembezi Mgocheki, Pia Addison
South Africa

Thaumatotibia leucotreta, the false codling moth (FCM) is increasingly becoming a phytosanitary pest with an exceptionally progressive host range including cultivated and non-cultivated fruits. It occurs throughout Africa and surrounding islands with an Afro tropical climate. FCM has over 70 host plants and is active throughout the year. Generations increase rapidly when host plants are actively growing. In the Western Cape, it is an important pest of Citrus but has always been present on some deciduous fruit to a lesser extent. It is known that FCM populations show high genetic diversity over short distances. This indicates a possible species-complex which requires further investigation. For two consecutive years, pheromone traps were placed in six regions of the Western Cape where deciduous fruit is grown to catch male FCM. Fruit damage assessments ware carried out concurrently. Damaged fruit and nuts from areas adjacent to the orchards were collected

and reared for FCM. Molecular analyses were carried out based on region and fruit type. DNA sequence, morphological characters, and ecology will be used to construct phylogenies for FCM. By building DNA- and morphology-based phylogenies, it is possible to identify new species and uncover hidden relationships and patterns between FCM. This novel information is essential for the refinement of pest management strategies already in place for other tortricid pests as well.

Developing IPM tactics for pollen beetles in oilseed rape

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Rothamsted Research, UK

Pollen beetles (*Meligethes aeneus*) are a serious pest of oilseed rape crops in the UK and throughout Northern Europe. Resistance to the major group of insecticides used to control them – the pyrethroids – is now widespread on mainland Europe. Integrated pest management (IPM) strategies are urgently needed to reduce the number of insecticide treatments to lessen selection pressure for resistance and to protect the environment.

We are developing an IPM strategy based on three tactics: (i) improved monitoring, (ii) risk assessment and (iii) crop management.

(i) We aim to develop a commercial monitoring trap for pollen beetles. This will enable growers and advisors to determine more easily when spray thresholds have been breached, thereby reducing unnecessary sprays. Electrophysiological and behavioural techniques are being used to identify the most appropriate colour and attractive volatile bait for the trap. Work to indicate the optimum positioning of the traps in relation to landscape and environmental factors is also in progress.

(ii) proPlant, a commercially-available decision-support system used widely in Europe, is being tested and refined for UK conditions using data on the phenology of the beetles from sticky traps run at sites across the UK and weather data. Risk periods forecasted by the system, monitoring effort and resulting management decisions are being compared to Crop Monitor, the best currently available UK decision support system.

(iii) The effectiveness of a border trap crop of early flowering turnip rape (*Brassica rapa*), as a diversionary tactic to reduce pest pressure on the main oilseed rape crop during its susceptible phase, is being tested on a field scale using cropping systems with and without insecticide.

S53: Invasive species I.

Room Copenhagen

Longhorn beetles in The Netherlands: evaluation of eradication of *Anoplophora chinensis* (Forster)

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Two species of longhorn beetles, *Anoplophora glabripennis* (Motschulsky) and *A. chinensis* (Forster) (Coleoptera: Cerambycidae) have recently been introduced from Asia into areas in northern America and Europe. Both longhorn species are very harmful to a wide range of species of deciduous trees. Larvae of both species are tunnelling in the wooden parts of the host plant: *A. chinensis* in the lower parts near and in the soil, *A. glabripennis* in the upper parts of the tree. Heavily attacked trees often die in the course of a few years time. Both species are registered as 'IAI- quarantine organisms' by the EU, and as such are considered pest species, whose introduction into, and spread within, all member states shall be banned. Countries are obliged to prevent entry of these beetles, or, if already present, to eradicate / control them. Plants and wood packing material are the main pathways of entry into new areas. In the EU emergency measures against *A. chinensis* are in place since November 2008 (Commission Decision 2008/840/EC). The emergency measures were taken because of the many interceptions and findings of *Anoplophora chinensis* on *Acer* spp. imported from China and Japan, growing concern about an infestation in northern Italy detected in 2000 and a small outbreak in the Netherlands detected in December 2007. Measures imply that in case of an infestation a buffer zone of 2 km should be demarcated around the infested area. The buffer zone may be reduced to at least 1 km in case of the first detection of the pest in an area and following a delimiting survey. Measures apply to species within the plant genera *Acer*, *Aesculus*, *Alnus*, *Betula*, *Carpinus*, *Citrus*, *Corylus*, *Cotoneaster*, *Fagus*, *Lagerstroemia*, *Malus*, *Platanus*, *Populus*, *Prunus*, *Pyrus*, *Salix* and *Ulmus*.

Anoplophora glabripennis, the Asian longhorn beetle, has been first intercepted from wood packing material in July 2008, but no infestations have been found of native hosts in The Netherlands. The Citrus longhorn beetle, *Anoplophora chinensis*, has been intercepted in the Netherlands on many consignments of plants for planting of *Acer* spp. originating from China and Japan. Of the latter species, 2 small local outbreaks have been detected since 2007 on trees and shrubs outside the nursery: the first in Westland (a glasshouse area) in December 2007 and a second in Boskoop (tree nursery centre) in November 2009. In order to eradicate this pest, in both areas all woody deciduous host plants were removed within an area of 100 m around the plants were exit holes were found. In Westland all *Acer* spp. trees within a radius of 200 – 300 m were removed as well, and surveys are conducted within a 1 km zone. In Boskoop the area up to 2 km was intensively surveyed. In Westland 11 trees (2 *Acer campestre*, 1 *A. platanoides*, 2 *A. pseudoplatanus*, 1 *Crataegus* sp., 2 *Corylus avellanae* and 1 *Cornus sanguinea*) were infested, showing 24 exit holes and 28 larvae). All infested plants were present within 30 m from the nursery. In Boskoop, 7 exit holes were found in 2 dead stumps of *Acer palmatum* and 1 exit hole and 2 fullgrown *A. chinensis* larvae in a *Carpinus* tree. The trees were part of a hedgerow edging a company that had imported *Acer* trees from China since 1993. In both areas no infested trees have been found beyond 30 m distance from the source. The biology, damage, interceptions and results of the findings and eradication measures are discussed in detail.

The Yellow-Legged Hornet *Vespa velutina* (Hymenoptera: Vespidae): a new invader in France

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The Yellow-Legged Asian Hornet, *Vespa velutina* (Hymenoptera: Vespidae) is an invasive species recently introduced to France. Within a few years, this hornet spread throughout a great part of south-western France and became well-known because of its large nests usually located in tree tops, and its propensity to prey on honeybees in front of hives.

Since the first record of this species in France in 2004, the invasion has been monitored. After six years, the hornet

appears well acclimatized to the French ecosystems, invading both natural and urbanized environments.

The hornet's predation behavior, the genetic diversity of its French populations and the defense of honeybees against this new enemy are in study. Honeybees, however, are not the only preys of this invader. A diet study revealed a very wide prey spectrum, from social Hymenoptera and flies to dead vertebrate flesh.

The species, which is originally widespread across south-east Asia, presents a large range of color variations. The population introduced to France belongs to the *nigrithorax* form, which is distributed from Pakistan to South and East China.

A first predictive model using climatic data suggests that *V. velutina* could spread over a large part of Europe.

A study of the variation of the species across its native range was initiated by using geometric morphometrics applied to wing venation and head shape, in combination with microsatellite genetic analyses. It will provide new data to investigate *V. velutina* biogeography and the modalities of intra-specific variation in a *Vespa* species. When the origin of the invasion is established, such studies will also allow to refine the predictive invasion model and to compare the original and invasive populations of this invasive hornet.

Differences between independently invading and crossed populations of the alien maize pest *Diabrotica virgifera virgifera* in Europe

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The chrysomelid beetle Diabrotica virgifera virgifera LeConte, also known as the Western Corn Rootworm, is a serious pest of maize and an emblematic example of a highly successful invader. From the 1980s until early 2000s, D. v. virgifera has been introduced several times from North America into Europe resulting in several genetically differentiated outbreaks, including outbreaks spreading in central southeastern Europe and north-western Italy. This study aimed to compare phenotypic traits between pure and crossed D. v. virgifera populations in order to understand the role of genetic variability in shaping phenotypes in D. v. virgifera and its invasion success. Traits of the crossed populations often appeared to be similar or to be the average of those of the parental populations. However, phenotypic variability was larger in crossed populations than in parental populations, probably reflecting a larger genetic variability. This may be responsible for an increased adaptability and may therefore render the invasion more problematic when populations start to cross in natura.

This research was funded by the French "l'Agence Nationale de la Recherche" (ANR-06-BDIV-008).

Is the Alpine divide becoming more permeable to biological invasions? - Insights on the invasion and establishment of the walnut husk fly (*Rhagoletis completa*) in Switzerland

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The Walnut Husk Fly, *Rhagoletis completa* Cresson (Diptera: Tephritidae) is native to North America (Midwestern US and Northeastern Mexico) and has invaded several European countries in the past decades, likely by crossing the alpine divide separating most parts of Switzerland from Italy. Its current distribution in Switzerland was determined by sampling walnuts (*Juglans regia* L.) in ecologically and climatically distinct regions along potential invasion corridors that may have become more accessible to invasive species as a result of global warming. *Rhagoletis completa* was found to be firmly established in most low altitude areas of Switzerland where walnuts occur. Infested fruit were recovered in 42 of the 71 localities that were surveyed, with mean fruit infestation rate varying greatly among sites. The incidence of *R. completa* in Switzerland is closely related to meteorological mean spring temperature patterns influencing growing season length but not to winter temperatures reflecting survival potential during hibernation. Importantly, areas in which the fly is absent correspond with localities where the mean spring temperatures fall below 7°C. Possible invasion/expansion routes along alpine valleys are discussed in relation to climate and distance to the alpine divide. Furthermore, the role of environmental resilience exerted in the study is addressed by the possible inhibitory/toxic effect of secondary metabolites in walnuts on larval fitness. The incursion of *R. completa* into Switzerland and more recently other European countries such as Germany, Austria, France and Slovenia represents a valuable example of alien species that settle first in the Mediterranean basin and from there become invasive by crossing the Alps. This process is likely facilitated by global warming and should be more closely monitored to quickly detect incursions of other dangerous tephritid fruit pests, such as *Rhagoletis pomonella*, *Bactrocera dorsalis*, *Ceratitis capitata* or *Anastrepha fraterculus*.

Investigating global invasion routes of the harlequin ladybird (*Harmonia axyridis*)

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Species invasions have wide ranging ecological and economical impacts, and are one of the greatest threats to biodiversity, agriculture and human health. Despite this, there is still much we do not understand with regard to why only certain species become successful invaders, what determines their success and what impacts they have on other species.

The successful invasion of different continents by *Harmonia axyridis* (harlequin ladybird) provides a unique opportunity to investigate the invasion history of a highly invasive species, and to attempt to identify common factors underlying invasion success.

Molecular genetic data can provide vital insights into invasion dynamics. We have used mitochondrial DNA sequence data to investigate the global invasion of *H. axyridis*, as part of an ongoing study. By analysing individuals from native and invasive populations we aim to understand: (1) the source(s) and routes of spread of the invasion and (2) the genetic characteristics of the founding population(s).

The findings of this study complement microsatellite data being gathered on the same harlequin populations, as well as data on the presence of bacterial endosymbionts carried by individuals within these populations. This will provide a powerful dataset, making this one of the best case studies for understanding species invasions.

Aproceros leucopoda (Hymenoptera: Argidae): a new invasive pest of elm (*Ulmus* spp.) in Europe

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The non-indigenous sawfly, *Aproceros leucopoda* Takeuchi, 1939, which is native to East Asia, has been recorded in Poland, Hungary, Romania, Ukraine, Slovakia and Austria at least since 2003.The larvae attack elms (*Ulmus* spp.), and can completely defoliate the trees. The life cycle of *A. leucopoda* was investigated in Japan, but further research is required in Europe. The parthenogenetic reproduction and the ability of the species to produce several generations a year provide numerous progeny. Natural enemies of the pests identified up to date could not control the populations of the sawfly effectively. We suspect that this pest will spread to Central and South-West Europe. It is necessary to assess the economical impact of *A. leucopoda* in forest and urban areas, too.

S54: Non-insects entomology

Room Strasbourg

Life history of *Typhlodromus bagdasarjani* (Acari: Phytoseiidae) on immature stages of two-spotted spider mite at different temperatures

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The predatory mite *Typhlodromus bagdasarjani* Wainstein & Arutunjan (Acari: Phytoseiidae) is an indigenous and widespread species of Middle East fauna, frequently recorded in plants infested by spider mites, eriophyoids, tydeids or insect pests such as thrips and whiteflies. In this research, we studied the effect of temperature on biology and reproductive potential of *T. bagdasarjani* under laboratory conditions. The experiments were conducted at 10, 15, 20, 25, 30, 35 and 40±1ºC, 60±10% RH and L16:D8 h photoperiod. No development was observed at 10 and 40ºC. The total developmental time averaged 28.2, 15.0, 8.9, 7.6 and 7.2 days at 15, 20, 25, 30 and 35ºC, respectively, using a diet of immature stages of two-spotted spider mite *Tetranychus urticae* Koch. In general, the duration of preoviposition and oviposition periods decreased with increasing temperature. However, there was no significant difference between the durations for 25, 30 and 35ºC. The postoviposition period was not statistically different among the five temperatures tested. Female adult longevity and life span were longer at lower temperatures and decreased slightly at higher temperatures. The maximum mean female adult longevity (108.7 days) was at 15ºC and its minimum (37.2 days) was at 35ºC. Mated females laid on average 0.4, 0.5, 1.0, 0.9 and 1.0 eggs/female/day and 19.9, 26.3, 41.1, 39.6 and 31.3 eggs over their entire life at 15, 20, 25, 30 and 35ºC, respectively. As temperature increased, the intrinsic rate of increase (r_m) and finite rate of increase (λ) significantly increased and were highest at 35ºC (0.186 and 1.21, respectively). Net reproductive rate (R_0) varied from 3.3 to 13.6 females/female/generation, while the highest values recorded at 25 and 30ºC. Mean generation time (T) was much longer at 15ºC (55.3 days) than at the higher temperatures. However, the T value was not significantly different at 25, 30 and 35ºC. Doubling time (DT) was longest at 15ºC (31.4 days) and decreased with increasing temperature. The results demonstrated that temperature is a critical environmental factor affecting *T. bagdasarjani* population growth. This predator has more efficiency to control spider mite population in lower temperatures (15 to 20ºC). At high temperatures, the r_m value of *T. bagdasarjani* is not as high as that reported for *T. urticae* in related work.

Biodiversity and biogeography of millipedes in the Ryukyu Archipelago, Japan

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Millipedes are a fascinating group of arthropods, with an estimated global species number as many as 80,000. Despite their high diversity and low vagility that make them as a good subject for evolutionary and biogeographical studies, they are generally neglected among scientists, with only about 100 scholars worldwide as specialists of millipede taxonomy. The systematics of millipedes (class Diplopoda) is still unknown at a considerable level, and many novelties – new species for science, distribution records, and evolutionary relationships – are expected to discover, especially in regions such as East and Southeast Asia.

One of its main target area of Hungarian Natural History Museum in Budapest has traditionally been focusing to the Eastern part of Asia, where dozens of expeditions have been carried out in the past two centuries. As a result, large collections and important scientific expertee have been accumulated here about the fauna of countries like Mongolia, Korea, Pakistan, Nepal, Vietnam, Taiwan, etc.

My research on millipedes has started 25 years ago, and after 7 collecting trips to Taiwan, I compiled the checklist of millipedes of that island. To continue my study, I extended my interest to the Southwestern Islands of Japan. The Ryukyu Archipelago represents an important connecting chain between several biogeographical zones, and its millipede fauna is poorly investigated, as that became clear during my stay in the past one year. With extensive collectings on 24 islands I can prove now the occurrence of 82 Diplopoda species (as compared to 65 mentioned earlier in the literature), and I have found 56 new island records, including at least 7 new species for science. (The total millipede fauna of Japan, at the moment, consists of 280 species.)

After making several taxonomical revisions in order to clarify the status of certain species and species groups, I have an – almost – complete dataset suitable for biogeographical analyses to describe the relationships of the different faunas of the Ryukyu Islands. The phenetic hiearchical classification (UPGMA-tree) applied supports a strong north-south difference between the island groups, but has not highlighted the importance of such geological features like the Tokara and Kerama Gaps, as it had been expected from other paleo-biogeographical studies, based especially on terrestrial vertebrate animals. In addition to the influence of Palaearctic, Oriental, and Southeast Asian Tropical effects, an interesting relationship to the Australian Region has also been shown, which is in concordance with certain botanical investigations.

Oribatid mites (Oribatei) of the European North of Russia: taxonomic diversity, area of distribution

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In European North of Russia the fauna of oribatid mites was investigated in taiga zone, tundra zone and west mountainside of the north part of the Urals (The Polar, Near Polar and North Ural); 354 species, 142 genera and 67 families of the oribatid mites are known. Many «west» taxons don't penetrate into the European North of Russia.

In taiga zone the most variety of species is typical for such families as Suctobelbidae, Oppiidae, Ceratozetidae, Camisiidae, Phthiracaridae, Carabodidae, Damaeidae and Oribatulidae. The characteristic feature is a high degree of similarity to the Siberian fauna.

94 species, 54 genera and 29 families of the oribatid mites are known in plain areas of subarctic tundra nowadays. There is a high degree of similarity between species composition of oribatids in plain and mountain areas of subarctic tundra and boreal zone. In continental tundra typical arctic species aren't discovered. A few species are arctic-boreal, among them Sphaerozetes arcticus, Edwardzetes edwardsii and Svalbardia paludicola. The species which are common with arctic tundra ones make near 40% of the list.

Some south species are found in arctic-boreal zone which mostly spread in lower latitudes of European part of Russia.

In European North of Russia species with a wide natural habitats predominate in the fauna's list of oribatids (holarctic and palaearctic). Cosmopolitans and semicosmopolitans include near 10% of all the species. More than 30% of the whole species are circumpolar.

Temporal patterns of sex ratio in terrestrial isopods (Crustacea, Oniscidea)

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Sex ratios of iteroparous isopods show very heterogeneous values in the literature. Females usually prevail males but sex rates published differ greatly. This inconsistency may be probably due to differing collecting methods, to geographical variation and/or a distinct temporal activity pattern of sexes.

We analyzed the changes of sex ratios in time in various woodlice species on different habitat levels in the same biogeographic region. Populations were sampled with seasonal pit-fall trapping so the data refer to the animals' surface activity.

Our hypothesis was that seasonal pattern of sex ratios shows similarities in inter- and intraspecific relations on habitat and mesohabitat levels: males predominate early in the season and their high frequency is followed by the first reproductive peak of females during marsupial egg-incubation period.

This hypothesis was only partly supported. We could distinguish different types of male temporal activity patterns that can be characterized by

- Type 1: ratio stability (e.g. *Armadillidium vulgare*)
- Type 2: early male activity (e.g. *Trachelipus rathkii*)
- Type 3: early male activity followed by low frequency after mating (e.g. *Porcellium collicola, Protracheoniscus politus*)

The explanation might be a reproduction-driven increased epigeic activity of sexes: first the mate search of males and later the shelter search of gravid females (Type 2-3.); or it lays in a differing reproductive strategy and/or in longevity (Type 1.)

Although detailed analyses were not possible due to inconsistent sampling designs and frequencies, we believe that these similarities are based on existing biological processes.

Evaluation of germination losses caused by mites in seeds of maize and mung from farmer's holdings in Tehsil Toba Tek Singh Punjab, Pakistan

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The mites are important pests of stored grains and other stored commodities. They are responsible of both qualitative and quantitative losses in stored grains. These mites feed on embryo thus resulting in germination loss in the grains along with deterioration in quality of seed as well as flour prepared from the infested grains. The present studies were conducted to determine the impact of mite population on germination in seeds of Maize and Mung from farmers holdings of Tehsil Toba Tek Singh. The samples were collected from Tehsil Toba Tek Singh viz., Toba Tek Singh, Janiwala, Dabawala, Jalalpur, Dulum, Rajana, Bairianwala, Pairra and Chatiana. Mite population, germination and infestation were recorded initially and after three months of storage. The results revealed highly significant differences between pest mite populations at different places. In maize maximum and minimum initial and final population of harmful mites were recorded from Rajana which was 3.33 and 6.66 respectively. In mung, maximum initial and final population of harmful mites was 2.33 and 5.33 respectively, from Rajana. Significant variations were recorded in initial and final germination percentage of the both commodities which ranged 86-91, 74.75-81 respectively, in maize and 85.87-92.12, 75.87-83.37 respectively in mung. Similar trend was recorded in infestation of both commodities. Negative correlation was observed between harmful mite population and final germination percentage of maize and mung with correlation coefficients of -0.07 and -0.507 respectively.

Effects of thinning on spider diversity of a subtropical plantation forest in Taiwan

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Current plantation management policies have evolved into focusing on both conserving biodiversity and maximizing economic benefit. Before designing effective strategies for conserving biodiversity of plantation forests, we should understand the difference in species characteristics between plantation forests subjecting to different degree of thinning. In many terrestrial ecosystems spiders are the most diverse and abundant arthropod predators. Spiders rely on a distinct complex of environmental factors and therefore are sensitive to changes of the habitats due to forest succession, natural disturbances or forestry practice. Therefore, spiders are considered as a good indicator for comparing the biodiversity of various environments and for assessing the effect of disturbances. In this study, we compared the spider community structures and guild compositions of plantation forests receiving different degree of thinning (0%, 25% and 50%). The study site was located in *Cryptomeria japonica* plantations in central Taiwan. The diversities of spiders as well as microhabitat structures and microclimates were quantified once every three months for two years. Before thinning, spider family compositions did not differ significantly among three plantation forest types. Results of analyses showed that two years after thinning spider family compositions of three plantation forest types differed significantly. Plantation forests receiving no thinning or differential thinning treatments all had different spider

compositions in different years. Such results indicated that there were temporal variations in spider diversity. Two years after thinning, the understory vegetation densities in all three plantation forest types were higher than those recorded from the first year. Thinning treatment might have changed the structures of dense understory vegetations and consequently resulted in declines in abundance, species diversity, and changes in composition. Moreover, the heterogeneity in understory vegetation recovery rate, and temporal variation of spider diversity, might further generated diversity variations in forests receiving different degree of thinning.

S55: Genetically modified plants – Effects on insects I.

Room Rome

A review of laboratory data on the impact of transgenic plants on natural enemies indicates non-random effects

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We analysed the peer-reviewed literature on the impact of genetically modified plants on arthropod natural enemies in laboratory experiments. Significantly more non-neutral responses were found than expected at random, indicating that Cry toxins and proteinase inhibitors have non-neutral effects on natural enemies that . There is a continued bias towards a few predators, especially the green lacewing, *Chrysoperla carnea*, which may be more sensitive to GM insecticidal plants (17% of the quantified parameters significantly negative) than other predators (11% significantly negative). Parasitoids were more susceptible than predators, with fewer positive (18%, significant and non-significant positive effects combined) than negative effects (66%, significant + non-significant). Proteinase inhibitors produced significantly less neutral effects (27% on predators, 29% on parasitoids) compared to Cry1A/Cry2A (35% on predators, 26% on parasitoids) or Cry3A/B (43% on predators, 31% on parasitoids). GM plants can have a positive effect on natural enemies (5% of responses significantly positive), although significant negative (21%) effects were more common. Data exist on 48 natural enemy species, still far from adequate to predict the effect of GM-plants on natural enemies. In spite of this, it is clear that the impact of transgenic plants on beneficial arthropods cannot be assessed on laboratory experiments alone.

An overview about the effects of transgenic *Bacillus thuringiensis* maize on non-target Lepidoptera

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One of the major applications of transgenic crops in agriculture are the *Bacillus thuringiensis* Berliner (*Bt*) plants, in particular *Bt*-maizes which produce insecticidal Cry toxins that target specific orders such as the Lepidoptera or Coleoptera. We reviewed publications that reported on the direct toxic effects of *Bt*-maize and/or Cry toxins of current *Bt*-maize events on larvae of non-target Lepidoptera. In total, 20 peer-reviewed publications were identified, of which 16 papers contributed laboratory-based data and seven field-based data. An adverse effect on caterpillars was recorded in 52% of all laboratory-based and in 21% of all field-based observations. The variables most often studied and having the highest occurrence of effects were larval survival, body mass and developmental time. Overall, 11 lepidopteran species were tested. The majority of the studies originated from the USA, whereas other species and other parts of the world were widely neglected. The papers we reviewed indicated a potential hazard for Lepidoptera that are exposed to and feed on lepidopteran-specific *Bt*-maize pollen. Even so, hazard characterization appears yet incomplete due to the still limited numbers of publications and concurrent lack of knowledge, the restriction of data to only a few species, the over-representation of North American species, and the identified limitations of both laboratory and field experiments.

Determination of Cry1Ab toxin content of *MON 810* maize pollen by enzyme-immunoassay

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Activated Cry1Ab toxin was measured in the pollen of maize of *MON 810* genetic event using two enzyme-linked immunosorbent assays (ELISAs). Commercial 96-well microplate ELISAs, EnviroLogix Cry1Ab/Cry1Ac QuantiPlate® and Abraxis Bt-Cry1Ab/Ac ELISA were applied and optimized for pollen. Due to its high protein and starch quantity, pollen was found to be a difficult biological matrix, reflected in low but reproducible recoveries in sample preparation: 51-55% and 48-49% in spiked pollen relative to spiked pollen extract and buffer, respectively. To assess the role of extraction conditions on the digestibility of pollen grains as solid and hardly destructible particles, the efficacy of various protocols were compared. Concentration of activated Cry1Ab in pollen was calculated with Cry1Ab activated toxin/protoxin cross-reactivities in ELISA, 41% and 56%, for the EnviroLogix and Abraxis kits, respectively. Purity of the pollen fraction is an essential factor: in one batch of DK-440 BTY pollen, toxin content was 108 ± 7 ng Cry1Ab/g dry pollen, while the corresponding level was over 100-fold higher (13030 ± 1690 ng Cry1Ab/g dry weight) in the pollen sack. Considerable variability was found in Cry1Ab production in two, apparently different DK-440 BTY cultivar phenotypes with 100-150 and 4-18 ng Cry1Ab/g dry pollen. Cry1Ab content in pollen was severely affected by weather conditions: drought before tasseling might lead to increased Cry1Ab level in pollen, but reduced pollen production.

Relationships of Helicoverpa armigera, Ostrinia nubilalis and Fusarium verticillioides on MON 810 maize

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Ostrinia nubilalis is a stem/cob pest on maize of low economical significance in the Pannonian Region. Efficient parasitisation is provided by dipteran and hymenopteran species. *Helicoverpa armigera* is presently a more important cob pest in Hungary. Several insecticides are registered for maize, but farmers do not use them. *MON 810* maize was developed against *O. nubilalis* and advertised to indirectly decrease *Fusarium* infestation.

During 2009 extremely high cob damage occurred in Júlia-major (Hungary). Investigating near 4000 cobs on five different non-GM plots, 85-95% of damage originated from *H. armigera* larvae; *O. nubilalis* contributed to this damage only in a single plot. *F. verticillioides* infection appeared only in a smaller part (25-35%) of damaged cobs. *H. armigera* and *O. nubilalis* larvae feeding on *F. verticillioides* mycelia can distribute its conidia with faecal pellets.

MON 810 had 100% effectivity against *O. nubilalis* on stem, and 90-95% against cob damage. The Cry1Ab toxin content of silk/young seeds is lower than leave/stem of *MON 810*.

Fusarium-infected *MON 810* cobs were drastically decreased, and it can occur only after *O. nubilalis* larval damage. *H. armigera* larva cannot tolerate *Fusarium* infected food and tries to move out from the cob. In a further infestation it use the side of cob, but cannot reach seeds thought 8-12 husks. Cob damage (on top) at a high level (40-60%) resulted in only 4-9% decrease in yield and some fusariotoxin content in seeds.

S56: Insect biochemistry and physiology, including their hormonal regulation IV.

Room Maastricht

A process of uptake of Vitellogenin through receptor by the ovary

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Vitellogenin (Vg) is a female specific glycolipoprotein, yolk precursor produced by all oviparous animals. Vg is internalized by a 205 -kDa membrane bound receptor (VgR) in silkworm, *Bombyx mori* oocytes, To elucidate the pathway of VgR internalization in silkworm oocytes during the uptake of Vg, we carried out immunogold electron microscopic studies labeling both Vg and VgR in utrathin frozon sections of ovarian tissue. During early stages of internalization, Vg and VgR were observed together in coated pits, coated vesicles and early endosomes. The uptake of Vg by the ovary was also confirmed by *in vitro* fluorescence labeling studies. Using RT-PCR and rapid amplification of cDNA, some of the regions of VgR (350, 554, 1140 and 1360 bp) were isolated and sequenced. Localization of binding sites are under progress. The study is aimed in the context of how the knowledge of vitellogenin binding with vitellogenin receptor has been and can be used for the design of novel, safe and selective compounds to control pest insects in the foreseeable future.

Circadian and non-circadian expression of clock genes in the male reproductive system of *Spodoptera littoralis*

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The circadian clock in insects is formed by interacting molecular feedback loops consisting of clock genes. The expression of the two clock genes, *period* (*per*) and *timeless* (*tim*), is regulated by transcriptional activators, encoded by *Clock* (*Clk*) and *cycle* (*cyc*). This activation leads to periodic increase in the levels of *per* and *tim* mRNA followed by the accumulation of PER and TIM proteins in cell nuclei, where PER acts as a repressor of CLK/CYC leading to suppression of *per* and *tim* transcription. In Lepidoptera the CRY2 protein encoded by the *cryptochrome2* seems to play role as an additional repressor in this negative feedback loop. In the insect clock mechanism the photoreceptive CRY1 protein, the product of another ortholog of *cryptochome1* gene, mediates the degradation of TIM, synchronizing the clock to LD cycles. Soon after dawn, TIM is degraded and the ensuing degradation of PER allows the initiation of the new clock cycle.

Here *S. littoralis* was used to investigate the expression of *per*, *tim*, *cry1* and *cry2* mRNA as well as PER and TIM proteins in the cells of male testis that contains peripheral clock involved in sperm release. In the cyst cells surrounding sperm bundles in the testis, all genes and proteins investigated showed rhythm in light/dark (LD) cycles but was constitutive in constant darkness (DD). However the *cry1* expression was extremely low or even at *undetectable levels.* In barrier cells separating testicular follicles from the vas deferens, cycling of genes and proteins expression was observed in both LD and DD.

The pattern of clock genes expression and cellular localization of PER and TIM proteins in cyst cells described here suggest that light-driven non-circadian oscillations of clock genes may occur in certain cell types that presumably do not possess all the elements required for autonomous pacemaking.

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Role and identification of gut symbiotic bacteria of the red firebug *Pyrrhocoris apterus*

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The gut bacterial flora of insect is essential for food digestion, nutrition, pheromone production, regulation of pH, synthesis of vitamins, temperature tolerance, resistance against bacterial entomopathogens, antifungal toxin production, and for the detoxification of noxious compounds. Enzymes produced by these gut microflora also play an important role in the detoxification of insecticides. To identify cultivable bacterial species of the intestinal tract of the red firebug *Pyrrhocoris apterus* we performed the analysis of 16S rDNA sequences and MALDI-TOF mass spectrometry. A total of 12 bacterial species were identified including both Gram-positive and Gram-negative genera. Gram-positive organisms included *Lactococcus lactis, Microbacterium sp., Bacillus sp.* and *Lactobacillus plantarum.* A number of Gram-negative bacterial species as *Delftia acidovorans, Sphingobacterium sp., Klebsiella pneumoniae, Ochrobactrum sp., Chryseobacterium piscium, Pseudomonas sp.*, *Stenotrophomonas sp.* and *Paenibacillus sp.* were identified. The results of the mass spectrometry technique were in agreement with the molecular characterization. Various isolated bacteria are common for gastrointestinal tract (GI) of many species, but it seems that several bacterial species are host-specific and dependent on environmental factors. Genera *Pseudomonas sp.* and *Stenotrophomonas sp.* are well known for their occurrence in soil and ability to degrade pesticides. This study provides a useful data for further observation of changes in spectrum of gut microflora of *P. apterus* after ingestion of different biologically active compounds (juvenoids, juvenogens, phytoecdysteroids) and for the investigation of their detoxification mechanisms.

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Permissive and non-permissive hosts: polyDNAvirus as key factor for parasitoid success?

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Our investigations focus on deciphering how parasitoids interact with their hosts on a physiological, biochemical, and molecular level. The gregarious endoparasitic wasp *Glyptapanteles liparidis* physiologically manipulates its main

host, the gypsy moth larva (*Lymantria dispar*), through induction of changes, which suppress the host's immune system and induce host developmental arrest in the larval stage.

During oviposition, female wasps inject virus particles together with eggs and venom. The virus, a polyDNAvirus (PDV), elicits immunosuppression in the gypsy moth larvae so the parasitoids can develop successfully without being encapsulated by host hemocytes.

For hibernation, the parasitoid depends on alternate host species like *Euproctis chrysorrhoea* and *E. similis* that overwinter as larvae. Interestingly, the wasps also parasitize larvae of the closely related species, *Lymantria monacha* (nun moth), but the parasitoids are able to develop to maturity only when first instars are parasitized. In later instars, the parasitoids are invariably encapsulated and killed. Superparasitism does not increase the parasitization efficiency, but induces severe molting problems in the host. The PDV genes responsible for suppression of host immunity are obviously expressed in permissive hosts, but not in non-permissive hosts. We observed that the hemocytes of newly parasitized gypsy moths underwent apoptosis and spread less, whereas hemocytes of parasitized nun moths did not.

The parasitoids evoke major changes in host hormones and development, with endocrine communication appearing to be bidirectional, so that hormones of the host affect the parasitoids and parasitoid-derived hormones having an impact on host development and physiology. In parasitized gypsy moths, juvenile hormone (JH) levels are elevated throughout the last (fourth) instar, and the JH III which is detected in host hemolymph is mainly secreted by the second-instar parasitoids. The PDV acts in concert with the parasitoids by blocking the JH degradation pathway via specific enzymes. These manipulations result in abnormally elevated concentrations of JH III in the blood. Host JH titers remain high throughout parasitism, instead of declining as occurs in non-parasitized pre-metamorphic larvae, and the hosts are developmentally arrested as larvae.

Host larvae cease feeding and spontaneous locomotion stops just before the mature parasitoid larvae emerge and pupate; yet, the hosts survive for several days but never show any signs of metamorphosis. In contrast, PDV-injected gypsy moth larvae without developing parasitoids metamorphose, but exhibit high levels of malformations. Nun moth larvae that are parasitized are smaller, but otherwise parasitism has no severe impact on host growth and development.

New insights into aphid isoprenoid pathway

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Isoprenoids form an extensive group of natural products involved in a number of important biological processes. In insects, they serve among other as hormones and pheromones. Their biosynthesis proceeds through sequential 1'-4 condensations of isopentenyl diphosphate (C5) with an allylic acceptor, the first of which is dimethylallyl diphosphate (C5). The reactions leading to the production of geranyl diphosphate (GPP; C10), farnesyl diphosphate (FPP; C15) and geranylgeranyl diphosphate (GGPP; C20), which are the precursors of mono-, sesqui- and diterpenes, respectively, are catalyzed by a group of highly conserved enzymes known as short-chain isoprenyl diphosphate synthases or prenyltransferases. In recent years, the sequences of many new prenyltransferases have become available, revealing novel mechanisms of product chain-length selectivity and an intricate evolutionary path from a putative common ancestor.

We characterized an aphid prenyltransferase producing both GPP and FPP in similar amounts under in vitro conditions. In an effort to identify the mechanism responsible for this dual activity, we assessed the product selectivity of several aphid prenyltransferase site-directed mutants, designed to effect substitutions in amino acid residues seen to be in close proximity to the GPP or FPP ligand in a homology model. Our analyses pointed to two amino acid residues, Gln107 and Leu110, likely to play a key role in conferring dual GPP/FPP synthase activity to the aphid enzyme. Our research is now focusing on the study of the implication of aphid GPP/FPP synthase in juvenile hormone, alarm and sexual pheromones biosynthesis using qRT-PCR and RNAi methods.

The monoterpenoid deterrent production in leaf beetle larvae: regulation and evolution

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The larvae of some leaf beetle species are capable to produce iridoids (cyclopentanoic monoterpenes) *de novo*. These chemical signals can be released in droplets of secretions from nine pairs of dorsal glands. It has been published that iridoids are effective deterrents against predators, like e.g. ants or spiders. Previously we have demonstrated that the iridoid biosynthesis proceeds in the larval fat body via the mevalonate pathway to glucosylated 8-hydroxygeraniol which is transferred into the glands where the glucosides are finally converted into the iridoids. Analyzing the key enzymes we wish to understand the regulatory mechanisms of this spatial separated pathway. Especially the geranyl diphosphate synthase is in a key position for regulation. Based on transcriptome computer analyses of the species *Phaedon cochleariae* we identified a number of candidate genes. After cloning and heterologous expression of we are performing assays to study the enzyme activities. Moreover, comparisons with sequences from related species can shed light on the mechanisms behind the evolution of iridoid biosynthesis. Because iridoid producing species have the ability for sequestration not only endogenous precursors can have an impact on the *de novo* synthesis but also exogenous glucosides. We are determining not only the glucoside profile in the host plants, but also their induction after feeding as well as their processing by the larvae.

S57: IPM challenges and prospects in annual and perennial crops II.

Room Brussels

New prospects of exploiting tritrophic interactions for biological crop protection

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When attacked by insects, plants emit volatiles that can serve as signals for natural enemies of herbivores to locate their victims. The emissions of such volatiles can be manipulated to improve crop protection. We demonstrated this by restoring the emission of a specific belowground signal emitted by insect-damaged-maize roots. This signal, the sesquiterpene (*E*)-BETA-caryophyllene (EβC), is highly attractive to the entomopathogenic nematode *Heterorhabditis megidis*. This attractant has been lost in most American varieties and this loss was previously found to strongly reduce the effectiveness of the nematode as a control agent of the larvae of the western corn rootworm (WCR), a ferocious root pest. To restore nematode attraction,

a non-producing maize line was transformed with an EβC-synthase gene from oregano, resulting in constitutive emission of EβC. In WCR-infested field plots treated with nematodes, transformed lines showed significantly less WCR damage and had fewer WCR adults emerge than isogenic lines.

EβC is only weakly attractive to *Heterorhabditis bacteriophora*, one of the most infectious nematodes against WCR. To overcome this drawback, a new strain of *H. bacteriophora* was selected in the laboratory for a better responsiveness to EβC. In subsequent field tests we confirmed that the selected strain was more effective than the original strain in reducing WCR population in plots with a maize variety releasing EβC, but this was not the case in plots with a maize variety that did not emit this signal. The results of these studies illustrate the great potential of manipulating crop plants, as well as natural enemies of herbivores to improve biological pest control.

A discrete spatiotemporal population model for management of western corn rootworm (Diabrotica virgifera virgifera LeConte; Coleoptera: Chrysomelidae) at landscape level

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Maize yield is affected by root-feeding larvae of the Western Corn Rootworm (WCR). As the larvae of this univoltine species are largely restricted to maize, crop rotation is an effective and widely used control method. A discrete spatiotemporal model was developed to estimate population built ups under different rotation ratios in agricultural landscapes; and consequently, to improve crop rotation strategies against WCR within the framework of integrated pest management. The modelled agricultural landscape was simplified into a lattice with fields as cells. The distribution of WCR is assumed to be discrete because of its close association with maize fields. The cells were defined as first year maize, continuous maize or non-maize, and this with or without the restriction that maize is not grown for more than 3 consecutive years which would be in accordance with IPM. The lattice was encapsulated into a torus to handle edge effects. Twice per simulated year, the density of WCR was calculated in cells covered with maize: (1st) for adults emerging in their natal fields; (2nd) for a proportion of adults dispersing and arriving in other maize fields to lay eggs. The model output was the proportion of maize fields that reached population densities above a defined economic threshold level. However, also farmers' decisions for or against rotation in a certain situation may have an effect on population dynamics. We therefore modelled the effect of farmer decisions on the rotation ratio of maize in a region as well as the odds ratio of rotating first year and continuous maize fields. Preliminary model evaluations suggested that farmers' preference for or against rotation affects the output; however, the odds ratio has a minor importance compared to the rotation ratio.

Sorghum, Miscanthus & Co: Energy crops are potential host plants of the western corn rootworm larvae

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One of the most important crops grown for the production of biomass is maize. To reduce the negative effects of large scale and continuous cultivation of maize a number of alternative plant species have been suggested. Although there are many studies evaluating the economic, environmental and social aspects of their cultivation, the direct or indirect effects on agricultural pests are rarely investigated. Especially whether these plants are suitable hosts for the larvae of the western corn rootworm (WCR) is largely unknown.

Here we present results of greenhouse experiments that evaluated the ability of WCR larvae to develop on the plant species proposed as alternatives to maize in order to avoid large scale, year after year maize monocultures and the build up of high rootworm densities.

The development of the larvae of WCR was monitored on 34 plant species, including 18 *Sorghum* species/varieties, *Miscanthus* x *giganteus* and 16 field grasses, including a number of *Lolilum* and *Festuca* varieties. To assess the quality of these plants as hosts the number of larvae that survived, and their head capsule widths and dry weights were recorded.

Some of the field grasses were suitable host plants for WCR larvae, but the number of larvae that survived and their dry weights were less than that recorded when fed on maize. The roots of most of the 18 *Sorghum* species or varieties tested were unsuitable for larval development. The number of larvae that survived, and their weight and head capsule widths when reared on *Miscanthus* are similar to those recorded for larvae reared on maize.

The delivery of a virus risk assessment to decision makers in the seed potato industry via rapid result provision of aphid trap catches and the incorporation of new data on *Potato Virus A* transmission

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In England and Scotland, an aphid monitoring scheme provides a risk assessment of virus spread for seed potato growers, and is mainly focused on *Potato Virus Y* (PVY). The scheme is made up of a network of yellow water traps (YWT's) situated within seed potato crops in the main growing areas of Scotland and England and provides data on the number of aphids captured by species and the ability of each to transmit PVY. Growers maintain the traps and send the contents in for identification. The results are returned to the grower on the same day as sample arrival at the laboratory and are also incorporated into a website that has a map based interface for easy interrogation of results. The growers utilise this service and incorporate the data into their decision making processes on haulm destruction timing, insecticide use and product choice and as a marketing tool. In recent years the incidence of *Potato Virus A* (PVA) has been increasing and needs to be considered alongside PVY in the risk assessment system. There is little data available on the ability of aphids species to transmit PVA and in order to fill the gap transmission experiments on the most common aphid species captured in the traps have been undertaken. This uses a method recently reported by Verbeek *et al* (2009) which enables the direct comparison of results for PVY and PVA transmission. The results and their incorporation into the risk assessment system will be discussed.

Control of European corn borer in bell peppers with chlorantaniliprole applied through a drip irrigation system

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The European corn borer (*Ostrinia nubililalis* Hubner) (Lepidoptera: Pyralidae) is the most important economic pest

of bell peppers throughout the mid-Atlantic region of the U.S. Borers crawl under the fruit calyx and bore into, and feed on, the placenta, immature seeds and pericarp, rendering the fruit unmarketable. Infested fruit often rot and drop from the plant before harvest. To protect the fruit, growers begin weekly sprays when moths are active and fruit >1.3 cm are on the plant (late July – early August) and continue sprays until harvest is completed (late October). Most pepper production utilizes black plastic mulch with drip irrigation and high wooden stakes, limiting pesticide application. A new chemistry insecticide, chlorantraniliprole, is highly soil systemic, very soluble, and effective against Lepidopteran larvae at low rates. A 3-yr study applying chlorantraniliprole through a drip irrigation system to bell peppers demonstrated that, on every harvest date examined, 2-4 applications of chlorantraniliprole were as effective, or more effective, in reducing percentage borer-infested peppers than a standard grower pesticide program of multiple applications of acephate and indoxycarb each year. This application method could be successful in other row crops such as tomato, eggplant, cabbage, and others. Growers could realize reductions in pesticide inputs, sprayer fuel, time of application, and costs of spray equipment.

S58: Invasive species II.

Room Copenhagen

Ongoing biological control studies of *Laricobius osakensis* (proposed) Montgomery & Shiyake (Coleoptera: Derodontidae), a predator of *Adelges tsugae* Annand (Hemiptera: Adelgidae)

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Adelges tsugae Annand, is an invasive pest of eastern (*Tsuga canadensis*) and Carolina (*T. caroliniana*) hemlocks in eastern USA. Classical biological control is recognized as the best option for long-term biological and economic sustainability. We are presently evaluating a new predator for *A. tsugae*, *Laricobius osakensis* Montgomery & Shiyake (proposed), recently found in Japan. Host-range tests were conducted to determine the suitability of this predator as a biological control agent. The tests involved no-choice and paired choice feeding, oviposition, and development assessment with *A. tsugae*, 3 other adelgids, and 3 non-adelgid species. *L. osakensis* fed and laid more eggs on *A. tsugae* over all the other species and completed development only on *A. tsugae.* The overall results indicate that this predator is specific for HWA. Subsequent to these findings, mass rearing of *L. osakensis* must be optimized. Rearing has so far followed procedures developed for the closely related biological control agent, *Laricobius nigrinus*, but has yielded poor results. Results of research investigating how best to rear *L. osakensis* will also be presented.

More than twenty years successful prevention of establishment in Europe of the EU quarantine pest *Thrips palmi*

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After an alert by Japanese authorities of introduction of the harmful *Thrips palmi* in Japan, in 1987 the first interception in Europe of this later IAI EU quarantine organism was a fact. In The Netherlands a female and a male were taken from *Chrysanthemum* cut flowers imported from Japan. In accordance with EPPO Reporting Service this interception was followed by 1940 notifications of *T. palmi* by EU member states in the period 1988-2009. These notifications were a result of rejection of the same number of consignments of almost exclusively end products, such as cut flowers (mainly orchids) and fruit vegetables (mainly aubergine and bitter melon). Inspite of the high number of notifications, introduction in glasshouses has been reported a few times only. The National Plant Protection Organizations (NPPO's) of The Netherlands and UK have reported respectively 45 (mainly *Ficus* nurseries) and 1 (*Chrysanthemum* nursery) introductions. All populations were eliminated by destroying infested plants or by heavy chemical treatment. Additionally Portugal's NPPO reported that.*T. palmi* was found in 2004 at two localities in their country, but the identification of the thrips material from these localities has not been confirmed. Identification of the thrips is hampered by its small size and the common occurrence of juvenile stages on end products. Diagnostic protocols based on morphological features as well as molecular identification techniques are developed and will be improved in the near future. *T. palmi* is one of the very few pests whose introduction into Europe has been prevented by the effective co-operation of at least 17 EU-member states.

Tapinoma nigerrimum (Hymenoptera: Formicidae): last shield against the spread of the Argentine ant

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Conservation of biodiversity is one of the most important subjects for sustainable human development and resource use. With the expansion of international trade, invasive alien species have become a major cause of biodiversity loss on the global scale. Invasive ants are among the most harmful groups, causing serious problems to ecosystems, agriculture and human life. The Argentine ant *Linepithema humile* (Mayr) native to South America is one the most important invasive species as it is currently found in many parts of the world. Like other invasive species, its eradication or effective management with existing strategies has proved difficult. For example, containing these invasions with pesticide application and toxic baits can cause serious damage to the local biodiversity. In Corsica, native ant *Tapinoma nigerrimum* seemed to limit the spread of Argentine ant. Both species exist in Provence-Côte d'Azur Region. Bioassay between *L. humile* and *T. nigerrimum* testing competition for food and space has been made to test the hypothesis of a local resistance. In the laboratory *Tapinoma nigerrimum* showed ability to resist or even, in some case, to exterminate the Argentine ant. This occurred irrespective of the order of introductions and until a relative excess of *Linepithema humile.*

Aedes albopictus (Skuse, 1894): monitoring and current status of an important invasive mosquito species in Spain

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Although invasive alien species (IAS) are considered one of the most important threats to biodiversity, it is well know that the impact of some of them strongly and directly affect public health, their influence being secondary or null on native species in terms of "interspecific competition". Inside this group of IAS we can situate the Asian tiger mosquito, Aedes albopictus (Skuse, 1894), in a worrying preferential place due to it is ability to transmit arbovirus such as Dengue, Yellow Fever or Chikungunya. Since the first detection of Ae. albopictus in Spain in 2004 the expansion of this invasive mosquito has been constant and irregular through the East of the Iberian Peninsula. In this work we will present the results of an exhaustive monitoring of Ae. albopictus carried out in several suitable environments, such

as cemeteries or scrapyards, situated in some of the most populated cities of the Mediterranean Spain. The Spanish and European management against the species will be also briefly discussed.

This work was partially funded by Research Project CGL 2009-11364 (BOS), supported by the Ministry of Science and Innovation of Spain.

Revision of the genus *Epiphyas* – the light-brown apple moth in context

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Epiphyas is an indigenous Australian genus of over 60 moth species (Family Tortricidae). Until now, our taxonomic knowledge of the genus has been limited to I.F.B. Common's six-page review (1961), without illustrations of adults and containing only a few genitalia drawings.

The larvae of one species of *Epiphyas*, *E. postvittana*, became a noted pest of apples in parts of Australia during the late 1800's. This species is now commonly known as the light-brown apple moth, but the larvae of *E. postvittana* are widely polyphagous and have been found in other crops such as Lucerne (*Medicago sp.*) and various cultivars in the genera *Brassica*, *Citrus* and *Vitis*.

E. postvittana became established in New Zealand during the 1870's, possibly through horticultural trade, and is now also found in England, Hawaii, the United States and Sweden. It is listed as a quarantine threat by many countries, thereby placing restrictions on certain horticultural exports.

E. postvittana belongs to a group of six similar looking but phenotypically plastic *Epiphyas* species known as the "*postvittana* group" and identification of *E. postvittana* using morphology alone can be problematic. To address the needs of trading partners globally, reliable diagnostics for the larvae and adults of *E. postvittana* are required.

This presentation reports on the progress made in the revision, with a particular emphasis on the identification of *E. postvittana* and the other economically important *Epiphyas* species using a combination of morphology, knowledge of the genetic heritage of the genus and aspects of their biology such as host plant preference and pheromone systems.

Web systems and tools to support invasive species education programs in multiple languages across national and institutional boundaries

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Challenges facing nature protection and conservation educators include: locating reliable information about species invasive species. Although there have been several projects focused on some aspect of these needs, issues such as: copyrights precluding using or modifying information; access to quality images at no cost; formats or download limitations; ability to modify information for local needs; the language in which information is available; and systems through which information can be delivered to intended audiences are inhibiting these educational programs.

Prof. Lakatos and other European educators have been working with the senior author and have been contribution images to ForestryImages (www.forestryimages.org) and Invasive.org (www.Invasive.org) for a number of years. In 2008 the senior author spent a six-month sabbatical at and taught courses at The University of West Hungary (UWH) where he used and demonstrated how to use ForestryImages, Invasive.org and the more recently developed BugwoodWiki (http://wiki.bugwood.org/) as integral components of the courses he taught. Students in the senior authors' courses developed "fact sheets" on species of concern to Hungary in Hungarian and English. Since the sabbatical, the authors have begun building a Hungarian-focused Invasive Species web-accessible information system in English and Hungarian using the Bugwood systems.

This presentation will outline the features of the systems being used, the features of the system being built and how we plan to use them in the future, and our ideas for their expansion to cover other countries, languages and future Invasive species needs.

S60: Genetically modified plants – Effects on insects II.

Room Rome

A new method for *in-situ* measurement of *Bt*-maize pollen deposition on host-plant leaves

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Maize is wind pollinated and produces huge amounts of pollen. In consequence, the Cry toxins, if expressed in the pollen, will be distributed by the wind in the surrounding vegetation where they may be consumed by NTOs. Non-target Lepidoptera larvae, which may be affected by *Bt*-pollen on their host plants, can serve as an example. Although some information is available to estimate the amount of pollen on host plants, recorded data are based on indirect measurements such as shaking or washing off pollen, or removing pollen with adhesive tapes. These methods often lack precision and do not allow to gain specific information such as spatial and temporal accumulation of pollen on the leaves.

Here, we present a new method for recording in-situ the amount and the distribution of *Bt*-maize pollen on host plant leaves. The method is based on the use of a mobile, small digital microscope (DinoLite Pro, including DinoCapture software) which can be used in combination with a laptop-computer in the field. During experiments in 2009 and 2010, the method was evaluated. Maize pollen could be correctly identified and pollen densities as well as the spatial heterogeneity of maize pollen was recorded on maize and different lepidopteran host plants (*Centaurea scabiosa, Rumex* spp.*, Succina pratensis* and *Urtica dioica*) growing adjacent to maize fields. First data will be presented and analyzed for their implications regarding the exposure assessment of non-target Lepidoptera.

Protected lepidopteran larvae and Cry1Ab toxin exposure by Bt maize pollen in the Pannonian Region

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Deposited maize pollen containing Cry1Ab toxin effects non-target lepidopteran larvae inhabiting weed communities at field edges. Most of the drifting pollen is deposited at field perimeters. The critical zone for MON 810 pollen (~100 ng

Cry1Ab toxin/g dry pollen) is 6-10 meters for rare and protected species. For other events (SYN-Ev176, DAS-1507) producing more Cry1 toxin in pollen new critical zone analysis is needed.

The food plants of 213 protected Lepidoptera species in the Pannonian Region were compared with plant surveys (weeds, bushes and trees) nearby the Hungarian cornfields. Results were focused on the pollen shedding period to find the affected plant–insect relationships. Leaf structures and the deposited pollen densities were evaluated. Plants with wide, horizontal and hairy leaf surface retain deposited pollen for a longer period. Larvae of *Aglais urticae*, *Inachis io*, *Polygonia c-album*, *Vanessa atalanta* feeding on *Urtica dioica*; *Argynnis niobe*, *Brenthis ino*, *Euplagia quadripunctaria*, *Pandoriana pandora*, *Spialia sertorius* feeding on *Rubus caesius*; and *Acherontia atropos* feeding on *Datura stramonium* may be affected principally in the Pannonian Region. Choosing models from them is necessary for European authorization. Cry1 toxin sensitivity of larvae (depending on species), Cry1 toxin content of pollen and pollen yield of a GM-cultivar are important parameters of this topic. *I. io* is a suitable model for perimeter of maize fields.

Potential effects of pollen from stacked *Bt*-maize to non-target Lepidoptera in agrarian systems

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The cultivation of *Bt*-maize expressing lepidopteran-specific Cry proteins poses a potential risk for non-target butterflies. Therefore it is necessary (*i*) to assess the hazard posed by Cry proteins in pollen; (*ii*) to estimate the exposure to pollen deposited on the host plants of larvae in the field; (*iii*) to get data on the occurrence of larvae in relation to maize fields during anthesis.

The small tortoiseshell (*Aglais urticae*) and the peacock butterfly (*Inachis io*) are common in central European agrarian landscapes and were used as test organisms. Their larvae feed on stinging nettle (*Urtica dioica*). The DKC 5143 (event *MON 89034* x *MON 88017*) maize cultivar investigated expresses Cry1A.105 (8.6 µg/g pollen FW), Cry2Ab2 (0.33 µg/g pollen FW) and Cry3Bb1 (3.8 µg/g pollen FW).

Hazard was assessed in single-dose laboratory feeding studies to determine effect thresholds. A dose of 300 pollen/cm^2 did not reveal any significant differences in mortality rates of 3rd instar *A. urticae*.

The average amount of pollen found on nettle leaves was 29±41 grains/cm^2 directly at the maize field edge. In a distance of 5 meters the pollen density was 3±4 grains/cm^2. Pollen load on host plants decreased rapidly with increasing distance.

Patches of nettle and the occurrence of larvae of *A. urticae* and *I. io* were mapped in two agrarian landscapes. Over 72% of nests were found in distances of at least 25 meters to maize fields, corresponding to a pollen density of less than 0.9±1.2 grains/cm^2.

Bt-maize (*MON 810*) effect on the collembolan *Folsomia candida* – some new aspects

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There is a considerable ongoing debate about the environmental effect of the *Bt*-maize *MON 810*. Results referring to springtails are based on standard laboratory or field tests. Little effort was made using classical ecotoxicological methods such as dose-response relationships or long-term consequences. To make up for this omission, two series of laboratory experiments were performed. In the first experiment, the Cry1Ab toxin content of the maize was different along a gradient. The springtail *F. candida* fed more from, and reproduced better on isogenic than *Bt*-maize. No dose-response was detected. However, the highest concentration tested was only about one-third of the toxin, which is produced by *MON 810* in the field. In the second series of experiments *F. candida* populations were fed continuously on *Bt*-maize for up to 31 months. Collembolan food consumption, reproduction and food preference did not correlate with the duration of *Bt*-maize consumption. Nevertheless, differences of these parameters between populations were significant. Populations which preferred isogenic over *Bt*-maize fed more and reproduced better than those showing no preference.

S61: Xenobiotic effects and side-effects on arthropods

Room Strasbourg

Baseline susceptibility and stability for insecticides in a field population of beet armyworm, *Spodoptera exigua* (Noctuidae: Lepidoptera)

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Baseline susceptibility data were generated for insecticides representing four major classes of insecticides commonly used against beet armyworm, *Spodoptera exigua* (Hubner) in Cotton Zone of Southern Punjab, Pakistan. A field population was collected from the cotton crop with known number of pesticide applications in a crop season and tested against four insecticides i.e., chlorpyrifos, deltamethrin, spinosad and lufenuron for eleven generations. LC_{50} values for deltamethrin ranged from 46.8-57.6 µg L^{-1} while 11.5-45.1 µg L^{-1} for chlorpyrifos, 0.36-17.2 µg L^{-1} for spinosad and 2.4-73.8 µg L^{-1} for lufenuron after 48 hour leaf-dip treatment. LC_{50}s after 72 hours exposure ranged from 27.7-46 µg L^{-1} for deltamethrin, 9.0-32.8 µg L^{-1} for chlorpyrifos, 0.23-10.8 µg L^{-1} for spinosad and 1.4-29.1 µg L^{-1} for lufenuron. The results revealed that susceptibility level increased for all the four tested insecticides in the subsequent generations. It increased significantly for spinosad and lufenuron suggesting their high toxicity level, prolonged and effective role. Deltamethrin and chlorpyrifos LC_{50} values showed stability of resistance in *S. exigua* field population. Wise use of new chemistry insecticides is proposed in rotation with conventional insecticides for their prolonged effectiveness.

Control of *Culex pipiens molestus* in septic tank by using deltamethrin-sucrose solution

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The mosquitoes in the *Culex pipiens* complex of the Republic of Korea (ROK) mostly had consisted of *Culex pipiens pallens*, and since *Culex pipiens molestus* was reported in Seoul, it has been reported almost everywhere in the ROK. *Cx. pipiens molstus* occurs mostly in water tanks and in septic tanks in the basements of buildings, and urbanization

has progressed, their occurrence has become more prevalent. They occur all the season and even bother humans in late autumn and in winter because they can oviposit without any source of blood in limited space. Most of *Cx. pipiens molestus* control at septic tank in the ROK has been carried out by lavicides, because they are easy to apply compared to other control method. However, control by the lavicides is more expensive and has troublesomeness like frequent treatment. If adult control such as thermal fogging is performed to reduce side effect of lavicides, there might be another side effect. Sludge microorganisms are essential to degrade organic matters in septic tanks. However, when insecticide was sprayed by thermal fogging into septic tank, the sludge microorganisms died and aren't able to proceed degradation of organic matters. Herein, we studied some experiments to develop a new control method of *Cx. pipiens molestus* in septic tank by sucrose-insecticide solution. The sucrose in plant fluids is an extensively used as energy source for both males and females of mosquito. When a mosquito has arrived at a sugar source, the stimulation of sugar-sensitive sensilla on its tarsi and labella induces feeding. As the viewpoint, the new application method of adulticide to control *Cx. pipiens molestus* in septic tank in building will be applied by using insecticide-sucrose solution to attract mosquito and to prolong contact time on the solution, hanging on the ceiling of septic tank. Under laboratory condition, susceptibility of ten insecticides to *Cx. pipiens molestus* was evaluated with topical bioassay to select candidates for use in outdoor bioassay and repellent activity and route of action of the insecticides were assessed by patch test and direct-non direct bioassay under laboratory condition, respectively. In our test, deltamethrin demonstrated the highest susceptibility and the least repellent activity to the mosquitoes. In septic tanks in basement in four buildings, control effects of deltamethrin-sucrose solution to *Cx. pipiens molestus* were assessed and significant decrease of density of the mosquitoes occurred during the test.

The effect of sulphur and chlorpyriphos on two spotted spider mite, *Tetranychus urticae* (Acari: Tetranychidae) and an introduction to natural enemies in grape

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In many agricultural systems spider mites are believed to be induced pests, only reaching damaging densities after pesticides decimate predator populations. Vineyards typically receive two types of pesticides, insecticides and fungicides. Chemicals in either class could impact spider mite densities both directly through spider mite mortality, and indirectly by negatively affecting natural enemies. The impact of a broad-spectrum insecticide, Chlorpyrifos (Cl.) and an inorganic fungicide, Sulfur (Su.) on two spotted spider mite was investigated in Department of Plant Protection in Urmia University. In this experiment, chemicals were used in factorial design based on completely random design for investigation of main and associated effects. Su and Cl. were used against two spotted spider mite at the rates of 2, 4 and 6 gram in liter water and 0.5, 1 and 1.5 liter in thousand liter water, respectively. All experiments were carried out with 5 replications and 20 acari in each replication. Mortality counted after 24, 48 and 72 h treatment. In the case of sulfur, highest mortality was observed at the rate of 6 gram in liter that was 92.99 percentages. For chlorpyrifos this amount was recorded in rate of 1.5 liter in thousand liter water with 52 percentage mortality after 72 h treatment. According to the bad side-effect of each substance which was used in the experiments, involving effect on mammalian such as human beings, natural enemies, burning plant danger and …, an experiment was done to decrease recommended concentration. For integrated effect investigation, a mixture of 2 g Su.+0.5 l Cl., 2 g Su.+1 l Cl., 4 g Su.+0.5 l Cl. and 4 g Su.+1 l Cl. was used. In associated interaction, the highest mortality was recorded at the mixture of 4 g Su.+1 l Cl. 72 h after treatment that was 83 percentages. According to the importance and maintaince of natural enemies and also decrease the other bad effects of this chemicals in the integrated pest management and results from the experiments, integrated use of these chemicals is recommended.

Evaluation of Sublethal doses of chlorpyrifos and fenpropathrin pesticides on stable growth parameters in adult stage treatment of *Habrobracon hebetor* Say. (Hym.: Braconidae)

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The sublethal effects of the pesticides chlorpyrifos and fenpropathrin were assessed against *Habrobracon hebetor* Say. (Hym.: Braconidae) by using demographic approach. In this research, stable growth parameters were investigated. Experiments were conducted at 26±1 °C, 65±5 RH, and photoperiod of 16:8 h (L:D). One day old mated females were exposed to LC_{25} and LC_{30} of the pesticides for 24 h. Glassy exposure cages (12×12×1.5 cm) were used for experiments. On glassy surface, 3 ml of each pesticide solution were sprayed by trigger sprayer and spray volume of 2 ml/cm^2. Distilled water was used in control treatment. 16 survivals were randomly selected and transferred to 6 cm Petri dishes. Two last instar larvae of *Ephestia kuhniella* Zeller were offered to each female daily as host until all of females were dead. The numbers of eggs produced, hatched, and emerged adult per female per day were recorded. Stable populations were estimated using Carey's (1993) procedure. In control and pesticide treatments, Gross reproductive rate (GRR) and net reproductive rate (R_0) were 131.72±5.86, 70.35±7.67, 63.87±7.61, 37.46±4.41, 30.42±2.19 and 111.55±2.54, 45.18±3.48, 52.65±2.6 21.64±1.48, 17.97±2.19 female/female/generation, respectively. Intrinsic rate of increase (r_m) and finite rate of increase (λ) were estimated 0.301±0.002, 0.252±0.007, 0.278±0.006, 0.2±0.006, 0.222±0.013 and 1.34±0.003, 1.28±0.008, 1.31±0.008, 1.22±0.007, 1.24±0.015 female/female/day, respectively. Mean generation time (T) doubling time (DT) were 16.51±0.18, 16.19±0.33, 15.26±0.2, 16.33±0.34, 13.94±0.29 and 2.11±0.03, 2.35±0.15, 2.21±0.11, 3.01±0.19, 2.73±0.35 day, respectively. Statistical analysis showed that these parameters of the different sublethal concentration the pesticides treatments had significantly difference from control except DT parameter. LC_{30} the fenpropathrin and LC_{30} the chlorpyrifos had the most effect on population growth parameters of *H. hebetor*, respectively.

The effect of some chemical additives as formulation on the *Bacillus thuringiensis* enhancement against the potato tuber moth *Phthorimaea operculella* (Lepidoptera: Gelechiidae)

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Some additives have been adopted to improve the formulation of *Bacillus thuringiensis* var. *Kurstaki* (HD-73)

and to increase its potency against first instar larvae of potato tuber moth, *Phthorimaea operculella*. Procedures were based on the incorporation of some selected essentially non toxic and low cost compounds with different modes of action with the endotoxin to increase its activity. Among the compounds tested were wetting agents, Stickers, Feeding stimulants, Carriers, UV protectants and Chemical additives including some inorganic salts, nitrogenous compounds, protein solubilizing agents, lipid emulsifying agents, organic acids and oxidized carbohydrates.

Evaluation of spray technology with minimum requirements for the control of desert locust *Schistocerca gregaria* (Orthoptera: Acrididae)

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This study was carried out for the development of ground-based sprayers and for sorting out of the related test procedures for the control of desert locust *Schistocerca gregaria* (Orthoptera: Acrididae) and also to evaluate the effect of power on the droplets and their collection efficiencies at different air speeds. In order to make an efficient, economical and responsible use of the pesticides, it is important to have a reasonable idea of the amounts of pesticide falling not only on the target pest but also on the plant and on the soil being carried away by the wind so that the application parameters should be best adjusted for the correct targeting. This study used special facilities (low speed wind tunnel, spinning top droplet generator and image analyser) to try to refine these recommendations to a narrower range of desirable droplet sizes also the data was obtained that might suggest changes in operational parameters, which could lead to the minimization of the off-target drift that primarily arises from the small droplets produced during atomisation. The analysis of data has revealed some interesting trends that were not otherwise apparent and also grouping the data from several experiments has helped to increase the reliability of the results. In all the trials, vertical position of locust received the highest volume of spray at 5 batteries 23µl at 1m/sec, 28µl at 2m/sec and the highest collection of spray volume of 42µl was noted at 3m/sec of airspeed.

Comparison of insecticidal activity of essential oils against red flour beetle *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae)

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Tribolium castaneum Herbst (Coleoptera: Tenebrionidae) is one of the most prevalent stored-product insect pests in Pakistan. It feed on those grains only, which have already been damaged by primary pest. To check the efficacy of different essential oil repellency behavior, experiment was conducted in the Toxicology Laboratory, Department of Agricultural Entomology, University of Agriculture, Faisalabad, Pakistan, to determine the efficacy of oil extraction of *Eucalyptus camaldulensis* and *Piper nigrum* in various concentrations i.e. 20%, 40%, 60% for the control of red flour beetle under laboratory conditions. The incubator was maintained at 30 ± 2 ^{0}C and 65 ± 5 % R.H. The experiment was laid in completely randomize design. The results showed that Maximum larval and adult mortality of red flour beetle was observed in those treatments where maximum concentrations of plant extract was sprayed in both the plant species at all the post treatment intervals. It was again observed that *P. nigrum* showed less effect on the adult and larval mortality of the pest as compared to *E. camaldulensis*.

S62: IPM challenges and prospects in annual and perennial crops III.

Room Brussels

Pesticide free control of Flea beetles (*Phyllotreta* spp.) in Rocket (*Eruca sativa*)

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Flea beetle (*Phyllotreta* spp.) is an important pest of cole crops. Problem of flea beetle control is unsolved in organic farming. The most sensitive cole crops are leafy vegetables for example rocket. Since 2009. spring we have established small parcel field tests applying different non-chemical methods. Our main target is to use preferably such soil mulch material which is being present in the nearby area of the experiment. In addition to mulching we also try to apply plant extracts, soaked vegetal liquids, essential oil, and plant agents which can be purchased as pesticide, or pesticide complementary material. During the vegetation period we monitored the beetles using Csalomon KLP+ traps, placed to defined areas for a certain period of time. We have evaluated the results of different treatments by counting the number of holes found on the leaves collected from rocket using statistic method.

Determination of the optimum dose for sterilizing Greenhouse Whiteflies, *Trialeurodes vaporariorum* (Westwood) (Hem.: Aleyrodidae) by gamma radiation

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The Sterile Insect Technique (SIT) is an environmentally friendly control method that is mainly used in Area Wide Integrated Pest Management (AWIPM) programs. Greenhouse whitefly (GHWF), *Trialeurodes vaporariorum* (Westwood) makes serious damages to glasshouse crops. A series of experiments was carried out to establish the optimum dose required for GHWF adult sterilization through SIT. Pest colonies were reared on Tobacco in greenhouses. Then, infested leaves were cut off daily, and the 4th nymphal stages selected randomly. The rest nymphs and pupae of the colonies were carefully removed from the leaves. Selected 4th nymphal stages were put on leaves in Plexiglas cages under controlled conditions (65±5% RH, 25±2^{0C}, L/D=16/8). They were checked daily for capturing newly emerged adults while no mating occurred between them. The sexes were collected separately by tiny glass tubes and irradiated by gamma radiation (60Co source) in different doses; 50, 60, 70, 80 and 90 Gy (n=4). The irradiated females mated with fertile males and the irradiated males mated with fertile virgin females. They were then released on plant cages enclosing transplants of Tomato (var. *Cherry*) as a main host. The laid eggs and their fertility was evaluated daily. Also, longevity of irradiated males and females was studied until the death of the last one. Fertile pairs were selected as control treatment in all experiments. According to the results, the optimum sterility doses for females and males were 70±5% and 80±5% Gy respectively showing that females were more radiosensitive than males. Results showed significant differences (≤%1) of fecundity and non significant differences of longevity between irradiated insects at the tested doses.

Predatory mites to control *Thrips palmi* Karny (Thysanoptera:Thripidae): Prey consumption rates and compatibility with chemical insecticides

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The potential of four predatory mites (*Amblyseius swirskii* Athias-Henriot*, Typhlodromips montdorensis* Schicha*, Neoseiulus cucumeris* (Oudemans) and *Iphiseius degenerans* Berlese) were investigated for their potential to act as control agents for *Thrips palmi* Karny. Both prey consumption rates and their compatibility with chemical insecticides were assessed. All mites readily feed upon various life-stages of *T. palmi*. The second instar larvae proved the most preferred life-stage, with *T. montdorensis* feeding upon the most larvae (2.8 larvae) over a 5 day period. *Typhlodromips montdorensis* also consumed an average of 1.2 adult *T. palmi* per 5 day period compared to *I. degenerans* feeding upon 0.6 adults. Both direct exposure of mites to chemicals and the impact of chemical residues on mite survival was also assessed. After 24 and 48hr assessments following direct insecticide application, spraying with chemicals abamectin, spinosad and imazalil provided mortality of predatory mites (across all species), which was significantly higher than the other treatments ($p<0.001$). Spraying with pymetrozine did not provide any increased mortality compared to the water control. Spraying with thiacloprid proved detrimental only to *I. degenerans*. Investigating indirect chemical application no significant differences in mite mortality were obtained following application of pymetrozine and imazalil. Indirect application of spinosad was identified as the most detrimental treatment ($p<0.001$) to all mite species. Abamectin also proved detrimental, with only *T. montdorensis* showing any potential resistance. The potential of incorporating the mites into IPM strategies for *T. palmi* control is discussed.

Investigation of life history parameters for the development and validation of a simulation model describing the population development of the currant-lettuce aphid, *Nasonovia ribisnigri* in glasshouse lettuce

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Life history parameters of the currant-lettuce aphid, *Nasonovia ribisnigri* were studied at five constant temperatures and a stochastic population dynamics model constructed. The optimum temperature range for population development was between 15°C and 18°C. Populations can develop at as low as 10°C, and above 20°C fecundity decreases and mortality increases. At constant 25°C, populations could not develop. Statistical models describing these parameters were developed and incorporated into an individual based aphid population simulation model. This was validated through experiments following aphid population development under controlled but fluctuating temperature conditions and under glasshouse conditions. In controlled conditions, the model was shown to be a good descriptor of the overall larval development time (although the time as a second instar was slightly overestimated), larval mortality, adult development and lifespan. The models describing age specific fecundity predicted the total number of offspring per aphid accurately. Mean offspring per adult per day was well described for most of the experiment, although there is a small divergence after about 15 days when the total number of aphids was beginning to drop. In glasshouse conditions the model fit was good where the average temperature was around 14°C however there was divergence in the trial where the average was around 18°C. Utilisation of the model as a tool for considering IPM strategies is discussed.

The effects of cultural control methods on the Lesser date moth (*Batrachedra amydraula* myer) infestations

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The lesser date moth is one of the major pests of date palms (Phoenix dactylifera) in Iran. Its injury has been recorded up to 50-70 percent in some areas such as Bam in Kerman province of Iran. The pest damages fruits in both field and storages. Among different control methods of the lesser date moth, the cultural method has been one of the old methods, but its use has been neglected due to reliance on pesticides. This research has been carried out in Khuzestan province by using incidentally cluster-sampling methods. Sampling areas were divided into 30 plots. Then one sample (15 trees) was selected randomly in each plot. Macheak method was used for estimating the pest infestation. Different management strategies including tillage, nutrition, irrigation, pruning, chemical control, bunch covering and bunch arrangement were evaluated using a questionnaire. Correlation analyses were applied to related management strategies to infestation levels. Correlations with significant correlation were selected for multiple regression analysis.

Based on correlation analysis fruit stalk pruning($r = -0.61$), bunch covering($r = -0.55$) and chemical control ($r = -0.51$) had the most considerable effects on decreasing the lesser date moth infestation. Based on multiple regression analysis the effect of chemical control (cc), bunch covering (bc) and fruit stalk pruning (fsp) on pest infestation determined 46.4, 42.7 and 23.4 percent respectively. Integrated effects of three factors reduced the pest damage under the economic injury level. The estimation model formula for determining the integrated effects of control strategies on pest infestations is as follows:

% infestation= 1.664-0.464cc-0.427bp-0.234fsc

(R^2 = 66.3 and Durbin-Watson statistic = 1.73).

S63: Sensory ecology (Pheromones) I.

Room Copenhagen

The importance of background odor for insect olfactory orientation to a resource

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Insects search in a highly complex odorant world for food sources, mates, and oviposition sites to gain reproductive success. In nature, volatile signals leading to a resource are usually embedded in a background of habitat odor which may affect the insect's response to resource-indicating cues. Three different types of background odor can be distinguished: (a) irrelevant background, (b) "noisy" background odor that may mask the resource-indicating signals, and (c) background odor that may "sharpen the view" for resource-indicating volatiles and enhance the

response to these [1]. The relevance of this latter type of background odor will be addressed here by a study of the foraging behavior of an egg parasitoid attacking eggs of pine sawflies [2]. The parasitoid is attracted by resource-indicating pine volatiles that are induced by egg deposition of pine sawflies [3]. Our electrophysiological and behavioral studies show that the quantitative ratio of a resource-indicating volatile and habitat background volatiles is crucial for attraction of the parasitoid to pine with eggs [4].

Mate choice is a matter of "taste": Host plant shift induced changes of contact pheromones affect mate and species recognition in herbivorous insects

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In herbivorous insects, shifts to novel host plants may lead to reproductive isolation. We used the mustard leaf beetles *Phaedon armoraciae* and *P. cochleariae* to investigate whether a host plant shift affects species and mate recognition which is known to be mediated by cuticular hydrocarbons (CHCs)[1]. Both species were found together in the same habitats but use different host plants. In the laboratory, *P. armoraciae* and *P. cochleariae* were reared on their natural hosts brooklime (Scrophulariaceae) and large bittercress (Brassicaceae), respectively, as well as on Chinese cabbage (Brassicaceae). Mating bioassays revealed that male mating behavior is significantly influenced by the host plant. In intraspecific mating trials, males of *P. armoraciae* mated more often with "same host" females than with "different host" females, while *P. cochleariae* males did not differentiate between "same host" and "different host" females. In interspecific mating trials, *P. armoraciae* and *P. cochleariae* showed significant premating isolation when reared on their natural host plants, but were lacking premating isolation when reared on Chinese cabbage. Chemical analyses revealed that the host plants affected the beetles´ CHC profiles which serve as contact pheromones. A canonical discriminant analysis based on CHCs clearly separated the different groups according to sex, species, and host plant. The data show that shifts between different plant families have a stronger effect on CHC profiles than shifts within a plant family. Our results indicate that host plant shifts affect premating isolation and mate recognition cues in mustard leaf beetles.

The Search for Bed Bug Pheromones: A behavioural and electrophysiological study of the common bed bug

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Bed bugs (*Cimex lectularius*), which have re-emerged as an important urban pest, are known to aggregate and disperse in response to semiochemicals. Although an alarm pheromone has been identified, there has been limited work on the aggregation pheromone or associated behaviours. This study aims to identify semiochemicals which could be exploited for bed bug monitoring or control.

A series of behavioural studies revealed activation and attraction of male bed bugs to odour from bed bug-exposed papers. Volatiles were then collected from the bed bug-exposed papers by air entrainment the extracts were tested using electroantennography (EAG) and coupled gas chromatography-EAG (GC-EAG). Several compounds were found to elicit EAG responses in bed bug antenna. Coupled GC-mass spectrometry (GC-MS) has been used to identify the EAG-active compounds and behavioural tests are underway to determine the compounds and blends of compounds that elicit the greatest behavioural response.

Through addition of semiochemicals, such as aggregation pheromones, traps could be changed from random interceptive devices, such as sticky traps, to targeted species-specific odour-baited traps that attract bed bugs out of their refuges or intercept them whilst they are active.

Half a century of pheromone science

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Contemporary biologists take the term as well as the concept of "pheromones" for granted. Yet, it was a sensational and controversial event when the January 1959 issue of Nature magazine published a two page communication by Karlson and Lüscher on "Pheromones, a new term for a class of biologically active substances". This seminal paper appeared simultaneously with the first identification of the chemical structure of bombykol by Butenandt, Hecker and coworkers (1959). *Bombyx mori* the silkworm moth, with its main pheromone component (E,Z)-10,12-hexadecadien-l-ol served as a prototype for an entirely new class of exogeneously active natural signal compounds. Two years later, the total synthesis via several independent routes by Butenandt, Hecker et al. 1961 concluded 20 years of pioneering work into unknown territory. Immediately, the impact of these discoveries for chemical communication, chemical ecology, sensory physiology and practical plant protection was recognized.

Nothing documents the significance of pheromones better than several thousand original research articles and dozens of monographs. Today, pheromones are known from pest insects in all major food and fiber crops and from stored products. Most prominent are insect sex attractants. But chemical signals for territorial marking, trail following, general chemical orientation to food plants and oviposition sites, hive cohesion and caste determination in social insects are also known. In insect pest management, pheromones and related kairomones play a key role as lures in traps for monitoring, mass trapping and for mating disruption. In favorable cases, pheromones can compete with non sustainable pesticides which provoke ecotoxicity and resistance. Today, pheromones of other arthropods including spiders are also known.

- Progress in vertebrate pheromone research is noteworthy, but slower. If exploited, its long term impact on human society, however, may be enormous.

- Pheromone research influenced other fields like nanogram analytics, electrophysiological methods including single cell recording, and biochemical genetics. Without pheromones, entomology would be like a soup without spices.

S64: Plecoptera taxonomy

Room Maastricht

Systematics, biogeography and genetic structure of the genus *Besdolus* Ricker, 1952

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The Central-Southern European genus *Besdolus* was first instituted as a new subgenus of *Isogenus* by Ricker (1952). *Besdolus* was then synonimized with *Dictyogenus* Klapálek, 1904 by Stark et al., 1986. Later on it was reinstated and revised by Zwick and Weinzierl (1995). Presently, it counts five species: *B. imhoffi* (Pictet, 1841), *B. ventralis* (Pictet, 1841), *B. bicolor* (Navás, 1909), *B. ravizzarum* Zwick & Weinzierl, 1995, and *B. illyricus* Kovács & Zwick, 2008. On the whole the species of the genus are considered very rare and have residual distributions, being reduced to very few populations. From the ecological point of view, even if they display different ecological requirements (being *B. bicolor*, *B. ravizzarum* and *B. illyricus* more orophilic and *B. imhoffi* and *B. ventralis* associated to the epipotamon), they are all sensible to the environmental modifications and are somewhat endangered and threatened with extinction.

With the aim to better understand systematics and biogeography of this genus and to evaluate the molecular distances among the species and their genetic structure we used a molecular approach, sequencing a fragment of the mithocondrial gene COI. Several populations of each species were essayed: specific boundaries, species relationships, degree of isolation and genic flow have been analyzed and are reported and commented.

Molecular genetics of four morphological species of *Anacronueria* genues (Plecoptera:Perlidae) in sympatric speciation. Its Implications on taxonomical, phylogenetical, speciation

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We evaluated four Plecoptera species of the genus *Anacroneuria*: *A. chorrera*, *A. paleta*, *A. tachira* and *A. cacute*, on condition of sympatry in the Picón river in Venezuela with cuticular hydrocarbons and mitochondrial DNA. This genre has been little studied and taxonomic difficulties because the diagnostic morphological characters show a high similarity to questions its taxonomic status. The results of the analysis of biochemical characters (cuticular hydrocarbons) and molecular (ADNrmit), support the existence of two groups (Group 1- *A. tachira* and *A. cacute*; Group 2- *A. chorrera*), but evidence that *A. paleta* had unique character of hydrocarbons, classified as third kind. The phylogeny for the 12S region, allows characterizing *A. paleta* as paraphyletic group with two lineages shared monophyletic groups. In conclusion this work demonstrates the synonymy between *A. tachira* and *A. cacute*, and validation of *A. chorrera* as a second species. Meanwhile, the parafilect species *A. paleta,* offers the possibility of a relict species with introgression or the possibility of hybrid species. Future studies should be evaluated this hypothesis using diploid markers.

On the identity of *Isoperla curtata* Navás, 1924: a behavioural and molecular approach

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The identity of Isoperla curtata Navas, 1924, an Iberian endemics, has been questioned in the past since its description. In fact, there is a marked variability in pigmentation, wing length and in the penial armature within the species. Also, Aubert (1963) noted diferences in the ecology of populations: more orophilic in the northern part of the distribution area, and termhophilic in Sierra Morena (Southern Spain). The same author wrote that it is difficult to arrange this polymorphism and divide I. curtata in subspecies or separate species. To clarify the real taxonomic status of I. curtata we combined a behavioural and a molecular approach on material collected in two different mountain systems of its distribution area, one in the North and the other in the South. We recorded and analyzed the mating call, the so called "drumming", and we used a molecular marker, sequencing a fragment of the mithocondrial gene COI. Preliminary results of both approaches are in agreement and show a clear distinction of this taxon in two separate entities that seem to deserve a specific status. The northern species should correspond to the nominal taxon, I. curtata, while the Sierra Morena populations belong to a new yet undescribed species.

Plecoptera of the Balkans: history of investigations, and the present knowledge on distributional patterns

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Though the first record on the stoneflies of the Balkans dates back to F. J. Pictet's monograph from 1841, the systematic investigation of the area began only in the turn of the 20th century. Unfortunatelly, many of these early collectings are lost, and thus, have to take with reservation. The second period of the researches were followed from the sixties to the eighties, but the limited possibility of cooperation between Western and Eastern European specialists made it very difficultin the case of Bulgaria and Albania. The exploration of the Balkanian fauna has revived in the last ten years, and our knowledge on the different countries became more balanced with hitherto 197 species reported from the peninsula.

More than the half of the known species have an area restricted to the Balkans and one of the neighbouring regions (Carpathians, Alps and Anatolia), and 84 species are endemic. The Balkanian distribution of the Alpine–Balkanian species are restricted to the Dinaric Mts (South Alpine–Illyrian species), while the Carpato–Balkanian species are widely distributed in most of the Eastern Balkans (Dacian–Moesian species). Balkano–Anatolian species are present in the Aegean Isles and the Greek mainland. The endemic taxa are mostly restricted to small areas, and their distribution outline an Illyrian, a Moesian and an Attikan centre.

The stonefly-fauna (insects: Plecoptera) of Austria: Diversity, ecology and zoogeography

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Currently, 131 stonefly species/subspecies are known from Austria. This relatively high species diversity compared to other Central European countries is a result of heterogeneous landscapes and the concurrence of different ecoregions: the

Alps, the Central Midlands, the Hungarian Plains, the Western Dinaric Balcan, Italy (Southern Alps), and the Carpathians. (Sub-)endemic species are concentrated at the south-eastern margins of the Alps indicating the effects of earlier glaciation processes. Most species are crenal or rhithral preferring elements but some potamobiont Perlid- and Perlodid-taxa, which are extremely rare or even extinct in most of Europe still live in the south-eastern plains of Austria.

The paper presents the current status of the knowledge on Stoneflies in Austria and analyses distributional patterns of selected species. Ecological notes and remarks on taxonomical problems are added.

Recent findings of rare and endangered stoneflies (Insecta: Plecoptera) in Croatia

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Only 28 species of Plecoptera were known for Croatia until the last few years when we started intense studies on stoneflies throughout Croatia. During these studies, we stumbled upon some remarkable stonefly species, which are for a longer time absent from many countries in Europe. Some of these species were found in rather rich populations at some localities through the flow of several rivers. For example, *Brachyptera monilicornis* is living in several smaller and bigger rivers on the north-western border of Croatia with Slovenia. In the same border area live also *Taeniopteryx nebulosa, Besdolus imhoffi, Perla carantana, Perla illiesi*, and *Protonemura julia*. Furthermore, on the eastern border of Croatia with Bosnia and Herzegovina, *Marthamea vitripennis* was found again after one century, together with *Perla burmeisteriana, Besdolus imhoffi* and mayfly *Oligoneuriella rhenana*. *Besdolus imhoffi* lives also in few more rivers in the north-western mountainous area as in the southern Mediterranean part of Croatia. On the northern border of Croatia with Slovenia and with Hungary endangered *Xanthoperla apicalis* lives. All these stoneflies are included on the recent list of 50 strictly protected Plecoptera species in Croatia.

Are they any future of classical taxonomy?

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Biodiversity is one of the most popular Word in biology in the last two decades after 1992 Conference in Rio. A lot of money was spent for this topic, however today we do not know much more about actual biodiversity, and all over the world we are facing a great decrease in number of classical taxonomists. Modern molecular methodologies are creating a kind of new »taxonomy« that has a very little or nearly nothing in common with the classical ones. Is this the beginning of end of classical taxonomy we know in the last couple of hundred years?

Situation is not the same at all groups of organism. What was the situation in small group of aquatic insects like stoneflies (Plecoptera).

S65: Genetically modified plants – Effects on insects III.

Room Rome

Grasshoppers and butterflies as biodiversity indicators in a GM-plant monitoring program – An Austrian case study

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Biodiversity is a key parameter in an ecological monitoring of GM-plants which is mandatory according to the Directive 2001/18/EC. The program 'Biodiversity Nature Safety' (BINATS) was developed and implemented on 100 representative test areas (625x625 m) – which include fields and adjacent landscape elements – in the Austrian agrarian region. Vascular plants and landscape structures already have become standard elements of biodiversity monitoring programs in cultural landscapes. In addition to these indicators Orthoptera and Lepidoptera were selected as representative indicators based on an *a priori* cost-benefit-calculation and tested for their applicability in the field.

In total, 53 different grasshopper and 41 butterfly species were registered across the test areas. In general, habitat diversity, landscape patch shape complexity and share in grassland were positively, and land use intensity as well as temperature negatively correlated with species numbers. Only in case of butterflies the relationship between summer temperatures and diversity was hump-shaped.

BINATS provides a standardised design for future inventories of biodiversity in the agrarian region into which additional animal indicators and their particular inventory needs can easily be integrated if needed. Baseline data are now available as reference for detecting and assigning unintended biodiversity effects of GMP cropping as well as of other changes in agricultural practices by means of regular monitoring.

Metabolomic responses to herbivory in genetically modified potato

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An important question in risk assessment of genetically modified (GM) crop plants is whether unintended genetic or phenotypic side-effects occur in the plant after modification. Side-effects can be caused by gene disruption or altered gene regulation, and one result may be a change in the production of plant metabolites. Such effects on the metabolome level can have ecological consequences for a plant's interactions with pathogens and herbivores, since many of these interactions are mediated by chemical composition of the plant. In this study we present results of a metabolomic approach to study leaf chemistry in response to herbivory or virus infection in a GM potato variety, in comparison to its respective non-modified counterpart. The GM potatoes are modified in their starch metabolism to reduce amylose content in tubers for industrial starch production. Analysis of leaves with ^{1}H-NMR spectroscopy and multivariate data analysis revealed no separation in metabolomic profiles, suggesting that metabolite levels were not changed due to genetic modification. Both varieties showed similar chemical responses to aphid herbivory and virus infection, i.e. a, decrease in sugars, an increase of phenolic compounds and a change in glycoalkaloids patterns. We suggest that metabolomic techniques should be an integral part of ecological risk assessment of GM crops.

Can transgenic Bt maize and biological control be combined to reduce pest populations of Western corn rootworm in maize?

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The Western corn rootworm (WCR) *Diabrotica virgifera virgifera* is one of the most serious pests of maize. Bt maize expressing Cry3 proteins against this pest reduces rootworm populations, but the toxin is not always lethal and rapid development of resistance may be expected. Using entomopathogenic nematodes as biological control agents together with Bt maize may help delay resistance development. The success of this combination depends on the emission of herbivore-induced volatiles by the attacked maize roots, which are known to attract the nematode *Heterorhabditis megidis*. We carried out a field study using five different maize lines, two of them expressing the mCry3A against *D. virgifera*, one the Cry1Ab against the European corn borer, their near isogenic control, and the conventional line Delprim, which is known to be attractive to *H. megidis* due to the high emission of the sesquiterpene *(E)*-β-caryophyllene in roots upon WCR attack. Maize plots received one of three treatments: (1) WCR eggs were added, (2) WCR eggs and entomopathogenic nematodes (*H. megidis*) were added, and (3) neither herbivores nor nematodes were added. Bt maize expressing the mCry3A successfully prevented root damage and reduced adult emergence. Adding nematodes was successful in reducing root damage to Delprim, but had no additional effect on root damage or adult emergence in any of the other plots. Bt maize lines that emit more *(E)*-β-caryophyllene may help to further decrease *D. virgifera* survival.

Occurrence of Diptera and secondary pests in *Diabrotica*-resistant Bt-maize

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Different maize cultivars (Bt-maize MON 88017 toxic to *Diabrotica* beetles, isogenic partner DKC 5143, conventional cultivars Benicia and DK315) were grown in a field experiment at Schwarzenau, Germany, and the species assemblage of Diptera was analysed during 3 years. Additional feeding trials with maize plant residues were conducted in the laboratory with saprophagous Diptera larvae. The larval hatching rate of saprophagous flies and midges ranged between app. 800 to 1000 ind/m² per season, but were not significantly different between the treatments. Feeding trials with decomposing larvae of *Lycoriella castanescens* (Sciaridae) which were fed with Bt- or non-Bt-maize litter, roots or pollen did not show any significant differences between the four maize cultivars regarding mortality of the larvae, rates and duration of pupation and hatching rates. Even so, all larvae which had fed on Bt-maize contained Cry3Bb1-Bt-toxin up to 263 ng/g larva. However, the hatching rates of phytophagous larvae of frit flies (Chloropidae) were significantly higher in Bt-maize. Also, predacious dipteran larvae were significantly more abundant in Bt-maize plots in comparison to the controls; this was mainly due to the high number of aphidophagous larvae of *Aphidoletes aphidimyza* (Cecidomyiidae) which reacted to increased aphid abundance. The results indicate that MON 88017 Bt-maize may favour secondary pests which are not the target of the Bt-toxin transferred to the transgenic maize event.

Thursday poster session

TH 1-4: Quantitative ecology

TH 1
Population dynamics of white peach scale, *Pseudaulacaspis pentagona* Targioni and its main natural enemies, in Sari County, Iran

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This study was carried out in peach and kiwi orchards in Sari county, Mazandaran province, Iran, in 2008 and 2009 to establish population dynamics of white peach scale, *Pseudaulacaspis pentagona* Targioni, which is the key pest of peach and kiwi in the region. This study indicated that white peach scale had three generations per year. The first eggs on peach and kiwi were laid during late March and mid April. This pest had a peak of population density on peach in mid May in first generation whereas peak of the pest density on kiwi observed in mid September in third generation. Two natural enemies namely, *Prospaltella berlesei* and *Chilocorus bipustulatus* were the most common natural enemies of white peach scale in the examined area. When parasitism rate and population of predator were increased, population of this pest was decreased. Also, the parasitism rate of white peach scale by *P. berlesei* was higher in kiwi than peach garden. Peak of the parasitism rate of *P. pentagona* by the parasitoid in peach orchard observed in late June whereas in kiwi orchard in early July. The population of *C. bipustulatus* was higher in peach than kiwi garden. This predator had a peak of population density in peach orchard in late September.

TH 2
Spatial distribution and seasonal activity of *Zetzellia pourmirzai* (Acari: Stigmaeidae) and its two prey species, *Cenopalpus irani* and *Bryobia rubrioculus* (Acari: Tetranychidae) in a sprayed apple orchard of Kermanshah (Iran)

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The population densities and spatial distribution patterns of *Cenopalpus irani* Dosse and *Bryobia rubrioculus* (Scheuten) and their egg predator, *Zetzellia pourmirzai* Khanjani & Ueckermann, were studied in a sprayed orchard in Kermanshah, western province of Iran, from 31st May till 7th November, 2007. The number of leaves with maximum variation of 6.66% was about 130. The population densities of *C. irani, B. rubrioculus* and *Z. pourmirzai* were highest on 9th August (11.092 per leaf), 20th July (0.554 per leaf) and 30th July (1.385 per leaf), respectively. The index of dispersion, regression models (Taylor and Iwao) and Lloyd's mean crowding to mean showed an aggregated distribution for all species. Some changes in the distribution from aggregated to random was indicated by Morisita's index during different sampling dates. The smallest optimum sample sizes, calculated with Taylors' coefficients, were 20.806, 192.912 and 128.117 for *C. irani, B. rubrioculus* and *Z. pourmirzai*, respectively. Linear regression of predator to prey population densities showed a density-dependant predation by *Z. pourmirzai* on *C. irani* and on *B. rubrioculus*. The spatial distribution parameters of the tetranychoid mites and their predator could be used in order to improve sampling programs, when estimating the population densities of these mites and the efficacy of the predator being used in orchards IPM.

TH 3

Optimising the sample size for *Pronematus ubiquitus* (Acari: Iolinidae) and its spatial distribution and seasonal activity in natural and sprayed apple orchards in Kermanshah, Iran

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The population density and the spatial distribution pattern of *Pronematus ubiquitus* (McGregor) were studied in two natural and sprayed apple orchards in Kermanshah, western province of Iran, from 31st May till 7th November 2007. One hundred and thirty leaves with the relative variation of 3.53% were selected as the sample size. The highest population density of *P. ubiquitus* was obtained on 30th July (3.192 per leaf) and on 20th July (1.077 per leaf), in natural and sprayed orchards, respectively. The index of dispersion, Taylor's regression model and Lloyd's mean crowding to mean showed an aggregated distribution for this species. The Iwao patchiness regression indicated a random spatial distribution for sprayed, and aggregated distribution in unsprayed orchards. Some changes in the mite's distribution, from aggregated to random, was calculated with Morisita's index during different sampling dates in July for the unsprayed orchards. Three different coefficients, of Taylor, Iwao and K, were used in order to optimize the sample size for future studies. The smallest optimized sample sizes obtained with Taylor's coefficients were 32.80 and 129.52 for natural and sprayed conditions, respectively. The spatial distribution parameters of *P. ubiquitus* can be used to improve a sampling program to estimate the population density of this mite in orchards IPM.

TH 4

Mathematical Model for Biological Control of the South American Tomato Pinworm, *Tuta absoluta* (Lep.: Gelechiidae), with Releases of *Trichogramma achaeae* (Hym.: Trichogrammatidae) and *Nesidiocoris tenuis* (Hem.: Miridae), in Tomato Greenhouses of Spain

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The South American tomato pinworm, *Tuta absoluta* (Meyrick), from its entrance in Spain in 2006, turned out to be a pest with hard economic consequences both in greenhouse and open field tomato crops. From that time on, a work has been going on with autoctonous parasitoids natural enemies that could be adapted to this new prey/host and would admit the development of a biological pest control program. Principally, two species have been studied: the egg parasitoid: *Trichogramma achaeae* Nagaraja & Nagarkatti, and the predator: *Nesidiocoris tenuis* (Reuter). This study was aimed at setting up a mathematical model that would enable us to program the use of the mentioned natural enemies, already commercially available in Spain, France and Morocco, depending on the pest population dynamics in greenhouse tomato crops. The data used for the construction of the model have been collected in years 2008 and 2009 in experimental greenhouse. This model has been improved using data obtained from 4 commercial greenhouses. Finally, the model has been validated in 20 greenhouses, similarly commercial ones, all of them situated in South Spain. A mathematical model for the fytophagous-predator-parasitoid system has been developed to be applied in biological pest control of the South American tomato leafminer *Tuta absoluta* (Meyrick), and also for the comparative study concerning different biological control agents in this concrete case.The obtained model also made it possible for us to find out that the principal pest control agent is *T. achaea* such that by its action on the eggs of the pest, the pest populations can be controlled almost to extinction in a greenhouse. On the contrary, the predator is unable to regulate the pest population in an adequate way, therefore can play only a complementary role.

The research has been partly realized in the framework of the Hungarian–Spanish intergovernmental scientific and technological collaboration, with the support of the Scientific and Technological Innovation Fund (of Hungary, ES-17/2008), the Ministry of Education and Sciences (of Spain, HH2008-0023) and the Hungarian Scientific Research Fund OTKA K 68187, K 81279, K 62000.

TH 5-8: Soil entomology – an ecosystem perspective

TH 5

Structure and dynamic of rove beetles (Coleoptera: Staphylinidae) communities in the floodplain forests of the European North-East of Russia

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At the present time, research in Russia and European countries studies biota in the floodplain forests. However animal populations in floodplain forests are studied much less than those in boreal forests formed on the watershed. Floodplain forests are also key habitats for rare species of invertebrates. River floodplains with unstable water regime, temporary submersion of habitats of invertebrates are convenient to reveal and research adaptations of animals to deficiency or excess of humidity. The aim of our research was to determine the structure and dynamics of rove beetle communities in the floodplain of birch-aspen forests located in the middle taiga (Sysola river basin) and northern taiga (Pechora river basin). Analogous key plots that differed in key ecological conditions of soil and plant cover were chosen in the floodplain forests of the Sysola and Pechora river basins. Standard methods of entomology and soil zoology were applied for quantitative accounting of rove beetles in May-September of 2003-2005 years (middle taiga), in June-October of 2006-2009 years (northern taiga). Subfamilies Staphylininae, Tachyporinae and Aleocharinae accounted for a considerable number of genera and species in floodplain forests. Euritopic species and representatives of forests or forests and meadows dominated. Communities of rove beetles were characterized by high specific diversity, together with seasonal and annual dynamics in floodplain forests. In particular, Rove beetles avoid forest plots which flooded in the periods of high water conditions.

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TH 6

Collembolan morphospecies (Hexapoda: Collembola) in serpentine soils: a case study in a natural ecosystem in northeastern Portugal

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Serpentine soils represent challenging habitats for plants and soil dwelling organisms, such as collembolans, because they typically exhibit high levels of heavy metals (e.g. chromium, cobalt, and nickel). Serpentinized areas cover about 8000 ha in Northeastern Portugal. While the plant communities are well studied, the collembolans are virtually unknown. The data presented here represent the first effort to describe the structure of a collembolan community, using morphospecies as a surrogate of species, in a serpentinized area occupied by a natural forest of *Quercus rotundifolia* and *Quercus faginea* located nearby Bragança (Portugal). Sampling was performed during the last week of September of 2008 in a serpentinized area near Bragança (Portugal). At each of the 29 sampling points (distributed along two transects) collembolans were collected with a soil core (5 cm diameter x 10 cm depth). The collembolans were extracted from the soil (using a McFadyen apparatus), sorted, counted and finally identified to morphospecies level. The number of morphospecies observed was 37. The total abundance in the mineral horizon (1862 individuals) was not significantly different from the organic horizon (1883 individuals). The Simpson Diversity Index and Richness were higher in the organic horizon (21.7 and 35 species, respectively) than in the mineral horizon (9.9 and 30 species, respectively). The species accumulation curves showed that the estimated number of morphospecies for the mineral horizon is 36 while for the organic horizon is 38.

TH 7

Collembolan communities in a sustainable system for production of woody biomass for energy: abundance and diversity of morphospecies

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Woody biomass for energy obtained from short rotation woody crops (SRWC) needs to be managed in a sustainable way, thus allowing ecosystem conservation. However, there is a gap in our knowledge concerning the effects of these crops on soil organisms, of which collembolans represent a good indicator of soil quality. On the other hand, soil biological sciences are strongly affected by the taxonomic skill crisis, with many groups of soil animals suffering from a taxonomic impediment in terms of identification. This problem can be reduced by using a para-taxonomic approach where morphospecies can be used as surrogates of taxonomic species. The objective of this work was to study the structure of collembolan communities in a SRWC experimental field using morphospecies. Abundance, richness, evenness and diversity indexes were used to describe the structure of the collembolan community and species accumulation curves were computed to estimate species richness in the study area. Prior to the installation of the SRWC, 106 soil samples were collected at each defined sampling point (distributed along 14 transects) using a soil core (5 cm diameter x 10 cm depth). In the laboratory, collembolans were extracted from the soil (using a McFadyen apparatus), sorted, counted and finally identified to morphospecies level. The number of morphospecies observed was 34, representing a total abundance of 3221 collembolans. The Simpson Diversity Index and richness were 27and 34, respectively. The species accumulation curves showed that the estimated number of morphospecies was 38.

TH 8

Diversity and abundance of soil arthropods on maize fields with different farm practices in Northern Portugal

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The widespread use of pesticides in agricultural areas has been related to the destruction of habitat for non-target arthropods and, thus, community composition is expected to be affected. Our main aim was to evaluate soil surface arthropod communities and to test for differences in seasonal trends, community composition and group abundance in four maize fields in Northern Portugal. The fields were sampled using pitfall traps in November 2008 (Autumn) and May 2009 (Spring). Two fields used organic systems with no application of inorganic fertilizers or pesticides and two used conventional systems where inorganic fertilizers and herbicides were applied. A total of 6558 individuals belonging to 133 different arthropod groups were collected. The most abundant group was the Family Formicidae followed by the order Entomobryomorpha. Overall abundance and group richness varied more with season than with field type, both being greater in spring and in the conventional fields. Regarding abundances, Family Scelionidae was the most divergent group between management systems, showing a greater abundance in the conventional system. Results demonstrate that the arthropod soil community is modified by the agricultural management system, with particular groups being differentially affected.

TH 9-11: Carabid ecology

TH 9

Method for ecological monitoring based on research of ground beetle fauna (Coleoptera, Carabidae)

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Carabidae is a suitable group for conducting ecological monitoring. We proposed the procedure based on our studies carried out at 2007-2008 in flood land territories in the Karmaskalinskiy Region of the Republic Bashkortostan.

Our methods were the following:

1. Choice of biotopes for the investigation
2. Determination of the basic sources of the anthropogenic influence

3. Isolation of the individual sections of an investigation, the installation of trap series
4. Determination of individual anthropogenic factors and division by effect

Beetle collection and identificatin will be carried out at the second stage. Female index will be determined as well.

At the analysis phase, the assessment of the degree of domination, the quotient of faunistic and quantitative similarity will be used. The relative number of ground beetles will be determined using average catch efficiency.

These data allow us to draw conclusions about the degree of influence of anthropogenic factors to the ground beetle fauna in individual biotopes, and about factors that have a negative influence. We studied three biotopes and estimated the degree of degradation in the ground beetle fauna and the possibility of its development. The most negative anthropogenic factor was related to truck traffic.

TH 10
Ground beetles (Coleoptera: Carabidae) as object of bioindicator researches in area of emissions of a timber industry complex

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Ground beetles (Coleoptera: Carabidae) are widespread, numerous and one of the most important groups of Coleoptera. They are convenient objects for the bioindication of anthropogenic stress on ecosystems. The purpose of this work is to reveal the reactions of ground beetles to permanent pollution by emissions (sulphur compounds, mineral dust and others) by a timber industry complex. We studied carabids in the coniferous forests located along a gradient of pollution starting from a timber industry complex, from 2003 to 2009. Overall, 12 species of ground beetles have been collected in pine forests, and 10 species in spruce forests. High specific diversity of carabids were found in the forests located near the complex and in the control plot. A low specific diversity of carabids were detected in the forests at average pollution. The most abundant species on the plots with different degree of pollution was *Pterostichus oblongopuctatus*, which prefers forests of different type and is tolerant to the change of environmental conditions. The dominant species on the control plot was *Calathus micropterus*, a speciessensitive to anthropogenic influence. Ground beetles on the investigated plots are represented only by predatory species. Most species prefer different forests, some species inhabit bogs, meadows and river banks. The structure of carabid populations on the area affected by the timber industry emissions varies not only with the intensity of anthropogenic pollution, but also with the change of plant cover.

TH 11
High temperature induced spike bursts generated by antennal thermo- and hygroneurons in ground beetles

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Ground- living insects are very vulnerable to high temperature injury. We observed that the first indications of partial paralysis of the ground beetles *Platynus assimilis* and *Pterostichus oblongopunctatus* started at 44 °C while, in their habitats, in sunny areas, the maximum soil surface temperature may reach 55 °C. To detect and avoid sublethal and lethal temperatures, antennal campaniform sensilla of ground beetles house one thermo- (cold neuron) and two thermosensitive hygroneurons (moist and dry neurons). At temperatures of 25°C to 47 °C, the cold neurons switched from regular spiking to bursting. ISI (what is this?) analysis showed that the number of spikes in the burst and spike frequency within the burst were temperature-dependent and may precisely encode unfavourably or dangerously high temperatures in a graded manner. In addition to the burst characteristics, the total number of bursting neurons may also contain useful information on external temperature. Our data showed that dry and moist neurons may also respond to temperatures with spike bursting but these started at temperatures lower than the threshold temperature of the thermo neurons. This is the first report that spike bursting thermo- and hygroreceptive neurons are involved in perception of temperatures higher than preferred in arthropods. We emphasize, that in contrast to various sensory systems studied, the thermoreceptor neuron of ground beetle has a stable and continuous burst train, and no temporal information is encoded in the timing of the bursts.

TH 12-25: Invasive species

TH 12
Tarachidia candefacta Hübn. (Noctuidae, Lepidoptera) against ragweed Ambrosia artemisiifolia L (Ambrosieae. Asteraceae): the novel approach in the biological suppression of the adventive weed vegetation

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The biological suppression ragweed is being considered using none of the classical biomethod approaches, based on the introduction, but on the seasonal colonization of insects-phytophages, that is the novel trend in the insects' ecology. It is connected with the insects phenophase shift which will enable to develop the large batch of phytophage population *Tarachidia candefacta Hübn* under laboratory conditions on artificial medium, by the time of weed appearance in nature. It will allow not only to suppress the ragweed at the first developmental stages, but also to regulate the phytophage number.

TH 13
Adaptive processes in the populations of invasive species *Zygogramma suturalis* (F.) (Coleoptera, Chrysomelidae) and *Ambrosia artemisiifolia L*. (Asteraceae)

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In Russia the researches of biological invasions in aquatic and land ecosystem have been started not long ago. One of such bright invasive species is ragweed (*Ambrosia artemisiifolia L.*), which is considered to be dangerous quarantine plant. This species has spread in the chernozem zone of European part, South-west areas, South-east regions of European part, Eastern Siberia, Kazakhstan and in the Far East.

Ragweed leaf beetle (*Zygogramma suturalis (F.))* (Coleoptera, Chrysomelidae) has been introduced from Canada and the USA by Kovalev O.V. for ragweed biological reduction (Kovalev, 1968, 1971; Kovalev, Medvedev, 1983). The first release in number of 1500 species was carried out in Stavropol districts in 1978 .

In 1985-1987 Leaf beetle was introduced into Russian Far East territory (Primorsky region) (Kuznecov, Esipenko, 1986). By 1998 the beetle covered the territory no more 20 ha. Mainly they represented local sections, protected from wind. In 2006 during the field survey the beetle was found in

Dalnerechensky, Chuguevsky and Anuchensky regions. Having constant density of 5-6 beetles per m2, density achieved 15-20 beetles per m2 in some places. It was considered, that leaf beetle ability to independent expansion is rather small.

Thus, two ecomorphs of ragweed leaf beetle have been formed with specific peculiarities of species for them. One of them is on the Russian North Caucasus, and another one is in the Primorsky region.

TH 14
Colonization of *Glycaspis brimblecombei* (Hemiptera: Psyllidae), eucalyptus pest, in Spain

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Glycaspis brimblecombei Moore, 1964 (Hemiptera: Psyllidae) is a sap sucking insect of leaves, generally associated with red eucalyptus (*Eucalyptus camaldulensis*) which is widely used in rural and urban ornamentation. This psyllid from Australia has spread considerable, in its geographic distribution. At the international level, it was detected in USA in 1998 (Brennan et al., 1999), in 2000 in Mexico (Castillo, 2003), in 2002 in Chile (Sandoval & Rothmann, 2003), in 2003 in Brazil (Santana et al., 2003), in 2004 in Madagascar (Hollis, 2004) in 2005 in Argentina (Bouvet et al., 2005), in 2007 in Ecuador (Onore & Gara, 2007) and in 2008 in Venezuela (Rosales et al., 2008), Peru (Burckhrdt et al., 2008) and Spain (Hurtado & Reina, 2008).

In this communication, are analyzed aspects such as the temporal evolution that *Glycaspis brimblecombei* has suffered since the first detection in Spain and the dispersion grade in the autonomous communities of Spain. In addition to this, new data about its biology and distribution are given.

TH 15
Two subspecies of Colorado potato beetles are forming?

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In the native Colorado potato beetles (CPB) populations the main factor which maintain the expansion state defined by state of each population. Dividing of Eurasian parts of species area into zones characterizing of different level interrelations of local populations with their environment (Vilkova et al., 2005) seems to be justified.

Perhaps, during the last time the European population of L. decemlineata has differentiated significantly from parental north-American ones.

The sequencing of mtDNA fragment and AFLP-analysis of nuclear genome showed significant differentiation the North American samples from European (Grapputo et al., 2005). In the European territory has been found only one from 20 haplotypes of mt-loci identical to the haplotype from population of Idaho.

In our investigations a sequencing of 750-bp fragment of mtDNA from 5 populations from S.Urals showed us 11 nucleotide substitutions distinguishing from (Hebert et al., 2003).

Thus, the analysis of data obtained in our investigations, as the other researcher's data, allows us to discuss the possible processes which lead to forming at least of two CPB subspecies. Independent evolution of CPB in the territory of European part of area, lasts more then 80 years (more then 80 generations), the absence of gene flow with the parental populations, the bottleneck in the start of settling in the Eurasian territory, influencing of new kinds of environmental and forage factors, permanent insecticidal pressure – all of these factors influenced strongly to the populations of CPB in Eurasia. Did these circumstances led to the forming of two subspecies? Probably, the modern methods of investigations can give us the answer to this question.

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TH 16
Genetic structure, gene flow and dispersal patterns of western corn rootworm *Diabrotica virgifera virgifera* LeConte(Coleoptera: Chrysomelidae) populations from Croatia

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The WCR is a highly invasive pest of maize. It was introduced to Europe in the early 1990s from the USA and now is a serious pest in Europe, including Croatia. Understanding levels of genetic variability of introduced populations is important for investigating the adaptive potential of such populations in their new invaded environments. At the moment there is a little detailed knowledge of the population genetics of WCR in Croatia, or an understanding of the reasons for their invasion success. This study aims to investigate the genetic structure, gene flow and dispersal of WCR populations from Croatia by using the already established WCR 'core set' of six microsatellite markers. Samples of WCR (15-30 individuals) were collected at 15 sites located in eastern and central Croatia. After DNA extraction individuals were genotyped using an ABI3130xl Genetic Analyzer following methods of Kim *et al*. (2008). To investigate the genetic structure, gene flow and dispersal of WCR populations we report on: 1) tests of fit to Hardy-Weinberg equilibrium (HWE); 2) per locus estimates of: number of alleles, expected (HE) & observed (HO) heterozygosity, Weir and Cockerham's (1984) F_{IS} (inbreeding co-efficient) & θ (or F_{ST}); and 4) overall loci and populations estimates of θ. Using a Mantel test (correlation of F_{ST} (1/ F_{ST} -1) & Ln of geographic distance (km) among population pairs) we will examine whether the WCR gene flow patterns detected can be described under and isolation by distance model. Finally, evidence for recent bottlenecks will be assessed using the program Bottleneck 1.2. under the two phase model (TPM) and the step wise mutation model (SMM) suitable for microsatellites.

TH 17
Persistent spread of *Lycorma delicatula* in Korea

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Lycorma delicatula, an alien insect of China origin, has been successfully colonized in Korea since 2005. Explosive spread of *L. delicatula* in the mid part of Korea by 2009 was quite exceptional because a few local spreads were noticed at Cheonan county and metropolitan Seoul in 2005. *L. delicatula* lays eggs and dies off by November. Egg overwinters in egg cluster, and hatches from April in the next year. In January of 2010, daily minimal temperature below -10°C maintained for 15 days at Icheon and Kwangju counties with the peak minimum temperature of -22.8°C. Egg clusters of *L. delicatula* were picked up on the last day of the cold surge from the surface of twigs of *Ailanthus alitissima* and *Vitis vinifer,* wood pole and concrete pole in the wild, and placed in plastic wares at room temperature with

temperature range of 15 to 25 °C for hatching. Hatching rate was 79.8% at the 27 days after the hatching experiment. This implicates that *L. delicatula* will survive freezing winter and keep persistent spread in the most part of Korean peninsula except for high mountains in clod area. It is not easily eradicated by repeated insecticide spread because it flies away from the habitat with dense population into the surroundings which function as refuge against eradication.

TH 18

An invasive non-pest fungivore: Cis bilamellatus Wood (Coleoptera: Ciidae) in northern Europe

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Since its accidental introduction to southeast England during the nineteenth century, the invasive Australasian fungivore, Cis bilamellatus, has spread across England, Wales and Southern Scotland. Recently it has been recorded from Ireland, the Channel Islands and north-west France. On mainland Britain, an establishment phase spanning an estimated maximum of 45 years was followed by biphasic range expansion comprising a slow start of 1.6 km year-1 between 1910 and 1930, followed by 40 years of approximately linear spread of 13 km year-1. Northwards expansion now appears to be limited by sub-zero winter temperatures and is no longer apparent. Comparison with historic records of native ciids shows that this range expansion is genuine, rather than an artefact of recording effort or bias. It has no doubt been facilitated by C. bilamellatus' ability to exploit a wide range of sometimes under-used fungal resources, by its favourable rate of increase, by its tolerance of both wet and dry conditions, and by a low rate of parasitoid attack. The current ecological impact of C. bilamellatus appears to be low. It seems likely that C. bilamellatus will spread through Europe, limited primarily by resource availability and low winter temperatures.

TH 19

Pest Risk Assesment of Liriomyza species in Estonia

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Larvae of leafminer flies (Diptera: Agromyzidae) are highly specialised internal plant parasites. Only eleven of the 2450 species are considered fully polyphagous, five of which belong to the genus *Liriomyza*. Several of the polyphagous Liriomyza species are harmful pest species in many countries, introduction of which is prohibited or subjected to strict regulations. The purpose of this study was to determine which of the 20 registered economically significant *Liriomyza* species, possess the characteristics of a quarantine pest under Estonian agro-climatological conditions. During the risk assessment procedure of the list of species that are most likely to establish in Estonia was documented. Species not satisfying the criteria of a quarantine pest due to lack of pathway or establishment potential were excluded. In addition to currently regulated leafminers *L. sativae*, *L. huidobrensis* and *L. bryoniae*, the results indicate that *L. langei* should be included in the list of harmful organisms because of the pest risk comparable to the other harmful *Liriomyza* species. In order to secure competitiveness of Estonian plant producers, application of phytosanitary measures can be justified also in case of *L. xanthocera* and *L. brassicae.*

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TH 20

What will stop the invader? Dispersal barriers of the harlequin ladybird (*Harmonia axyridis)*

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Species invasions have wide ranging ecological and economic impacts, and are one of the greatest threats to biodiversity, agriculture and human health. A major aim of invasion biology is to understand why certain species are successful invaders, and dispersal ability is a key life history trait that influences this. Understanding dispersal and barriers to dispersal is critical to predict the spread and potential impacts of an invasive species.

The harlequin ladybird, *Harmonia axyridis,* is native to Asia, but is highly invasive in North America, Europe, South America, and South Africa and the species is predicted to continue to spread. However, little is known about its natural dispersal ability and nothing is known about barriers to dispersal. In this study we aim to investigate dispersal in native Japanese populations, and the role of barriers to dispersal in the form of physical features, such as mountain chains, bodies of water or fragmented habitats, and the role of geographic distance and climate.

We hypothesise there will be considerable dispersal in the native range with only major physical features acting as barriers. To test this we collected over 1000 individuals from 22 sites across Japan, which are being genotyped at 18 microsatellite loci. Genetic data will be analysed in a spatially-explicit framework to detect genetic discontinuities arising from barriers to dispersal. The results of this study will offer a unique insight into the dispersal ability of an invasive species in its native range, and will be incorporated into computer models to help predict the spread and impact of the species in its invasive range.

TH 21

Characteristics of ladybird *Harmonia axyridis* during autumn migration

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Individual sampling of migrating Harmonia axyridis (Coleoptera: Coccinellidae) on building walls was conducted between 5th October and 17th November 2009 in České Budějovice, Czech Republic. Out of 1571 individuals, there were 845 females and 726 males. The sex ratio in particular samples was even more strongly biased, suggesting infection of the ladybird population by male killing bacteria. Mean female fresh weight was 37.3 mg, mean male weight was 30.8 mg.

There were 56 individuals (3.6%) of the morph conspicua (mean weight 32.7 mg), 156 individuals (9.9%) of morph spectabilis (mean weight 34,4 mg), and 1359 individuals (86.5%) of morph succinea (mean weight 34,3 mg). Proportion of melanic individuals was constant. There were more individuals of the morph succinea that were heavily spotted in later samples.

Samples of females were dissected to score whether they had sperm in spermatheca. There were 46% females fertilised before migration, regardless of colour morph. There was a slight decrease of fertilisation rate with later date of sampling.

TH 22
Collembola assemblages under the invasive *Senecio inaequidens* and the native *S. jacobaea*

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In the present study we assessed the effects of the invasive *Senecio inaequidens* (Asteraceae), one the most invasive species in Europe, on the soil fauna. As a control we used the related native *S. jacobaea*. Both species can occur in the same open habitats and share quite similar life history traits (height, perennial habit,…). The invasive *S. inaequidens* is a perennial pioneer of dry habitats. The native *S. jacobaea* is a common biennial (to perennial) of various types of grassland. The aim of the study was to assess whether the invasive *S. inaequidens* alters the faunal composition of the Collembola communities. At the sample locality (Antwerpen, Belgium) three sample sites were selected: (1) dominated by *S. inaequidens*, (2) dominated by *S. jacobaea* and (3) both species equidominant. In each site, four pairs (one *S. inaequidens* and one *S. jacobaea*, maximum 1.5m apart) of plants were selected. The soil fauna was sampled in the rootzone of the plants in the autumn of 2006 with core samplers (5 cm deep, 8 cm Ø) and extracted with berlese-Tullgren. Overall, we collected 1423 specimen belonging to 20 taxa. 5 species were found in significantly higher numbers under the native *S. jacobaea* while 1 species had higher numbers under *S. inaequidens*.

TH 23
The currently known distribution of *Acizzia jamatonica* (Hemiptera: Psyllidae), a major pest of silk tree, in Europe

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Silk tree, *Albizia julibrissin* Durazzini, is a woody ornamental plant, which was introduced from Asia to Europe and then from Europe to North America in the mid-eighteenth century (Cothran, 2004). Due to its decorative appearance, it is planted in both public and private areas especially in the southern parts of Europe.

Acizzia jamatonica is a psyllid species native to East Asia. The primary damage of the pest is the weakening of different parts of silk tree caused by sucking, or, in the case of heavy infestations, the discolouration and desiccation of leaves. However, the excreted sticky honeydew may cause further problem and inconvenience by dropping onto and covering the surface of any objects (e.g. parked cars) under the infested silk trees.

The pest was recorded from Japan, Korea and China (Kuwayama 1908, Kwon 1983, Miyatake 1963). In Europe, it was first found in the northern part of Italy in 2001 (Alma et al. 2002) from where it might be supposed to start spreading to other parts of Europe. The psyllid was detected in Slovenia and Croatia (Seljak, 2003, 2006, Seljak et al., 2004, Šimala et al., 2006), France (EPPO, 2004), Switzerland (Wittenberg, 2005), Hungary (Pénzes et al., 2005, Rédei et Pénzes, 2006), Spain (Grimau, 2006, Sanchez et Burckhardt, 2009), Greece (Zartaloudis, 2007, Pásztor et al., 2010), Bulgaria (Vétek et Rédei, 2009) and Serbia (Vétek et al., 2009). The first report of the occurrence of A. jamatonica in North America was given by Ulyshen et Miller (2007).

Although neither the active nor the passive (with the help of wind) spread of the pest can be excluded, the role of effective control methods such as the use of healthy planting material has to be emphasised so that the further spread of *A. jamatonica* could be prevented as far as possible.

TH 24
Occurrence of the multicoloured Asian ladybird beetle, *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) in Hungarian habitats

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The multicoloured Asian ladybird beetle (*Harmonia axyridis* (Pallas, 1773)) was used for a long time as a successful biological control agent in the USA and Western Europe for reducing aphid, psyllid and scale populations in green houses, orchards and fields. However, it has been realized as an invasive alien species threatening the diversity of native aphidophagous insects through competition and direct praying. In addition, *H. axyridis* became a horticultural pest consuming various fruits and adversely affecting the wine production. Regarding its direct influence to humans, it is now a nuisance when occurring at high densities in buildings and contacting people and furnishings. Unfortunately, little attention has been paid to the expansion and spread of feral populations of *H. axyridis* in many European countries, thus it has been found in 2008 also in Hungary, and regarding its establishment and spread in other European countries, it will occupy presumably quickly our territory. *H. axyridis* must be a hazard for our native ladybird beetle species as well as for other aphidophagous arthropods. In the New World and also in some European countries it became one of the dominant coccinellid species competing and preying on native ladybirds. Present study shows the abundance and species composition of coccinellid assemblages in some Hungarian habitats in order to assess the pressure of *H. axyridis* on native coccinellids and to report on its dispersion in the north-eastern part of the country.

TH 25
Attack intensity of *Corythucha ciliata* (Hemiptera, Tingidae) on *Platanus spp*. in an urban area in Portugal: a comparison between pruned and unpruned trees

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Corythucha ciliata (Say, 1832), commonly known as sycamore lace bug (SLB), is an insect species native to North America. Since its accidental introduction in Europe (through Italy) in 1964, it has expanded across most European countries. The arrival of SLB in Portugal is uncertain but its distribution is wide. Sycamore (*Platanus spp*.), the only host of SLB, is one of the most widespread and important urban tree species in Portugal. It provides a wide range of environmental, social and economical benefits, which have been threatened by the invasion of this pest. SLB damages trees by feeding on the underside of the leaves causing discoloration and eventually premature senescence. While the long-term effect of SLB on the health of urban trees is yet to be fully assessed, there is compelling evidence that pruning further increases SLB damage. In this study we assessed the impact of pruning on the attack intensity of

SLB. To test the hypothesis that pruning promotes the invasion of SLB, we compared the intensity of attack of pruned trees with unpruned trees. We collected sycamore leaves from pruned and unpruned trees and then assessed the intensity of attack by scaling damage by visual rating. Our findings show that pruned trees exhibit significantly higher attack intensities than unpruned trees ($p < 0,001$, χ^2 goodness of fit). Based on these findings we recommend that sycamore pruning should be performed with caution (or even ceased), especially in urban areas where SLB is present.

TH 26-46: Xenobiotic effects and side-effects on arthropods

TH 26
Fumigant toxicity of Essential oil from Thymus kotschyanus on Callosobruchus maculatus and Ephestia kuehniella

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Imbalanced and extended uses of broad-spectrum pesticides have caused development of resistant strains of insects, huge obliteration of useful organisms, out break of secondary pests and unwanted environmental effects. In recent years, essential oils have received much interest as pests control agents because of their insecticidal, repellent and antifeedant properties. In this research, insecticidal activity of essential oil from *Thymus kotschyanus* Boiss and Hohen. was studied against *Callosobruchus maculatus* F. and *Ephestia kuehniella* Zeller. The dry leaves and flowers of plants were subjected to hydrodistillation using a Clevenger-type apparatus for 3 h. Detection has been done by GC_MS. Twenty three compounds of the oil were identified, the main one is Carvacrol (64.27 %). The experiment was conducted on 1-7 day old adults of insect at 26±1 and 65±5 R.H. in dark condition. The potency of fumigant effects of *T. kotschyanus* on *C. maculatus* and *E. kuehniella* were determind. LC_{50} values of *C. maculatus* and *E. kuehniella* were 3.31 and 0.95 respectively. LT_{50} values of *C. maculatus* and *E. kuehniella* were ranged from 1.85 to 1.02 h. and 3.14 to 1.16 h. respectively, For the highest dose (46.2 µL/L air). The half-life time of the *T. kotschyanus* oil at the 77 µL/L air on *C. maculatus* (73 days) was shorter than *E. kuehniella* (91 days).

This study suggest the efficacy of T. kotschyanus oil for the management of stored product insects.

TH 27
The lethal effects of Spinosad on *Chrsoperla carnea* larvae (Neu: Chrisopidae) via ingestion technique under laboratory conditions

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Chrysoperla carnea (Stephens) is a widespread polyphagous predator, used in biocontrol of aphids in greenhouses and very common in many agricultural systems. All rearing of *C. carnea* using methods described Malkashi *et al* (1385). Insect were reared at 25±1 C^O, 65±10% RH, and photoperiod of 15:8 h light: dark regime. Rearing dishes were plastic cylindrical in size 35×25×15 cm that for prevention of cannibalism and decrease of intervals vacuum using paper piece and mesh. The opening is covered with a piece of mesh. The eggs supply in rearing dishes. After hatching, Chrysopid larvae fed on eggs of *Ephestia cautella* Zeller. Some of the larvae used in experimentation and the other rearing for producing adult. To study Susceptibility this predator, we used a commercial formulation of biorational insecticide, Spinosad, Tracer^R against several stages of larvae *Chrysoperla carnea* with two bioassay methods, contact and ingestion. To stabilize variances, proportion data were transformed [arcsin sqrt (x + 0.001)] before analysis. The LT_{50} ، LT_{95} ، LC_{50}, LC_{95} and related statistics were estimated using SPP 10 .Spinosad commercial formulation was applied at doses of 250, 440, 800, 1400 and 2500 ppm for first instar. Concentration 2500 ppm in 72 h after exposure was the more mortality in first instar and a direct relationship between mortality rate and Spinosad concentration was detected. The LC_{50} values in 24, 48, and 72 h of exposure were estimated 1076,516 and 341 ppm and the LT_{50} was 16 h, too. For second and third instar larvae Spinosad commercial formulation was applied at doses of 500, 780, 1220, 1920 and 3000 ppm. The LC_{50} values in 24, 48, and 72 h of exposure for second instar were estimated 1999, 3737 and 1682 ppm and for third instar were estimated 16139, 4717 and 2639 ppm. The LT_{50} was 51 h for second instar and 61 h for third instar, too.

TH 28
Bioactivity of *Satureja hortensis* (Lamiaceae) and *Zingiber officinale* (Zingiberaceae) against the Mediterranean flour moth, *Ephestia kuehniella* (Lepidoptera: Pyralidae)

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Concerns over health and environmental problems associated with synthetic insecticides currently in use in agriculture, have led to an intensification of efforts to find safe, effective and viable alternatives; so in recent years, plant essential oils have received a great deal of attention as pest control agents. In this study the essential oils were extracted from Summer savory, *Satureja hortensis* leaves and Ginger, *Zingiber officinale* rhizomes through hydrodistillation. The essential oils evaluated for their repellent and toxic effects on the Mediterranean flour moth, *Ephestia kuehniella* (Zell.). Contact toxicity assayed by application of different concentration of oils on filter paper discs. The mortality of 14 day-old larvae of *E. kuehniella* was evaluated after 18 hour. Repellent activity against adult moths was evaluated after 1 hour at 0.8- 51.2 µl/l concentrations using connected glass vials bioassays**.** The results suggest that the Summer savory oil (LC_{50}= 0.27 µl/cm^2) was more toxic than Ginger oil (LC50= 0.61 µl/cm^2). Moreover, there was significant deference between the repellency of the oils. Repellent activity of Ginger oil reached maximum i.e. 71.67% at 51.2 µl/l concentration; while Summer savory oil didn't cause repellency more than 63.33% in all concentrations. All concentrations over 12.8 µl/l cause decrease in repellency of *S. hortensis* oil. In the best state, both of these essential oils showing the repellency of class IV activity.

TH 29

Fumigant toxicity of essential oil from *Zingiber officinale* (Zingiberaceae) against *Tribolium castaneum* (Col.: Tenebrionidae) and *Ephestia kuehniella* (Lep.: Pyralidae)

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The use of natural compounds, such as plant essential oils control agents are receiving increase attention as an alternative, as they are largely accessible and non-toxicity to humans and the environment. The objective of the current study was to determine the fumigant toxicity of an essential oil that was isolated via hydrodistillation from dry rhizomes of *Zingiber officinale*. The fumigant toxicity of the essential oil was tested against 1–7 day-old adults of the red flour beetle, *Tribolium castaneum* (Herbst) and 14 day-old larvae of the Mediterranean flour moth, *Ephestia kuehniella* (Zell.). The mortality of beetle adults was tested at different concentrations ranging from 250 to 1500 µL/L air and different exposure times (1-3 d). The mortality of moth larvae was tested at concentrations ranging from 50 to 500 µL/L air and exposure time from 6 to 12 h. If the highest mortality of adult beetles after 48h was recorded as 96.67% at 1500, but there was no significant difference between mortality of different concentrations ranging from 732.5-1500, so the significant mortality of adult beetles was recorded as 88.33% at 732.5. At concentrations higher than 315.5 µL/L air, mortality of *Ephestia kuehniella* was recorded more than 75% after 12 h, whereas there was no significant difference between mortality of this concentration and mortality of higher rate. The LC_{50} values of the oil for *T. castaneum* adults after 48 h of exposure was 375 µL/L air and for *E. kuehniella* larvae after 12 h of exposure was.114 µl/l air. The results demonstrated that mortality increased with increasing in concentration and exposure time.

TH 30

Efficacy of Spinosad Against *Tribolium castaneum* (Coleoptera: Tenebrionidae) and *Plodia interpunctella* (Lepidoptera: Pyralidae)

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Spinosad is a commercial reduced-risk pesticide based on a fermentation product of the bacterium *Saccharopolyspora spinosa*. Spinosad's performance was evaluated against adults of the red flour beetle, *Tribolium castaneum* (Herbst) and larvae of the Indianmeal moth, *P. interpunctella* (Hübner). To evaluate efficacy of spinosad against *T. castaneum* and *P. interpunctella*, crashed wheat and pistachio nuts were treated with different concentrations of spinosad, respectively. Adult beetles were exposed to wheat treated with spinosad at the rates of 0, 0.1, 0.5, 1 and 2 mg (AI)/kg. Mortality was counted after 7 and 14d. To assess larval mortality and adult emergence of *P. interpunctella,* eggs of moths exposed to treated nuts at the rates of 0, 0.1, 0.25, 0.5, 0.75 and 1 mg (AI)/kg. The significant adult's mortality of *T. castaneum* was 89% at 1mg (AI)/kg after 14 days and there was no significant difference between mortality of this concentration and mortality of higher rate. Spinosad at ≥ o.5 mg (AI)/kg suppressed more than 88% egg-to-larval survival of *P. interpunctella* after 21 days and egg-to-adult emergence after 49 days, whereas there was no significant difference among these concentrations.

TH 31

Fumigant toxicity of essential oil from *Satureja hortensis* (Lamiaceae) against three Stored-Product Insect Species

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Human health problems and environmental hazards caused by the indiscriminate use of chemical pesticides during past three decades have leads the scientists to look for less persistent and biodegradable alternatives. Essential oils from aromatic plants are recognized as proper alternatives to fumigants. In this experiment, fumigant toxicity of *Satureja hortensis* essential oil that was isolated via hydrodistillation, was studied against 1-7 day-old adults of the red flour beetle, *Tribolium castaneum* (Herbst) and 12-14 day-old larvae of the Mediterranean flour moth, *Ephestia kuehniella* (Zell.) and Indianmeal moth, *Plodia interpunctella* (Hübner) in fumigation chamber. The adult beetles were exposed to the concentrations ranging from 250 to 1000 µL/L air and exposure time from 9 to 24 h. The moth larvae exposed to the different concentrations ranging from 25 to 400 µL/L air, and mortality counted after 6, 9 and 12 h. At concentrations higher than 750 µL/L air, beetle adults mortality was recorded more than 70% after 24 h, whereas there was no significant difference between mortality of this concentration and mortality of higher rate. After 24 h of exposure, the LC50 value for *T. castaneum* was 462 µL/L. At 400 µL/L air, maximum mortality was obtained as 96% and 87% for *E. kuehniella* and *P. interpunctella* larvae, respectively. Data probit analysis demonstrated that *E. kuehniella* (LC50= 81 µL/L air) was more susceptible than *Plodia interpunctella* (LC50= 140 µL/L air). Relationships between exposure time and oil concentration on mortality of all species indicated that by increasing in oil concentration and exposure time mortality increased.

TH 32

Efficacy of garlic powder, *Allium sativum* L. against *Tribolium confusum* Jacquelin du Val.

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Tribolium confusum Jacquelin du Val is one of the insect pests of wheat flour and seeds of cereals. It consumes the endosperm and causes loss of grain and flour weight. In this study the efficacy of powder from *Allium sativum* L. was tested using Completely Randomized Design (CRD) against the storage pest *T. confusum* in the laboratory. Antifeedant efficacy was tested against larval and pupal stages of *T. confusum*. The experiment was conducted with 5 treatments and 50 replications for each treatment at 30±1 °C and 60±5 % RH in dark condition. Treatments were ratios of powder of *A. sativum* ranging from 50 to 250 mg/g wheat flour. In control we used only wheat flour. Mortality of larvae and pupae, Duration of larval and pupal stages and Larval and pupal weights were tested at different ratios. Results showed that the mortality rate of *T. confusum* larvae increased significantly with the concentration from 12 to 26 percent while mortality rate of control was 8 percent. Mortality rate of *T. confusum* pupae had no significant differences among ratios. Larval weights (1.7±0.2 to 2.5±0.1 mg) of all treatments in day 14 of larval stage were significantly different from control (2.9±0.1 mg) ($P<0.01$). Pupal weights in the first day of the stage showed that only concentration of 250mg/g significantly differ from control. Duration of larval stage in all treatments (21.6±0.29 to 27.3±0.78 day)

was significantly longer than the control (19.1±0.24 day) ($P<0.01$) and increased with the concentration. Findings indicated that *A. sativum* affect larval traits comparing to pupal stage and could be considered as safe model for new synthetic pesticides to control immatures of *T. confusum*.

TH 33
Impact of alpha-cypermethrin on body mass of the carabid beetle Platynus assimilis

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The aim of this study was to test the effect of widely used synthetic pyrethroid insecticide alpha-cypermethrin on non-target carabid beetle *Platynus assimilis* Payk. living in agricultural fields. The tests were carried out in the laboratory in January 2009. Mentioned pyrethroid is neuropoison acting on the axons in the peripheral and central nervous system. The adult (n= 60) were divided into 2 groups: control and test. On the beetles were measured body mass before the treatment and the end of study (14th day). Beetles were treated with Fastac 50, commercial formulation of alpha-cypermethrin (a.i. 50g l-1), by dose 0.15%, based on recommendations for field spraying. Food pieces were dipped for 10 seconds into the treatment (test) or distilled water (control). The beetles were kept 14 days in plastic boxes (0.5 l) individually on wet tissue and with access to treated food, at room temperature. The measured body masses increased 4 mg in control group, but no increase in treated group was detected. According to our results, treatment by alpha-cypermethrin affects insects feeding habits or probably inhibits or disrupts energy production from food, which could reduce predation in agroecosystems.

TH 34
A New Simple Methodology to Evaluate the Insecticide Side-Effects on *Trichogramma* Species (Hym.: Trichogrammatidae) in Greenhouse Crops

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Currently at Spain, there are several active ingredients (a.i.) for the control of South American Tomato Pinworm, *Tuta absoluta* (Meyrick), with larvicide effect on this lepidoptera species, and now a new biological agent is also available, egg parasitoid: *Trichogramma achaeae* Nagaraja and Nagarkatti. By the way, the aim of the present work has been, on one hand, to set up a simple methodology to evaluate the insecticide side-effects in greenhouse tomato crops and, for other one, to study the above mentioned effects. The comparison between the current methodology (OIBC and EPPO), with the *Ephestia kuenhiella* Zeller eggs use in piece of green card, and the new one, with small chromatic traps, was carried out by 3 trials in an experimental tomato crop greenhouse (1,000 m^2). In turn, the evaluation of the side-effects of a.i. was realized in a commercial greenhouse (1,080 m^2), with the species *T. achaeae* (TrichoControl ®, Agrobio SL), liberated to a dose of 100 adults/m^2 and the a.i. and doses following: Indoxacarb 37.5 g a.i./ha (Steward® 30WG, Du Pont), Rynaxypy 4 g a.i./hl.(Altacor® 35WG, Du Pont) and Methomyl 250 g a.i./ha (Lannate®20L, Du Pont), in comparation with checks. From test results, it has been found that the new methodology is more reliable than last one recommended by IOBC and EPPO; as this new one is easier and quicker. At the same time, the found side-effects of the different a.i. over the parasitoid activity are presented and discussed.

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TH 35
Side effect of four insecticides on demographic parameters of the aphid parasitoid, *Diaeretiella rapae* (McIntosh) (Hym., Braconidae)

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Effect of four insecticides (Pirimicarb, Pymetrozine, Imidaclopride, and Dimethoate) on life table parameters of the aphid parasitoid, *Diaeretiella rapae* (McIntosh) was investigated in order to determine the selectivity of common pesticides used against aphids in Iran. Parasitoids were reared on greenbug, *Schizaphis graminum* (Rondani) in a growth chamber at 25 ± 1 ºC, 60-70% RH, and a photoperiod of 16 L: 8 D hours. The effects of different recommended doses for field application rate of pesticides on life table parameters of parasitoid's pupae and adult were evaluated. According to our experience, Pirimicarb, Imidaclopride and Dimethoate were extremely lethal for adults at their field application rates. To contrary, Pymetrozine caused just 27% mortality. The highest values of longevity (6.2± 0.41) and the percentage of emergence rate for adults (97%) were established for Pymetrozine and Pirimicarb at 500ppm, respectively. Additionally, Dimethoat caused the lowest survival rate (0.71) for adults. The highest fecundity of 16.6 offsprings was recorded for Imidaclopride. The intrinsic rate of increase was ranged between 0.30 and 0.36, which was recorded for Pirimicarb at 1000ppm and Pymetrozine, respectively. So that Pirimicarb at 1000 ppm had the most adverse effect on life table parameters of the wasps' intrinsic rate of increase obtained in this treatment. The highest value of net reproductive rate (R_0) was observed in Pymetrozine (51.257±2.3). Significant differences were observed in r_m between all tested pesticides and control treatment in adult and pupa stages, so we conclude that our tested pesticides have reliable effects on parasitoide. Furthermore, according to the percentage of pupa's emergence, it seems that mummy stage was less susceptible to the studied insecticides than adults.

TH 36
Effects of *Peganum harmala* L. seed extract on the diamondback moth, *Plutella xylostella* (L.) (lep.: Plutellidae)

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Diamondback moth, *Plutella xylostella* L. (Lep.: Plutellidae) is important pest of cruciferous plants family including oilseed in Iran and in the world. Harmal, *Peganum harmala* L. is a persistent plant belongs to Zygophyllaceae family.

In this research, efficacy of harmal seed extract on larval mortality, pupal rate, adult emergence and larval and pupal weight of DBM and also deterrent effect of ethanol extract of plant on pest oviposition and egg hatching was investigated in the growth chamber in 25±1°C, 65±5% RH and 16L:8D photoperiod conditions. The seed plant extract was extracted

with absolute Ethanol 99% (Merck) (200ml) using a Rotary evaporator Extractor at 45°C.

Results showed that *P. harmala* extract in 30 and 40 mg/ml concentrations significantly caused increasing in percentage of larval mortality and also all treated larvae with these concentrations were died in larval stage. Also there are significant differences between different concentrations of extract in larval weight. Mean of pupae weight in 30 and 40 mg/ml concentrations of extract was significantly reduced. Furthermore, results showed that different concentrations of ethanol extract, caused oviposition deterrence in DBM adults. Highest deterrence was observed in 40 mg/ml concentration that caused 93% oviposition deterrence and lowest deterrence was seen in 10 mg/ml concentration with 39% oviposition deterrence. Mean of hatched eggs percentage of DBM on treated leaves with harmal extract in different treatments and control were 91, 84, 76, 67 and 96%, respectively. Comparison of means showed that 30 and 40 mg/ml concentrations of extract, in compared to control significantly caused reduction in hatching eggs of DBM.

In conclusion, extract of harmal have demonstrated strong insecticidal effect against *P. xylostella*, thus, this plant has excellent potential to provide naturally agents that may be utilized for *P. xylostella* control.

TH 37
Sublethal effects of indoxacarb doses on fecundity, developmental time and adult longevity of diamondback moth, *Plutella xylostella* (L.) (Lep.: Plutellidae)

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Diamondback moth, *Plutella xylostella* (L.) (Lep.: Plutellidae) is a serious lepidopteran pest of cruciferous plants throughout the world and Iran. Indoxacarb, is an new oxadiazine insecticide with strong effects on lepidopteran pests. Sublethal doses of insecticide can affect on physiology and behavioral parameters such as fecundity, egg hatching, oviposition parameters, development time, larval and pupal weight, pupal rate and etc. In this study, effects of sublethal concentrations (LC_{10} and LC_{25}) of indoxacarb on fecundity, adult emergence and preadult developmental time of *P. xylostella* were studied. The colony of DBM was reared in the laboratory conditions at 25ºC, 65±5 RH and 16L:8D photoperiod. LC_{50} value of indoxacarb on 3rd instar larvae of *P. xylostella* was estimated 4.82 ppm. Results showed that indoxacarb at LC_{25} significantly increased eggs and first instar larvae developmental time in diamondback moth but LC_{10} didn't affect on these parameters. The developmet time of second, third and fourth instar larvae of *P. xylostella* in sublethal concentrations were longer than control but weren't significant. Pre pupal and pupal development times of treated groups were similar with control and didn't change significantly. Also, the longevity of males and females of DBM in LC_{25} concentration was significantly shorter than control, but these parameters in LC_{10} groups didn't change. Fecundity of females in sublethal concentrations significantly declined compared with control. The results indicated that indoxacarb can effect on fecundity, development time and adult longevity of *P. xylostella*, Also effects on these parameters in LC_{25} treatment group were greater than LC_{10}.

TH 38
Efficacy of essential oil from *Ferula gummosa* Boiss (Apiaceae) on larvae and adult of *Ephestia kuehniella* Zeller (Lep.: Pyralidae)

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It is well known that a considerable number of plant species, besides their popular use as medicine, possess insecticidal activities. These plants have been suggested as alternative source of materials for insects control because they contain a range of bioactive chemicals. So, essential oils of these plants have received much attention as pest control agents. *Ferula gummosa* Boiss. is one of these medicinal plants, naturally grows in Iran. The present study was undertaken to investigate the effect of *F. gummosa*. essential oil vapor on *Ephestia kuehniella* Zeller. Mediterranean flour moth is a worldwide pest and its close association with human foods makes it prime target for control methods other than chemical pesticides. Therefore, essential oil was obtained from resins of *F. gummosa,* and subjected to hydro distillation using a modified Clevenger-type apparatus. The fumigant toxicity of the essential oil was tested against first, second and third instar larvae and adults of *E. kuehniella* at 27 ± 1°C, 60 ± 5 % R.H. and in dark condition. The mortality was tested at different concentrations and exposure time. Data probit analysis showed that lethal concentration to kill 50% of the population (LC_{50}) for the first, second, third instar larvae and adult were estimated as 9.75, 122.11, 365.11 and 44.26 µL/L air, respectively. So, first instar larvae were more susceptible to the essential oil. The present study suggests that essential oils of *F. gummosa* plant may be potential grain protectants as botanical alternative fumigants.

TH 39
Effect of two neonicotinoid pesticides on some population growth parameters of the cotton aphid, *Aphis gossypii* Glover (Hemiptera: Aphididae)

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Susceptibility of the cotton aphid**,** *Aphis gossypii* exposed to the neonicotinoids, imidacloprid and thiametoxam were assayed by three different bioassay methods (starvation, residual and FAO dip methods) under laboratory conditions on squash (*Cucurbita* sp.; Cucurbitacae). In the starvation method the aphids were exposed to the pesticides via spraying by potter tower without any water and food. In the residual method, the aphids were exposed to the pesticide-treated leaves. The aphids were dipped in the pesticide solutions in FAO dip test. Results showed that aphid mortality in the starvation and residual methods was higher than that in FAO dip test in case of both pesticides. This investigation indicated that bioassay methods can significantly ($P<0.01$) affect the population growth parameters; R_0 (net reproductive rate), r_m(intrinsic rate of natural increase), T(mean generation time) and DT (the doubling time). The values for r_m and R_0 obtained in the starvation method were 260% higher, respectively than those in FAO method with thiametoxam and 34% higher than FAO method with imidacloprid and also T and DT were estimated 59 and 62% less, respectively than these parameters in FAO method with imidacloprid compared with thiametoxam. In contrast,

residual method with imidacloprid causes 9 and 67 % increase in r_m and R_0 values respectively compared with FAO dip method and T and DT were 65 and 92% less, respectively than mentioned parameters in FAO method with thiametoxam. Residual and starvation methods did not have significant differences on measured parameters (P>0.01).

TH 40

Toxicity Evaluation of Nissorun, Palizin, Sirinol and Tondexir on *Tetranychus urtica* Koch a pest of *Brassica napus* L

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The bioinsecticides are realized to be the best and effective pesticides. The main aim of this experiment was to determine the efficacy of Nissorun (Hexytiazox) Insecticidal Gel (Palizin), Insecticidal Emulsion (Sirinol) and Tondoxir on the control of *Tetranichus urtica* in lab condition at 24, 48 and 72 h post treatments. Leaves of *Brassica napus* with *Tetranychus urtica* were used in all tests and the mortality were monitored. Analysis of variance showed that there were significant differences between treatments and control, and also significant differences were found among treatments. Tukay-Test among above treatments has shown that Nissorun, Sirinol and Tondexir with 97.33 ± 1.66, 95.67 ± 3.33 and 95 ± 4 were more effective than Palizin with 75.33 ± 5 percentage mortality and significant different with control (P< %1) respectively. Tukay-Test among 72 and 48 h post treatments with 75.33± 8.75 and 70 ± 7.5 percentage of total mortality are more effective than 24 h post treatments with 56.27 ±7 percentage of total mortality respectively.

TH 41

An investigation on efficacy of garlic extraction on adults of potato Colorado beetle, *Leptinotarsa decemlineata* Say., in Lab. Conditions

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This assayed aimed at evaluation the activity of garlic extraction on adults of potato Colorado beetle(PCB). Nearly 50 gr of fresh garlic tubers blended and mixed with 100 ml distilled water and kept for 30 min in room tempratures.Then centrifuged in 4000 rpm for 30 min .Supernatants isolated as the standard extracted.Serial dilutions selected as %50, %10 , %2.5 and %0 (as control). Four adults(2 males, 2 females) were placed on a petridish (10cm Diam.) contained some potatoe leaves that dipped in garlic dilutions.This experiment was performed with RCD with 4 treatments in five replicates.Daily feeding percent, fecundity, %fertility and %mortality recorded.On the basis of our findings, garlic extracted(GE) affected significantly on adult daily feeding(%) (P<0.000). So that control with highest %mean daily feeding (19±0.008) placed in one group and others to another.Also GE significantly influenced on %mortality (P=0.019) with maximum mortality in concentration of %50(GE) with %mean (45 ± 14.6).Likewise GE dilutions have no significant influence on fecundity (P=0.326), %fertility (P=0.325), oviposition period (p=0.126), mean daily oviposition (p=0.281) and embryonic period (P=0.151).

TH 42

An investigation on efficacy of garlic extraction on larvae of potato Colorado beetle, *Leptinotarsa decemlineata* Say., in Lab. Conditions

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This assayed aimed at evaluation the activity of garlic extraction on larvae of potato Colorado beetle (PCB). Nearly 50 gr of fresh garlic tubers blended and mixed with 100 ml distilled water and kept for 30 min in room temperatures. Then centrifuged in 4000 rpm for 30 min .Supernatants isolated as the standard extracted. Serial dilutions selected as %50, %25 , %10 and %0 (as control).

Daily feeding percent, mortality and larval period long was recorded. Garlic extracted (GE) affected significantly on first larvae daily feeding (%) (P=0.001).Control with highest percent (40±0) placed in one group and others treatment in anothers. Also this factor significantly affected on third larvae (P=0.037) with highest feeding% in control (22.6±1.67) and lowest in GE %50 with (14±1.1). furthermore GE treatments affected on daily %feeding in fourth larvae (P<0.000), with highest on control (16.6±1.8) and lowest in GE %50 (2±0).Daily feedings was not significant in second larval stage (P=0.3).

GE significantly affected on larval mortality (P=0.037). GE %50 with highest mortality percent (60±20) and control was the lowest (6.67±6.67).Also mortality percent in first (P=0.035), second (P=0.41), third (P=0.649) and fourth larvae (P=0.048) were compared. GE also significantly affected on larval period long (P=0.015) as the longest observed in GE %50 with (19.33±0.33) and shortest in control with (16.5±0.289) days. Although the long time of larval period until adult exit was not significant in different treatments (P=0.558).The long of larval period in first (P=0.418), second (P=0.023), third (P=0.036) and fourth larvae (P=0.455) were compared.

TH 43

Comparison toxicity of different dose of Tondxir, Sirinol and Palizin against *Tetranychus urtica* Koch a pest of *Brassica napus* L

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The main goal of this study was to determine the toxicity of natural insecticidal Tondxir, Sirinol and Palizin which are the crude extract of the red pepper, Garlic and eucalyptus on the control of two spotted mite *Tetranychus urtica* Koc (Arachnida: Acari: Tetranychidae) a pest of *Brassica napus* L. In this experiment five doses of above natural pesticides (3000, 1000, 300, 100, 3 and 0 ppm) have been tested. Leaves of Kolza with two spotted mite were used in all tests. The mortality was monitored after 24, 48 and 72 hours post treatments. The analysis of variance (ANOVA) has shown that there were significantly different between treatments and control (p<0.01) also ANOVA has shown that there were significantly different among post treatment periods. The mortality of the two spotted mite (TSM) with Tondxir, Sirinol and Palizin were dose dependent. Tukay-Test with different dose of the Tondxir, Sirinol and Palizin has shown that 3000 ppm of Tondxir with 85. 5 ± 1.2 percentage mortality and 1000 ppm of Tondxir with 69.58 % mortality after 72 h were more effective than the other doses (p<0.01)which is the same as Sirinol and biger than Palizin. Tukay-Test among post test period has shown that after 72 hours post treatments with 45.58 percentage of total mortality were more effective than 48 and 24 hours post treatments respectively for all natural products. Based on the composite response of this assay with the probit analysis, the predicted LC_{50} of Tondxir was 280.64 ppm with confident interval 232.78-331.9 ppm which is lower than Sirinol and Palizin respectively.

TH 44

Ovicidal activity of essential oil of *Ruta graveolens* L. against the eggs of *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae)

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Cowpea beetle, *Callosobruchus maculatus* F. is the major storage pest of cowpea. Due to the critical losses of this insect pest in some regions of Iran, most farmers avoided cultivating of cowpea. Present study was designed to evaluate the efficacy of essential oil of *Ruta graveolens* L. (Rutaceae) as an ovicide against the eggs of *C. maculatus*. Essential oil was extracted from the shade dried aerial parts of the plant via hydrodistillation. All experiments were run under the conditions of 27±1°C, 65±5% R.H. and the darkness. One-day old eggs of *C. maculatus* which were hatched on mung bean seeds were dropped separately in glass vials. Filter paper disks which were placed in the underside of the caps were impregnated with different concentrations of essential oil ranging from 3.6 to 35.7 µl/L air. Then the caps screwed firmly on the vials. After 24 h exposure, the eggs were transferred to untreated vials. Same experiments were run for three and five-day old eggs. Computed LC_{50} values showed that one-day old eggs (LC_{50} 2.49 µl/L air) were more susceptible than five-day old eggs (LC_{50} 4.19). Likewise, three-day old eggs (LC_{50} 2.56) were more susceptible than five-day old eggs but no significant difference were observed. Results of this investigation suggested that the essential oil of *R. graveolens* maybe beneficial as a natural control agent for reduces the population of *C. maculatus* in small scales.

TH 45

Insecticide resistance status of *Myzus persicae* populations from Turkey

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Extensive use of insecticides against *Myzus persicae* (Sulzer) has led to the evolution of several insecticide resistance mechanisms. Two amino acid substitutions (S431F and L1014F) in acetylcholinesterase and in voltage gated sodium channel genes conferred MACE and kdr respectively. In this study several populations of *M. persicae* were collected from different regions of Turkey in order to evaluate the genetic diversity and insecticide resistance status of peach potato aphid populations. The field populations were screened in terms of two known resistance mechanisms, modified acetylcholinesterase (MACE) and knockdown resistance (kdr) respectively using restriction fragment length polymorphism analysis (PCR-RFLP). According to the data obtained from this study it has been determined that *M. persicae* populations became insensitive to carbamates, organophosphates and pyrethroids which is associated with MACE and *kdr* resistance phenotypes and also most of the populations has been found to be heterozygous for both mutations.

TH 46

Susceptibility of the *Agonoscena pistaciae* (Hemiptera: Psyllidae) to amitraz and phosalone in Kerman, Iran

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The common pistachio psylla, *Agonoscena pistaciae* Burckhardt and Lauterer (Hem: Psyllidae) is one of the most damaging pests of cultivated pistachio trees throughout the pistachio orchards regions of Iran. In this study the susceptibility of the *A. pistaciae* to amitraz and phosalone were tested in the laboratory. Eight *A. pistaciae* populations including Rafsanjan, Anar, Bam, Kerman, Shahrbabak, Sirjan, Pariz and Paghaleh County collected from pistachio orchards. Insecticide toxicity was evaluated by dip bioassay of technical insecticides to 5th instars nymphs. Bioassay results showed that these populations had various levels of the susceptibility to amitraz and phosalone with the LC_{50} values ranging from 1.2 to 28.5-fold and 1.8 to 11.9-fold, respectively. The Rafsanjan and Anar populations' resistance factors were 28.5-fold for amitraz and 1.9-fold for phosalone, respectively. Based on the results, there was no cross-resistance among these two insecticides and suggesting characterizes the resistance and identifies the possible mechanisms involved in these pesticides resistance.

TH 47-60: Life history, reproduction and development of insect

TH 47

Study on the conidial dispersion of *Beauveria bassiana* (Balsamo) Vuillemin (Deut., Moniliaceae) in Date by larval and adult stages of Saw-toothed Beetle, *Oryzaephilus surinamensis* L. (Col., Silvanidae)

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One of the Saw-toothed beetle pathogen in date stored condition is *Beauveria bassiana*. The ability of different developmental stages of the beetle to disperse the fungus primary inoculums in three date cultivars Sayer, Zahedi and Deiri were studied. The individual dispersal functions as spore dispersal power and cross infestation rate as spore dispersal rate were calculated. Results showed that there were significant differences in spore dispersal ability by larval and adult stages and in three studied date cultivars. The slope of individual dispersal functions for different developmental stages were negative that indicating the reduction of primary inoculums of pathogen by distance. Their amounts were 3.19 and 116.72 cm in Sayer, 83.65 and 121.57 cm in Zahedi and 82.96 and 132.76 cm in Deiri for larval and adult stages, respectively. The rate of primary inoculums transmission was reduced by time also that the reduction rate of them for larva and adult were -0.04 and -0.05 in Sayer, -0.05 and-0.03 in Zahedi and -0.04 and -0.12 in Deiri, respectively. So, the maximum of dispersal occurred in first days of inoculation. Maximum spore dispersal occurred on Deiri and its amount was similar in Sayer and Zahedi. The adults were more effective on dispersal of primary inoculums on date than the larvae. Conidial dispersion on date wasn't aggregative and the fungi conidia were dispersed on all sites of stored date. Dispersal rate by adults was faster than larvae. Based on the results, it could

be concluded that primary pathogen inoculums had dispersal ability on host niche. The life stages dispersal ability rates were different in Date cultivars but the amount of those are significant. So it had an important effect on disease epizoothiology.

TH 48

Effect of different commercial Date palm cultivars on the growth of *Beauveria bassiana* on the larval and adult stages of Saw-toothed Beetle, *Oryzaephilus surinamensis* (Coleoptera: Silvanidae), using Fungal development index (FDI)

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Growth, infectivity and colonization rates for blastospores and conidia of strains IRAN441C of *Beauveria bassiana* was assessed for activity against larval and adult stage of *Oryzaephilus surinamensis* under three different feeding condition including Sayer, Zahedi and Deiri Date palm Cultivars. The fungal development index was used to compare the development rates of the fungal strain on the insect hosts. Results showed that the FDI values differ significantly for effects of Date cultivars (F=25.02; df= 2; α= 0.01) and for growth stage in three date cultivars (F=15.75;; df=5; α= 0.01). The Means of FDI values for strain IRAN441C was significantly the highest under Deiri Cultivar feeding and in Sayer is higher than Zahedi. The highest mean of FDI was showed for adult of Deiri and the lowest for larval of Zahedi. The mean FDI values for treatments would indicate that the infection and colonization of the B. bassiana in its beetle hosts appeared not only to be affected by the kind of Date cultivars feeding but also by the growth stages of the host. The data from our study indicate that this laboratory bioassay technique can play a crucial role in screening different isolates for determining the pathogenicity and efficacy of various fungal preparations to be selected against stored product beetle pests prior to being tested in field trials.

TH 49

Biology of *Ommatissus lybicus* (Homoptera: Tropiduchidae) on date palm in natural condition of Bam region

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The Dubas bug, *Ommatissus lybicus* de Bergevin is an important pest of date palms in Iran and especially in Bam region. Therefore, determination of its biological characteristics is important in IPM programs. It has two generations during a year. In this research, longevity of *O. lybicus* at two generations was investigated in 2008. Forty eggs (as a cohort) with maximum 24 hours old were used for determining longevity of this pest in each generation. With daily observation, the average of incubation period and duration of first, second, third, fourth and fifth nymph instars were determined to be 178.24 ,2.35 ,6.7 ,8.62 , 10.65 ,14.57 and 221.46 days in first generation, and 59.4, 3.23, 7.9, 10.87, 13.36, 16.2 and 111.28 days in second generation, respectively. This insect overwintered as egg in first generation. Sex ratio (females/ females and males) were calculated to be 0.57 in first generation and 0.59 in second generation. Female adult longevity, male adult longevity, pre-oviposition, oviposition and post-oviposition period were 21.27, 16.56, 1.66, 15.93, 3.73 days, respectively in first generation, and 24.44, 17.64, 2.64, 18 and 4.28 days, respectively in second generation. There was significant difference in two generations.

TH 50

Laboratory rearing of *Helicoverpa armigera* (Lep.: Noctuidae) on artificial medium and investigation on effect of nutriment types and different surfaces on oviposition rate of female moths

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Rearing of insects on artificial medium rather than on their host plants is advantageous in variety of investigations. In this study a simple, inexpensive and satisfactory technique was introduced for rearing of *Helicoverpa armigera* Hub. on artificial medium with almost all materials and ingredients locally available. The artificial medium contained soybean and barley flour, brewers' yeast, ascorbic acid, sodium benzoate, benzoic acid, agar and water. Different larval instars of *H. armigera* were collected from fields and reared on this artificial medium under laboratory conditions in a growth chamber (26±1 °C temperature, 65±5% R.H and a photoperiod of 16:8 (L:D). Also, in this study the effect of some nutriments and different surfaces on oviposition rate of female moths was compared. Results showed that pest larvae could successfully generate on this artificial medium. The oviposition rates of female moths nourished with different nutriments has not very numerous differences. Also, subject surfaces were the same operation in attracting of female moths for oviposition.

TH 51

***Dorcadion pseudopreissi*, a new turf pest in Turkey, the biology and damage on different Turf species**

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The longicorn beetle, *Dorcadion pseudopreissi* Breuning (Col.: Cerambycidae) was detected firstly in Turkey in 1988. The beetle found a new and favourable environment, with expanses of lush turf and pasture grasses for the development of its root-feeding larvae in Bursa city (north-western Anatolia). The pest increased in numbers and spread naturally into new areas such as urban landscape, home lawns and football fields. Its abundance has been appeared to have increased surprisingly in the past decades and then it has caused economic damage on the turf areas. Thus, the beetle has become a major pest in turf areas. This study which supported with a national project (TUBITAK-TOVAG 105O584) was investigated to establishment the biology and damage of a turf pest, *D. pseudopreissi* on different turf species namely *Lolium perenne* L., *Poa pratensis* L., *Festuca rubra* L., *F. arundinacea* Schreb. and *Agrostis stolonifera* L. (Poaceae) in field conditions during 2007-2009. Depending on weather conditions, adults emerge from the soil in early and late March and are sexually active for ca. 1-1.5 month until middle and early May in 2008 and 2009, respectively.

The larvae hatch in early June, feed on grass roots during June- August. In damage experiments, *F. arundiacea* was significantly less damaged than all other turf species, despite the highest number of larva was found in both years. The damage caused by the larvae was significantly far higher in *P. pratensis* and *F. rubra* than that of *F. arundinacea.* According to larva of *D. pseudopreissi* counting in soil, the damage in *A. stolonifera* was not originated from the larvae. Although the damage of larvae in *L. perenne* was significantly higher than that of *F. arundiacea* in 2007, there was no a significant difference between the turf species in 2008.

TH 52
Study of longevity of different life stages of Silverleaf whitefly, *Bemisia argentifolii* (Hemiptera: Aleyrodidae) on different hosts

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The Silverleaf whitefly (SLW), *Bemisia argentifolii* Bellows & Perring formerly referred as B strain of Sweetpotato whitefly *B. tabaci* is a cosmopolitan pest and a vector of virus diseases of green house crops. This study conducted to evaluate longevity of adults and immature stages (egg, N1, N2, N3 and pupa) on two hosts, Cotton and Eggplant. Pots enclosed Two-four leaves covered by Plexiglas cages and put in controlled conditions (26±2°C, 60±5% RH, and 16:8 L:D). Five pairs of 24-h old adults released under cages and removed from cages after 24 hours. Then 50 eggs selected randomly and exceeded ones deleted. These specimens remained until appearance of new emerged adults related data of life durations of immature stages recorded daily. 20 pairs of new generation kept separately and remained until the death of last. Data of longevity of these adults were recorded daily too. All data analyzed by SPSS (ver. 16) software. Results showed that longevity of Egg, N1, N2, N3 and Pupa were 4.1±0.03, 3.08±0.17, 2.1±0.05, 2.9±0.18, 3.10±0.02 days and were 4.03±0.016, 2.1±0.05, 2.1±0.1, 2.2±0.16, 3.5±0.07 days on Eggplant and Cotton, respectively. It showed significant differences between immature stages N1, N3 and Pupa in two hosts. Longevity of female and male were 11.4±0.9, 7.5±1.5 and 10.8±0.9, 8.02±1.4 days on Eggplant and Cotton, respectively that showed no significant differences between hosts. According to these results it seems that SLW produces higher population density on Eggplant than Cotton, because of its shorter life duration of immature stages.

TH 53
Study on the biology of the greater wax-moth under laboratory conditions and determination of larval instar by measuring body weight

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The greater wax–moth, *Galleria mellonella* (L.), is the most important pest of wax and causes considerable damage during storage period. This research revealed that, greater wax–moth has eight larval instars at 25±1 ºC, 60±5 RH and 14 L: D regime. Under these conditions the mean incubation period, larval developmental duration and pupal stage were 6.24±0.86, 26.57±3.90 and 6.083±1.026 days, respectively. Mating has significant effect on reduction of life duration. The mean period of life span for mated and unmated male was 15.18±1.83 and 19.62±1.82 days, respectively. A similar trend was observed for female. For mated and unmated female, life duration was 3.23±0.8 and 5.7±1.16 days respectively. There was a significant direct relationship between body weight and width of head capsule in different larval instars. This relationship could be a reliable and useful tool in determination of larval instar by measuring body weight.

TH 54
Seasonal abundance of *Planococcus ficus* (Signoret) (Hemiptera, Pseudococcidae) in Jahrom vineyards, Fars Province-Iran

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The vine mealybug, *Planococcus ficus* (Signoret) has been found in most grape-production areas throughout the world. The damage of the pest has increased on grape in some parts of Fars province-Iran during recent years. Some ecological aspects of vine mealybug were studied in vineyards in Jahrom during 2008-2009. Seasonal abundance of vine mealybug was monitored by time-consuming examination technique. In geographical condition of Jahrom vineyards *P. ficus* has 5 generations of seasonal abundance from April to November. After fifth generation all stages of *P. ficus* (female adult, nymphal instars and egg) overwintered on root from late November to next March. Population density of female adult and nymphal instars increased rapidly in May and has a great decline after harvest in August. Vine mealybugs were found in trunk in spring, leaves, buds and fruit in summer, however, the mealybugs always were found in protected locations (under the bark of the trunk).

TH 55
Annual dynamics of *Hypera postica* (Coleoptera: Curculionidae) population in Hamedan: Alternatives key factor analyses

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Alfalfa weevil, *Hypera postica* (Gyllenhal) (Coleoptera: Curculionidae), is among the most destructive pests of alfalfa, *Medicago sativa* L., in the world. Demographic parameters of *H. postica* were investigated at field (during 2004-2007) to characterize population dynamics of the pest in Hamedan. Stage-frequency of alfalfa weevil was best modelled using Manly-1997. Analyzing of multiple decrement life table parameters (obtained from eight year-field) using traditional and λ contribution methods revealed different key factors directly resulted from different sensitivity of population growth rate, λ, to variation of both k and b in various stages of the weevil. In traditional method, the key factor was determined as k_{LII}, the death of period-two larvae from all mortality factors, whereas in λ contribution method, the key factor was determined as $b_{2\&3}$, oviposition rate of females per square meter. Among all mortality factors, only $k_{LI\text{-}Z}$, the death of period-one larvae from the entomopathogenic fungus, *Zoophthora phytonomi*, k_{LII} and $k_{LII\text{-}Z}$, the death of period-two larvae from *Z. phytonomi*, acted as density dependent factors. Remaining factors were independent to population densities affected. Our findings may be incorporated in more efficient phenological models of this pest and its population dynamics.

TH 56

Long standing dynamics of termite population and its global ecological and meteorological significance

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The importance of termite (Isoptera) population is based on the following reasons;

1. It is extremely populated order.
2. This order increases its population during many years.
3. These insects have a big importance because of destroying wood construction.
4. The taxon has important effect on concentration of global carbon and carbon dioxide having effect on green house effect and world climate.

The aim of the work is to suggest model of termite population and their gas productivity, basing of ecological principle and empiric data. Model is based on:

Models of population dynamics by V. Volterra and G. Gause.

Models of cyclical oscillations of population structure suggested by N. Kondratyev et. al.

The global climate is under control of factors having both earth and space origin. Global warming took place from XVII century till 1997. Then global cold snap began. This dynamics had effect on global distribution of some animals including termites. Their biology was studied extensive by a number of specialists. But there is deficiency of study of their role in global climate. Present work is toward compensation of this deficiency. Direct human effect on climate is not significant. At the same time man plays role of trigger switching on significant biosphere processes controlling climate. The transformation of marginal lands, development of industry and building, stimulated increase of termite niche and population. Termite role in green house gases production increases too. It may have regular effect on world climate. The dry wood is substrate for metabolism of termites living under symbiosis with bacteria *Hypermastigina* (Flagellata).

The use of dry wood by humanity increased from 18 $*10^8$ ton in XVIII to $9*10^9$ to the middle of XX century. Then use of wood decreased because of a new technology development. Hence termite population is controlled by microevolution depending on dry wood and climate dynamics. Producing by them green house gases had reciprocal effect on world climate. It is possible to describe and predict dynamic of termite population using methods of mathematical ecology and analogs with other well studied insects (Colorado potato beetle, chrysomelid beetle *Zygogramma* and so on). Reclamation of new ecological niche for such insects as termites needs 70–75 years. That is delay of population dynamics in relation to dynamics of dry wood production. General principles of population growth were described by G. Gause (1934) and some authors of the end of XX century. This works and analogs with other insects suggest model of termite distribution during XXI century. The maximum of population and its green house gases production would be gotten during 8–10 years. Then the number of specimens and sum biological mass would be stabilized and decreased. Termite gas production is not priority for climate regulation, but it has importance as fine regulator of global temperature and climate stability.

TH 57

Rose gall wasp, *Diplolepis rosae* (Hym., Cynipidae) and its associated wasps in Iran

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The gall-maker *Diplolepis rosae* L. (Hym., Cynipidae) is confined to the genus *Rosa*. The conspicuous and multichambered galls have been found on several *Rosa* species. Besides the gall-maker *D. rosae*, the inquilin gall wasps and several parasitic wasps' species can be found.

To study the associated complex fauna of *D. rosae* in Iran, we sampled galls on the dog rose (*Rosa canina* L.) in Fars and Tehran provinces of Iran throughout 2004-2005. There are 7 species from 6 families of Hymenoptera as follows:

Ichneumonidae: *Orthopelma mediator* Thunb.
Eulophidae: Aprostocetus zosimus (Walker), Sigmophora brevicornis (Panzer)
Eupelmidae: *Eupelmus urozonus* Dalman
Eurytomidae: *Eurytoma rosae* Nees
Pteromalidae: *Pteromalus bedeguaris* Thomson
Torymidae: *Torymus lapsanae* (Hoffmeyer)

O. mediator was the most common parasitoid in early spring and *E. rosae* had the higher population in summer.

TH 58

Study on Greenhouse Whitefly *Trialeurodes vaporariorum* (Westwood) longevity and female fecundity on cherry tomato

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Greenhouse whitefly (GHWF*), Trialeurodes vaporariorum* (Westwood) causes serious damage on glasshouse crops like Tomato. In this study longevity of pest and female fecundity were evaluated on Tomato (var. Cherry, Bakker Co.), under control condition ($24±2^0$C, 60±5% RH and 16:8 h L: D). Two-four leaves tomatoes planted in pots (15*15*20) and located under Plexiglas cages by ten replicates. Then one pair (24 hours old) adults were released in each cage. After 24 h, all males removed from cages and remained females transferred on new plant daily until the death of the last one. Number of egg/day, longevity of all stages (immature and adult) and their death rate evaluated daily. Results showed that longevity of immature stages, (egg, 1st, 2nd, 3rd nymphs and pupa) were 8.03±0.03, 1.03 ±0.03, 3.10±0.07, 4.15±0.2 and 4.64±0.2 days, respectively. Longevity of male and female were 10.7 and 16.8 days too. Also death rate of immature stages were 0±0,4/9±1/9, 10.18±4.6, 5.2±1 and 1.8±1.1 percent. The mean fecundity rate was 2.8±0.4 egg/day.

TH 59

An investigation on efficacy of potato Colorado beetle, *Leptinotarsa decemlineata* Say, larvae feedings of garlic extraction on some adult life parameters in lab. conditions

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This assayed aimed at evaluation the effects of larval feeding of garlic extraction (GE) on adults life parameters of potato Colorado beetle (PCB). Nearly 50 g of fresh garlic tubers blended and mixed with 100 ml distilled water and kept for 30 min in room temperatures. Then centrifuged in 4000 rpm

for 30 min. Supernatants isolated as the standard extracted. Serial dilutions selected as %50, %10 , %2.5 and %0 (as control).

Larvae feed of potato leaves that dipped on GE concentrations. The adults that can exit from pupa in different treatments compared in the preoviposition period, oviposition period, fecundity, %fertility, egg numbers in batch, embryonic period, sex ratio, adult weight in exit time and also after 2 month feed with potato leaves without GE.

Larval feed significantly affected on preoviposition period in females (P=0.032) and the longest observed in control with mean (9.25±1.6) days and the shortest in GE %0.25 with mean (1.75±1.03) days was recorded. Oviposition period also significantly affected (P=0.050) and longest mean belongs to control with mean (23±10.1) days and shortest in GE %50 with (2.75±1.11) days. Fecundity was significantly affected (P=0.036) with the highest number in control (264.5±79.7) and lowest in GE %50 treatment (57.3±22.1). But larval feedings has not significant effects on sex ratio (P=0.647), %fertility (P=0.717), mean daily oviposition (P=0.263), egg number in batch (P=0.453), embryonic long (P=0.116), weight in exit time of female (P=0.535) and male (P=0.29), secondary adult weight after two month in female (P=0.138) and males (P=0.29).

TH 60
Response of the larval ectoparasitoid, Goniozus legneri Gordh (Hymenoptera: Bethylidae), to carob moth Apomyelois ceratoniae (Zeller) odors and pomegranate fruit Punica granatum L. volatiles in an olfactometer

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Insects respond to different olfactory cues like volatiles from plants, host odors and pheromones for mate searching and aggregation. Multiple arm olfactometers like six-arm olfactometer are generally used to detect and measure insect responses to multiple odor cues simultaneously. *G. legneri* Gordh is a larval ecto-parasitoid of *Apomyelois ceratoniae* (Zeller), the most important economic pest of pomegranate orchards in Iran. In this investigation, a six-arm olfactometer was used to test the responses of female parasitoids to odors emanating from 1- healthy pomegranate fruit, 2- *A. ceratoniae* larva with artificial diet (pomegranate powder with some necessary additional materials like ascorbic acid), 3- *A. ceratoniae* larva, 4- *A. ceratoniae* frasses, 5- flour moth (*Ephestia kuehniella* Zeller) larva 6- control (blank) arm . The experiments were carried out at temperature of 25$\pm$ 1°C, RH 60$\pm$5% with sixty replications. Our results showed that, female wasps were consistently attracted to odors derived from *A. ceratoniae* frasses (38.3%). volatiles from healthy pomegranate fruit (16.6%), *A. ceratoniae* larva with artificial diet (21.66%) and *A. ceratoniae* larva (15%) elicited moderate responses and odors from *E. kuehniella* larva elicited the lowest responses. The different preferences of wasp females indicated that they were able to distinguish their suitable insect host through varying chemical blends and this parasitoid have potential to be used in biological control programs of carob moth.

TH 61-67: Genetically modified plants – Effects on insects

TH 61
Important aspects to be considered when assessing the impact of *Bt*-maize on herbivorous insects in the field

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During three projects assessing the impacts of *Bt* maize events *MON 810*, *MON 88017* and *MON 89034* x *MON 88017* (in progress) on non-target organisms (NTOs) in comparison to their near isogenic lines and conventional cultivars in randomised plot designs on different trial locations since 2001, a prevalent community of herbivores was surveyed. This community is usable for environmental risk assessment and for general surveillance.

Leaf-feeding (plant bugs, plant- and leafhoppers) and flower-visiting arthropods (thrips) are representatives of this community. They are relevant for an impact assessment of *Bt* maize, as they are exposed to the Cry proteins. To create monitoring schemes for these NTOs, knowledge of their range of density and occurrence in agriculture is important as a baseline.

In our projects, comparing the density of NTOs in *Bt* maize with other cultivars, using differing statistical methods (General Linear Models, tests of equivalence), some ecological and plant physiological aspects were recognised to be of importance for relevant species: (*a*) the management of off-crop areas – the density of the plant bug *Trigonotylus caelestialium* is influenced by the mowing of field margins early in the growing season and (*b*) plant physiological differences – abundances of Thysanoptera in maize panicles are influenced by the relative stage of anthesis of other cultivars nearby.

These aspects need to be taken into account experimentally when developing baselines for these NTOs.

TH 62
Assessing the effects of Cry toxins on ladybird beetles: a case study with *Adalia bipunctata*

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For two common insecticidal Cry proteins expressed in commercialized *Bt*-transgenic maize varieties, i.e. Cry1Ab and Cry3Bb1, laboratory and field studies have generally revealed no detrimental effects on several non-target ladybird beetles (Coleoptera: Coccinellidae). However, a recent study by Schmidt *et al.* (2009, *Arch. Environ. Contam. Toxicol.*, 56, 221-228) claimed toxicity of purified Cry1Ab and Cry3Bb1 to 1st instar larvae of the two-spotted ladybird beetle *Adalia bipunctata*. We therefore conducted tritrophic studies to test whether an effect on *A. bipunctata* could be detected under more realistic routes of exposure to these two Cry proteins. Using spider mites as carriers, 1st and 2nd instar *A. bipunctata* were exposed to biologically active, *Bt* maize-expressed Cry1Ab and Cry3Bb1 proteins (events *MON 810* and *MON 88017*, respectively). Ingestion of either of these two Cry proteins by *A. bipunctata* did not affect larval mortality, body mass and development time. Similar results were observed in subsequent direct feeding studies where *A. bipunctata* larvae were fed with either of the two purified Cry proteins throughout their complete immature development at a concentration ten-times higher than that measured in the *Bt* maize fed spider mites. Our experiments clearly show that *A. bipunctata* larvae are not adversely affected after the ingestion of Cry1Ab or Cry3Bb1. The results will be discussed in the context of previous non-target studies conducted with ladybird beetles.

TH 63

Efficacy of transgenic *Bt*-cotton containing Cry1Ac-toxin against *Spodoptera exigua*

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The field results showed that *Spodoptera exigua* larvae had low susceptibility to *Bt*-cotton, as there was no significant differences in larval densities between transgenic *Bt* and conventional cotton under unsprayed conditions and insecticides were used to control the population in sprayed *Bt*- and non-*Bt* cotton plots. The lab experiments showed that there were no significant impacts of *Bt*-cotton plant parts (leaves and flower-bolls) on certain biological parameters (larval mortality, development time, pupal weight) of *S. exigua* larvae compared to conventional non-*Bt* cotton. In general, survival remained high in all treatments (84-87%). The inhibitory effects of *Bt*-cotton on the growth of larvae were more obvious than the lethal effects. Larvae that were fed on non-*Bt* cotton, completed development faster than those fed on *Bt*-cotton. A comparison of average larval period indicated that larval period increased on *Bt*-cotton leaves and flower-bolls (17.75 and 17.52 days respectively) compared with non-Bt cotton leaves and flower-bolls (14.82 and 14.57 days respectively). Pupal weight was reduced and the average pupal weight was significantly higher on non-*Bt* cotton leaves (0.139 g) compared to average pupal weight on *Bt*-cotton leaves (0.098 g).

TH 64

Efficacy Of Transgenic Bt Cotton Containing Cry1Ac Against Beet Armyworm Larvae (Lepidoptera: Noctuidae)

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Cotton insect pest management in Pakistan is mainly dominated by the use of broad-spectrum insecticides, which disrupt the beneficial insect fauna, leading to pest resurgence and outbreaks of secondary pests, as well as risk to human health and environment. One option to reduce the insecticide use on cotton is the exploitation of transgenic Bt cotton as an important component of integrated pest management. The transgenic Bt cotton containing crystalline proteins from *Bacillus thuringiensis* Berliner sp. *kurstaki* is cultivating throughout the cotton growing areas of the world to manage lepidopterous insect pests. Growing of transgenic cotton is a new technology in Pakistan agriculture. There has been concern over the effectiveness of Bt cotton against beet armyworm, which is a polyphagous insect pest and in case of severe infestation has caused significant loss to cotton crop in Pakistan. For this purpose field and laboratory experiments were carried out to examine the efficacy of transgenic Bt cotton containing Cry1Ac against beet armyworm. The field experiments were conducted for two cotton seasons from 2007-08 at Postgraduate Agriculture Research Station (PARS), Faisalabad, Punjab, Pakistan (31º 21.52 North and 72 º 59.40 East), where wheat and cotton are commonly intercropped. The experimental fields were laid out in a randomized complete block design (RCBD) consisting of four treatments each with four replications. A plant inspection method was used and larval population was recorded on weekly basis by selecting 15 plants at random in each replicate plot. The results showed that *S. exigua* larvae had low susceptibility to Bt cotton, as there was no significant differences in larval densities between transgenic Bt and conventional cotton under unsprayed conditions and insecticides were used to control the population in sprayed Bt and non-Bt cotton plots. The lab experiments were laid out in a randomized complete block design (RCBD) with four replications, with 25 larvae in each replicate. The treatments included were; a) larvae fed on leaves of non Bt cotton, b) larvae fed on leaves of Bt cotton, c) larvae fed on flowers of non-Bt cotton until the third instar, then fed with young bolls of non-Bt cotton, d) larvae fed on flowers of Bt cotton until the third instar, then fed with young bolls of Bt cotton. Larval mortality was recorded in all instars and cumulative mortalities were calculated. The result showed that there were no significant impacts of Bt cotton plant structures (leaves and flower-bolls) on certain biological parameters (larval mortality & development time and pupal weight) of *S. exigua* larvae compared to conventional non-Bt cotton. In general, survival remained high in all treatments (84-87%). The inhibitory effects of Bt cotton on the growth of larvae were more obvious than the lethal effects. Larvae that were fed on non-Bt cotton, completed development faster than those fed on Bt cotton. A comparison of average larval period indicated that larval period increased on Bt cotton leaves and flower-bolls (17.75 and 17.52 days respectively) compared with non-Bt cotton leaves and flower-bolls (14.82 and 14.57 days respectively). Pupal weight was reduced and the average pupal weight was significantly higher on non-Bt cotton leaves (0.139 mg) compared to average pupal weight on Bt cotton leaves (0.098 mg).

TH 65

A full life cycle test as tool for the evaluation of potential effects of genetically modified plants on the ground beetle *Poecilus cupreus*

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The cultivation of genetically modified maize varieties expressing Cry proteins may pose a risk for beneficial non-target organisms. The stepwise approach of an environmental risk assessment (ERA) starts with laboratory bioassays looking for potential effects of the expressed Cry proteins. For this purpose, the establishment of a standardized test procedure with the capability of reproducible results is needed.

Ground beetles (Carabidae) are common epigeal predators in the maize field, representing an important agent of integrated pest management, and are therefore in the focus of research. The breeding of the carabid *Poecilus cupreus* (L.) is well described because this species is used in the ERA of pesticides.

The test procedure used in pesticide evaluation had to be adapted for the testing of the Cry proteins. The newly developed test design and first results of the bioassay with more than 600 carabid larvae are presented. The comparison of an approach with Cry3Bb1 (*MON 88017*), negative control and positive control (Karate – lambda cyhalothrin) revealed no significant differences between Cry3Bb1 and negative control concerning pupation rate (82% against 78%; $p = 0.38$), hatching rate (74% against 66%; $p = 0.084$), larval development time 37.94 d against 37.86 d; $p = 0.89$) and hatching weight (0.064g against 0.064g; $p = 0.92$). However, all larvae exposed to pyrethroid Karate died within 10 days.

TH 66

The potential of transgenic legumes in storage pest management: assessing the impact on bruchid parasitoids

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Genetically modified (GM) legumes expressing an alpha amylase inhibitor (αAI-1) from *Phaseolus vulgaris* are protected from the attack of major bruchid pests. However,

some bruchid species remain unaffected by this inhibitor. Therefore, the combination of plant resistant factors, like αAI-1, together with biological control agents, especially parasitoids, may be a powerful and sustainable method to control such storage pests. However, the broad range of activity of αAI-1 and its possible transfer through the food-chain necessitate a detailed analysis of the possible impacts on natural enemies. A prerequisite for bruchid natural enemies to be potentially affected by αAI-1 is the presence of α-amylases. Hence, this enzyme activity was first characterized in different bruchid parasitoids based on the *in vitro* characteristics of complete insect extracts. Larval and female extracts of all species were able to hydrolyze the specific substrate potato starch, although a higher activity was observed in the latter. Moreover, all parasitoids were highly susceptible to the specific inhibitors acarbose and wheat αAI. Taken all together, these results reveal that bruchid parasitoids rely on α-amylase activity for carbohydrate digestion. In the second step of our assessment i*n vitro* inhibition studies demonstrated that larval and female were highly susceptible to αAI-1, suggesting that they could be harmed by the GM legumes in case they were highly exposed to the inhibitor through their host. Hence, the subsequent steps of the assessment will include tritrophic experiments using GM chickpea and cowpea seeds expressing αAI-1, bruchids and parasitoids. Furthermore, the presence of the inhibitor at the third trophic level will also be investigated.

TH 67
A Round Robin interlaboratory comparison of Cry1Ab toxin determination in *MON 810* maize and biological samples by enzyme-immunoassay

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A laboratory ring trial was performed for determination of Cry1Ab toxin in four laboratories using a standardized enzyme-linked immunoassay protocol, extended with in-house protocols for comparison. Identical standards and samples were distributed among participating laboratories. Botanical samples were lyophilized or frozen homogenized leaf material of *MON 810* maize. For comparison, *Bacillus thuringiensis* preparation DIPEL® was analyzed in two laboratories. Statistical analysis of the results was carried out by the ISO 5725-2 guidelines. Sample standard deviation and standard error (SD, SE), within-laboratory SD and SE (WLSD, WLSE), and interlaboratory SD and SE (ILSD, ILSE) were calculated. Measured interlaboratory average (IA) values were 12.9±5.0, 16.6±7.1 and 67.8±14.0 µg Cry1Ab/g for three lyophilized samples, and 29.1±3.0 µg Cry1Ab/g for a frozen plant sample. Yet the participating laboratories determined Cry1Ab concentrations that ranged between 63.0% and 163.5% of the corresponding IA using the joint protocol. Relative SDs in parallel determinations within given laboratories, WLSDs and ILSDs were 0-10.5%, 0.6-16.6% and 15.5-31.6%, respectively. The data emphasize the importance of a standardized protocol among laboratories for comparable quantitative Cry1Ab toxin determination. However, even when using a standardized protocol, significant differences still occur among toxin concentrations detected in different laboratories although with a smaller range of variation.

TH 68-72: Diptera taxonomy

TH 68
First record of the genus *Alliocera* with one species and *Beris chalybata* (Forster, 1770) from Turkey (Diptera: stratiomyidae)

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Alliocera graeca Saunders, 1845 and *Beris chalybata* (Forster, 1770), known as European species, are new records for the Turkish Fauna. The female of *Alliocera graeca* and the male of *Beris chalybata* are redescribed and photographs of two species are accompanied. Distribution of these species treated is briefly discussed.

TH 69
New contribution to information about Tabanidae (Diptera) adult and larvae from West Anatolia

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In this paper, the habitats of Tabanidae larvae in West Anatolia were studied for the first time. The larvae of 25 horse flies species and subspecies had been collected in several points differed by biotopical conditions and identified. Descriptions of new subspecies of *Haematopota pallens bozdagensis* ssp. nova, and its larva as well as unknown earlier larvae of *Tabanus portschinskii* Olsufjev, 1937, *Philipomyia graeca* Fabricius, 1794, *Dasyrhamphis carbonarius* Meigen, 1820 and *Nemorius abbassianae* Leclercq, 1960 were given.

TH 70
New Systematic Knowledge about *Tabanus karaosus* Timmer 1984 (Tabanidae: Diptera) from Turkey

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Flies of the family Tabanidae are common, widespread pests, known to take blood meals from many mammals including humans, and are known vectors of a number of diseases. Tabanidae is wide family that represented with 167 species in Turkey, have possesion of sober importance on economical and medical bevel. Allotype description of *Tabanus karaosus*, member of this family that was described on 1984 by Timmer, firstly accomplished on this study. Distribution of this species on Turkey is exhibited and variations demonstrated with assembled samples comparison by holotype descriptions. Taxonomical characterters of male specimens, also illustrations of male and female genitals were given in this study for the first time.

TH 71

Four genera and seven species as new records for Iran hover flies fauna (Diptera; Syrphidae) from East Azerbayjan province

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Syrphidae is one of the largest families of the order Diptera with more than 6000 described species over the world. Considering the ability to keep the body motionless in the air for quite a period of time during flight as well as visiting the flowers, they popularly called hover flies or flower flies. Larvae pray on aphids, scales and other insects so they could be considered as one the biological control agents. A survey was conducted on Syrphid fauna in East Azarbayjan provinc-Iran during 2008- 2009. Four genera and seven species were identified as new records for Iran insect fauna which listed as follow: *Anasimyia* Schiner, 1864, *Chalcosyrphus* Curran, 1925, *Baccha* Fabricius, 1775, *Spazigaster* Rondani, 1843, *Anasimyia contracta* Claussen & Trop, 1980, *A. transfuga* (L.), 1758, *Chalcosyrphus nemorum* (Fabricius), 1805, *Baccha elongate* (Fabricius), 1775, *Spazigaster ambulans* (Fabricius), 1798, *Chrysogaster virescens* Loew, 1854 and *Lejogaster metallina* (Fabricius), 1776.

TH 72

A geometric morphometric variation study in five geographical populations of *Shaerophoria scripta (Diptera: Syrphidae)* in Iran

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Morphological variation in five geographical populations of *Shaerophoria scripta*, one of the most important natural enemies of aphids in Iran was investigated. Totally 113 specimens were sampled from different climates including Ramsar, Tonekabon (Mazandaran Province), Parsabad (Ardabil province) Eghlid (Fars Province) and Kaleybar (Gilan Province). Fifteen landmarks on the fore wing were selected and their variation was analyzed. Raw data were analyzed using geometric and mathematical calculations in a Kendall's shape space. Multivariate analysis was carried out by transforming data to Tangent Space. One hundred twenty two images of front wing and partial warp scores were analyzed by partial warp analysis, cluster analysis, Canonical discriminant function, and canonical variate analysis. The results showed a significant morphometric difference between Eghlid and Parsabad populations with maximunm morphological distance while Tonekabon and Eghlid had the least one. The first two relative warps showed 58.42% of the total variation among populations. The result could be used, as a prerequisite for any further study of the natural enemy biology and its using in different climatic conditions.

TH 73-76: Plecoptera taxonomy

TH 73

Review of the status of two threatened stonefly species (Plecoptera) in southern Iberian Peninsula

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In the last years, a national project on the conservation status of Spanish invertebrates (Proyecto Atlas) is being carried out with the aim of updating the Red Lists of Threatened Species by means of distribution mapping and population monitoring of particular species. Two species of Plecoptera, *Leuctra bidula* Aubert, 1962 and *Nemoura rifensis* Aubert, 1961, have been deeply studied. The former, endemic of a mountain system from southern Iberian Peninsula and known only by a few specimens collected in 1960 and 1994, has not been found in the sampling campaigns done. The latter, distributed in the Rift (Morocco) and southern Spain, had been collected in only one occasion (and with only one male) in Europe, particularly in a stream from Sierra de Grazalema in 1960. After a complete sampling campaign, we have found only some individuals inhabiting the same stream. From these results, we have proposed their inclusion in the CR (Critically Endangered) IUCN category. Data on their historical and current distribution and threat factors are presented.

TH 74

Nymphal trophic behaviour of two Nemouridae species (Insecta, Plecoptera) in the Curone creek (northern Apennines, Italy)

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Knowledge of specific aspects of the feeding behaviour and feeding requirements of animals is indispensable in acquiring an insight into the competition, coexistence of similar species, availability of food and niche overlapping. Here, we present the results of a study on the feeding habits of the Euholognathan stoneflies *Nemoura hesperiae* Consiglio, 1960, an Italian endemism, and *Amphinemura sulcicollis* Stephens, 1836, a widely distributed species in Europe, in a little stream of northern Italy. *Nemoura hesperiae* fed mainly on coarse particulate organic matter (CPOM), together with detritus, while *A. sulcicollis* fed principally on detritus and, in a lower concern, on CPOM. Other minor components of their diet were fungi hyphae and spores. Algae and animal remains were also found punctually in some individuals. Thus they can be catalogued fundamentally as shredder and collector-gatherer respectively. Shifts on diet composition were detected in relation to size in both taxa. Probably niche overlap does not exist despite both species have similar size and nymphal development duration and coincide in time, though more precise studies are needed to through light on this matter. Furthermore, significant differences were found in detritus, CPOM and fungi spores content between both species that would support their inclusion in different functional feeding groups (FFG). This work supports that, though this grouping into FFG is very useful, they should not be inferred from related species or higher taxonomical levels. Even intra-population differences and ontogenetic shifts should be considered in fine scale studies.

TH 75

Study of flight period and adult size variations in an altitude gradient in Río Trevélez (southern Iberian Peninsula)

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Within the frame of a project on the effects of climate change on stonefly populations from Sierra Nevada Mountains (Granada, Spain), we have studied several aspects of the biology of 15 species. Particularly in this communication we present the results of a study on the adult phenology in the Trevélez stream at three different altitudes (approximately 1500, 2000 and 2500 m.a.s.l.) and during two years (June 2008 to June 2010). Its aim was to detect: 1) global variation in the flight periods of the studied species in relation with altitude/temperature; and 2) if this pattern

affect differently both sexes. Furthermore, a biometric study was done to observe if: 1) size variations exist in relation to altitude/temperature for species inhabiting at different altitudes and if those variations affect equally both sexes; and 2) size variations throughout the flight periods are more or less notable in relation to altitude/temperature, considering that females and males have differences in nymphal development.

TH 76
Preliminary data on the biology of the cavernicolous stonefly *Protonemura gevi* (Plecoptera: Nemouridae)

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We present some preliminary data on the life cycle and nymphal feeding of *Protonemura gevi*, a recently described species inhabiting a cave in southern Iberian Peninsula. This species has been collected only in this cave, despite the numerous samplings that have been carried out in nearby streams. Probably as an adaptation to a cavernicolous life it has reduced eyes and long antennae in relation to its body length, and both sexes are brachypterous. It seems that *P. gevi* has a univoltine non seasonal life cycle, with mature nymphs collected in several months and, sometimes, nymphs of different sizes (and so developmental stage) present at the same time. This indicates that the species has an asynchronous egg hatching and that several cohorts live at the same time, showing a clear cohort overlap. This is also reflected in the presence of adults in every month we reach to sample. This type of life cycle may be a consequence of the absent of clues such as temperature or photoperiod, due to the environment where nymphs (and also adults) are found is in total darkness and has an almost constant water temperature along the year. The nymphal gut content analyses show that the most ingested trophic resource is detritus, but also fungi hyphae, spores, and coarse particulate organic matter are ingested, together with mineral matter. Nevertheless, a deeper study with a higher number of individuals should be carried out before drawing a conclusion.

TH 77-80: Versatile conventional entomology

TH 77
Description of spermatheca and eggs of Eurygaster Austriaca (Schrank, 1778), (Heteroptera: Scutelleridae)

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Sunn pets (*Eurygaster spp*. including *Eurygaster austriaca*) is as known, is one of the most dangerous pest of wheats and other small grains, not only of Turkey, but nearly the whole of the middle east up to Middle Asia including as well as Bulgaria, Romania in the Balkans. Wheat bug (*Eurygaster* spp. and *Aelia* spp.) has reduced both wheat yield and quality in Turkey and its neighbours for years. Therefore, it is economically important species. In this study; Spermatheca morphology and egg of *E. austriaca* (Schrank, 1778), were studied by optical and scanning electron microscopy (SEM). The spherical shaped eggs were average1.05±0.05 mm in diameter. Each female was shown to deposit generally 14 eggs in a mass. Newly laid eggs were green, then their color slightly changes and starts pigmentation under the chorion and red eye spots and egg burster have appeared in the last phase of embryonic development. Egg surface are covered clearly marked polygons pattern with tubercles. One or more dome shaped granules are situated in the central area of some polygons. In *E. austriaca,* there is a ring of widely separated aero-micropyles around the anterior pole. The well-marked operculum intersects the ring of 17-19 aero-micropyles.Their shapes are similar to a truncated cone with an orifice at the apex. Egg-burster of Austriaca is thick and highly sclerotized. It is easily seen with a dark T-shaped or triangular configuration in the hatched egg. Hatching begins by peristaltic contraction of body of prolarva from the back to the front forcing the sharp sclerotized teeth of the egg-burster against the anterior pole of the egg. The egg-burster on hatched eggs does not separate from them and adheres by its tail to the inner lateral side of the egg.

The spermatheca of *E. austriaca* has a spermathecal bulb, a pumping region, distal and proximale flanges, spermathecal ducts and genital chamber. Spermathecal bulb is spherical, scleritized and its surface is covered with pores. *E. austriaca* have two scleritized pump flanges (distal and proximal flanges) and they are distant from the bulb. Distal pump flange is collar shaped and located under the pumping region Proximal flange is concave plate shaped and is located between distal and proximal spermathecal ducts. Distal spermathecal duct is very thin and sclerotized, but proximal duct is muscular, convoluted and accordeon shaped. Proximal duct is connected with anterior vagina.

TH 78
Faunistical and zoogeographical evaluations on the family Elateridae (Coleoptera) of the Western Black Sea region of Turkey

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In this study, Elateridae fauna and its zoogeographical structure of the Western Black Sea region of Turkey were tried to be exhibited. Research materials were collected from research area in 2008 – 2009 As a result, determination of species of collected specimens, 33 species were detected belonging to 19 genera and 5 subfamilies. Species numbers of subfamilies and genera are given in graphs. Distributions in Turkey and zoogeographical distributions of species were detected from present literature and shown in a table.

TH 79
Introduction to the fauna of Scoliidae (Insecta: Hymenoptera) in Fars province, Iran

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In order to study of Scoliidae fauna (Insecta: Hymenoptera) in Iran some specimens were collected at different localities in Fars province during 1998-2005. A total of 9 species and subspecies of 4 genera belonging to Campsomerini and Scoliini tribes of Scoliinae were determined. Among them 4 species which are marked with an asterisk are new records for Fars province. The specimens listed as follows:

Scoliinae, Campsomerini

Campsomeriella thoracica (Fabricius, 1787)*
Dasyscolia ciliata araratica (Radoskovsky, 1890)
Dasyscolia ciliata ciliata (Fabricius, 1787)*

Scoliinae, Scoliini

Megascolia (Regiscolia) maculata maculata (Drury, 1773)
Scolia (Scolia) anatoliae Osten, 2004*
Scolia (Scolia) fallax Eversmann, 1849
Scolia (Scolia) flaviceps Eversmann, 1846
Scolia (Scolia) sexmaculata sexmaculata (O. F. Müller, 766)*
Scolia (Scolia) sexmaculata orientalis (Steinberg, 1962)

Of these, *Dasyscolia ciliata ciliata* (Fabricius, 1787) is new to the fauna of Iran and Near East.

TH 80

Parthenogenetic weevil species of the genus *Otiorhynchus* (Coleoptera: Curculionidae: Entiminae: Otiorhynchini) in the Tatra Mountains - review of ecological and zoogeographical patterns

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The present distribution of weevil species in central Europe is the result of their glacial and postglacial history and the impact of recent anthropogenic transformations on environments. Parthenogenetic weevil species, especially of the genus *Otiorhynchus* play a key role in the understanding of the evolutionary processes within the biogeographical framework that has generated current ranges and the genetic diversity of different populations. In the Tatra Mountains, the highest and most impressive section of the Carpathians, we studied 9 parthenogenetic species (35% of all *Otiorhynchus* spp. recorded there), representing by 6 triploid forms (*Otiorhynchus ligustici, O. ovatus, O. pauxillus, O. scaber, O. lepidopterus, O. proximus*) and 2 tetraploid (*O. nodosus* and *O. scaber*), and of *O. austriacus* and *O. rugosus,* which the level of ploidy is not yet known. All these weevils are brachypterous and polyphagous, and live in different biotopes and biogeographical regions of the Tatra Mts. The largest populations create *O. scaber, O. rugosus* and *O. lepidopterus*, while *O. nodosus* reaches the highest altitude - up to 2300 m. These results are the base for the further molecular studies.

TH 81

Papilionidae, Pieridae and Danaidae (Insecta: Lepidoptera) of the Caldera of Lubá. Bioko Island (Equatorial Guinea)

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Located in the South of Bioko Island, the volcanic Caldera of Lubá represents the only sample of the monsoon forests in Equatorial Guinea. Declared Scientific Reserve in 1997, the first records about its flora and fauna diversity were obtained during the scientific expeditions carried out by the Universidad Politécnica de Madrid in the years 2005 and 2007. Both expeditions were done with correspondence to the Spanish Investigation, Development and Innovation (I+D+I) National Plan: CGL2005-23762-E and CGL2006-27110-E/BOS

In the present piece of work are showed the first results of the Papilionidea, Pieridae and Daneidae families.

Among the total 16 species, referred for the first time to the inside of the Caldera of Lubá, two mean the first quotes in Equatorial Guinea (*P. charopus juventus* Le Cerf (Papilionidae); *Amauris vashti* Butler, 1869 (Danaidae), and two are registered in Bioko Island for the first time (*P. phorcas congoanus* Rothchild (Papilionidae); *Nepheronia argia* Fabricius, 1775 (Pieridae).

TH 82-84: Sensory ecology (Pheromones)

TH 82

Do aphids and their predators use the same OBP to transport a same odour?

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Insect odorant-binding proteins (OBPs) are small, water-soluble molecules that are thought to transport the hydrophobic odorants to their receptors in the chemosensory neurones. In aphids, several OBPs were cloned from *Acythospihon pisum*. In particular the recombinant protein named "OBP3" exhibited remarkably binding affinities with the major component of the aphid alarm pheromone (E-beta-farnesene or EBF). Although similarity between OBPs of the same aphid species is poor, there is a high level of conservation between OBP of the same type.

As aphid predators such as hoverflies and ladybirds also use EBF to locate their prey, we investigated the presence/absence of an OBP3 in the hoverfly *Episyrphus balteatus* and the ladybird *Harmonia axyridis*.

A standard PCR cloning strategy was used to isolate the cDNAs of OBP3 from *E. balteatus* and *H. axyridis*. Identification of the deduced amino acid sequences as OBP was confirmed by BLASTP analysis. The predicted translated products have a typical 6-cysteines signature of OBPs. Surpisingly, comparison of these sequences with those of aphid OBP3 revealed a high percentage of identity (around 98%.). These results suggest that aphids and their predators use the same OBP to transport a same odour such as EBF. As OBP3 was found in females of hoverflies as well as in cDNA from males, we are currently investigating the expression level of OBP3 genes according to sex and age using quantitative real time-PCR.

TH 83

New faunistic records of the honey locust gall midge, by newly developed pheromone traps

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Invasive insect pests appear more frequently than ever in Europe, the driving forces being both climate change and logistics. Early detection can be a key issue in developing new, environmentally sound control methods. Gall midges (Cecidomyiidae) typically have a highly synchronized flight, making pheromone traps a suitable tool for detection.

The honey-locust gall midge, *Dasineura gleditchiae* Osten Sacken (Diptera: Cecidomyiidae) reached Budapest some years ago. The midge cause conspicious damages on ornamental trees in cities/urban ecosystems. This triggered the identification of the *D. gleditchiae* sex pheromone.

Based on reports of *D. gleditchiae* spreading as far north as central Germany, a pilot study using pheromone traps was done in Alnarp, Sweden, in 2008.

Results showed en-mas occurrence: hundreds of adult males were captured daily. Visual observations revealed larvae on

the wild host plant, as well as on two cultivars „Sunburst" and „Shademaster", associated with serious damage.

A mirid bug, *Pinalithus (Orthops) cervinus* Herrich-Schäffer, was found as a natural enemy. It sucks the galls, and, as an indirect effect, the larvae of the midge will perish.

TH 84
New prospects of insect pheromones application for the number regulation of dangerous species

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The violation of normal reproductive links in the pests populations is the perspective trend, forwarding the development of ecological plant protection.

The novel suggested method (dissemination method) consists in the population «inundation» with the insects, possessing the pheromone mark of the target species that is sticked on the insects and carried over the stations.

At that, both target species and representatives of different insect species and orders that are massively present in the cenosis are used as the pheromone mark carriers.

When testing the method in the apple orchard, *Lithocolettis pyryfoliella*, *Grapholitha funebrana* and *Grapholitha molesta* were used as the codling moth pheromone carriers. The study of pheronome compatibility of mentioned species did not show a considerable mutually negative effect, so it proves earlier known data and enables to use them in the dissemination method development.

The studied migration abilities of species make it possible to obtain data about their abundance and vertical distribution on the studied area that is necessary for optimal distribution of applying facilities in the cenosis.

For the application of pheromones specially developed applying facilities were used, the construction of which prevents the preparation pheromone form from the exposure and allows to apply the ceiling of pheromone on the attracted insects.

The pheromone preparation form represents the fine-dispersed powder – wax of natural origin, one of the hardest waxes (t° of melting - 78-85° C), with electrostatic ability to stick to insect cuticle and capable of providing more prolonged pheromone emission.

Preliminary testing of the method showed efficacy of disruption of pests chemical communication at the level of 90% during 1-2 weeks that appeared to be insufficient and required further investigations.

TH 85-91: Social insects and apiculture

TH 85
Volucella bombylans (Syrphidae, Diptera) Recorded from a Colony of *Bombus mesomelas* (Apidae, Hymenoptera) in Iran

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Bumblebees, have special economic importance because of their role in the pollination of pasture plants as well as horticultural and greenhouse crops. These bees are abundant in the mountainous regions of Iran. During excavation in the summer of 2009 of a colony of *Bombus* (*Thoracobombus*) *mesomelas* Gerstaecker around Moeil, a village on the lower slopes of the Sabalan Mountains in Meshkinshahr of Ardabil province, larvae of *Volucella bombylans* (Linnaeus, 1758) were collected from the nest. The nest was transferred to the laboratory and fed by sugar and pollen for further study. *V. bombylans* is a species of hover fly known previously from the nests of several different bumblebee species. This is the first record of this fly from a bumblebee colony within Iran. Adults of the fly are very similar in colour pattern and size to some bumblebees and therefore appear to mimic them. Their flight is also very similar to that of the bumblebees, so that they could be mistaken with bumblebees when flying. The bumblebee nest was situated in a deserted bird's nest 60 cm below the ground. Twenty eight pale new queen bumblebees were collected from this mature nest. Larvae of the fly were a dirty whitish-yellow color and vermiform. Their mean length was 24 mm. Their integument was hard and wrinkled; the body tapers anteriorly and at the broader posterior end there were, characteristically, six long spines. There were also two rows of small spines running along either side of the body. Posteriorly, on the dorsal surface, there was a prominent reddish-brown respiratory siphon. Larvae of this fly can attack bumblebee brood and could be harmful when there is a heavy nest infestation. Although most of the larvae were found below the comb feeding on nest debris, some were at the entrance to the nest. It is assumed that these larvae had been moved to the entrance by workers.

TH 86
Mites Species Associated with Bumblebees (*Bombus* spp.) in Iran

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Bumblebees, are economically important insects, commercially reared for pollinating various crops. In this survey, a total of 417 bumblebee specimens belonging to 19 species and 9 subgenera were collected. Of them, *Bombus terrestris* was the most frequent species (44.8%). Sixty-eight specimens of 8 bumblebees species (*B. terrestris, B. persicus, B. humilis, B. niveatus, B. argillaceus, B. ruderarius, B. lucorum* and *B. armeniacus*) were dissected and their air sacs examined for the endoparasitc mite *Locustacarus buchneri* (Stammer) but no infestations was obvserved. We also examined these specimens for other mites and found 9 phoretic mite species.: *Astigmata*: *Kuzinia laevis* (Dujardin, 1849) (Acaridae), *Thyreophagus corticalis* (Michael, 1885) (Acaridae), *Prostigmata*: *Scutacarus acarorum* (Goeze, 1780) (Scutacaridae), *Mesostigmata*: *Parsitellus fucorum* Willmann, 1939, *Parsitellus sp. nov.1*, *Parsitellus sp. nov. 2* (Parasitidae), *Pneumolaelaps hyatti* (Evans & Till, 1966), *P. marginepilosa* (Sellnick, 1940) (Laelapidae), and *Proctolaelaps longisetosus* (Postner, 1951) (Ascidae). One species (*Thyreophagus corticalis*) recorded on the bumblebees for the first time and six species was new records for Iran mite fauna (*Thyreophagus corticalis, Scutacarus acarorum*, *Parsitellus* sp. nov.1, *Parsitellus* sp. nov. 2, *P. marginepilosa* and *Proctolaelaps longisetosus*). Mites were most abundant on *B. terrestris* (33.3%), *B. lucorum* (26.9%) and *B. ruderarius* (27.3%), with the mean infestation of 2.21 mites per each *Bombus* specimen. *Kuzinia laevis* was most abundant on *B. terrestris* ("15 number of *K. laevis* hypopi on workers") and least abundant on *B. persicus* (one number). Deutonymphs of *K. laevis* were commonly found on the propodeum. There were no *K. laevis* on *B. persicus* and *B. niveatus*.

TH 87

Mutilla saltensis (Mutillidae, Hymenoptera) a parasite of *Bombus armeniacus* colony in Iran

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Bumblebees are abundant in the mountainous regions of Iran. Finding of their nest which usually built underground could be one of the best ways to study their field biology, ecology and interactions with other associated organisms. During excavation in the summer of 2009 of a colony of *Bombus* (*Thoracobombus*) *armeniacus* Radoszkowski, 1877 close to Shirvandarreci (means Valley of Shirvan; name of a person) near Shabil on the lower slopes of the Sabalan Mountains around the city of Meshkinshahr of Ardabil province, North-West Iran, females of *Mutilla saltensis* Radoszkowski, 1885, were collected from the nest. The nest was completely brought out and transferred to the laboratory. The colony was fed with sugar and pollen and maintained for further study. Mutillids are known as parasitoids on the enclosed immature of other insects like solitary and social bees. Adults are covered with dense velvety hairs and females sting severely and painfully when they are disturbed. Eighty species in 23 genera of family Mutillidae were recorded for Iran previously. Of these *Mutilla saltensis* is a species which was previously recorded from Sabalan, but its host was not known previously. This is the first record of this wasp gathered in a bumblebee colony within Iran. *Mutilla saltensis* have been recorded previously only from *B.* (*Thoracobombus*) *humilis* Illiger, 1806 in the world. Females are wingless and very similar to Mutilla europaea Linnaeus, 1758, in appearance and not easy to distinguish from this species. The bumblebee nest was situated in a desert bird's nest 56 cm below the ground. Thirty-two pale new queen bumblebees and 46 workers, 18 males and many larvae and pupa were collected from this mature nest. Nest structure and casts characters of bumblebees as well as female velvet ant with drawings and images discussed.

TH 88

A Nest Restoration Case by *Bombus* (*Megabombus*) *argillaceus* (Scopoli, 1763) (Hymenoptera: Apidae) from Turkey

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Bombus (*Megabombus*) *argillaceus* (Scopoli, 1763) is one of the widely distributed species in Turkey. However there is little information about its nest architecture. Here we defined a case of nest restoration by *B. argillaceus* from Kahramanmaraş province of Turkey. It was found that, the nest previously had been used by a small wasp colony, then after invaded and reused by *B. argillaceus* queen. Nest site characteristics, architecture and material were analyzed. One queen, 12 workers and 15 male specimens were recovered from the nest. 38 brood cells with 32 male and two female pupae were found. Also six empty brood cells and eight honey pots were discovered in the nest. The sizes of all brood cells with pupae were measured. The plant compositions of surrounding area of the nest were determined.

TH 89

Flower preferences of Megachilidae (Apoidea: Hymenoptera) in the Mediterranean Region of Southern Turkey

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The main objective of this study is to investigate the flower preferences of Megachilidae (Apoidea: Hymenoptera) species that are distributed in Mediterranean Region of southern Turkey. Field studies were performed in spring and summer between 2008 and 2009. All bee specimens were collected while they were visiting flowers. Meanwhile, the flowers that have been visited by bees also recorded or/and collected for diagnosis. In total, 14 provinces were checked. As a result, 230 bee specimens from 15 genera and 50 species were determined. 63 plant taxa were found related with these Megachilidae species. Most common genera and families of visited flowers were discussed regarding the plant taxa preferences of these species.

TH 90

Control of Wax Moth, *Galleria mellonella* L. (Lep.: Pyralidae) with Male Sterile Technique

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In this study, the control of wax moth using male sterile technique(MST) with gamma-ray were examined. In order to determine the safe and effective dosage of gamma-ray to sterilize male pupae of the wax moth , an experiment was conducted in a complete randomized design with 5 treatments and 5 replicate with 50 male pupae in each replicate. Treatments included different levels of gamma-ray dosage with zero, 250, 300, 350 and 400 gray.

Release ratio of sterile to normal males was also studied in a similar experiment. Treatments included sterile-males, normal-males and virgin-females with the ratios of 1:1:1, 2:1:1, 3:1:1, 4:1:1 and 5:1:1. The possible parthenogenesis reproduction of this pest was also studied. The results showed that the best dosage to sterilize male pupae of the wax moth was 350 grays of gamma-ray. The best release ratio was four sterile males, one normal male for each normal female(4:1:1). Also females cannot produce offspring without males.

TH 91

Development of eco-friendly, low cost hives for the Asian honey bee *Apis cerana* Fabr.

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A great hindrance in the development of bee industry with the honey bee *Apis cerana* has been its inherent behaviour to swarm and abscond. The Thai sac brood virus disease epidemic further reduced interest and enthusiasm amongst the farmers and beekeepers in the beekeeing with this species. The population of this important pollinators in our agricultural, horticultural and forest ecosystems, and a resource base of local bee industry is declining at rate threatening extinction. In order to conserve this important

genetic resource it was felt important to evolve some indigenous, eco-friendly, rurally acceptable and economically viable technologies for the farmers and beekeepers so as to revive their interest in beekeeping with this species. Three types of hives viz., straw hive, orchard hive and modernized wall hive making use of raw materials available on the farmers field were developed. Honey bees were scientifically established in these hives and experiments were conducted to evaluate efficiency with respect to colony build up, frugality and successful overwintering. Results revealed that the bees adapted to these hives and ecological and biological characteristics were significantly better in low cost easily made hives. These have found good acceptance among the rural people and are being adopted.

TH 92-96: Non-insects entomology

TH 92
Availability of terrestrial isopods in habitat qualification

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Alfa diversities alone give no information about the function and nature of species and habitats. Diversity can be rather different irrespective of a habitat's disturbance level. Indices containing species qualifications might help in evaluations in a nature conservancy point of view.

We propose an additive index (Terrestrial Isopod Naturalness Index=TINI) that might be helpful in conservationist evaluation of species and habitats. Terrestrial isopods (Isopoda: Oniscidea) as ground dwelling macro-invertebrates have a low dispersion ability and are rather sensitive to some environmental key factors (eg. moisture conditions, shelter sites and disturbance). Species with narrow tolerance limits are highly stricted to certain habitat types while others are widely distributed and occur under broad variety of conditions. Their occurence can be of indicator value.

Based on previously characterised species of Hungary we propose a system for qualification both species and habitats regarding naturalness (based on the species composition of assemblages).

The proposed index contains three main elements: distribution of spp on different biogeographical scales (global, European and regional ones;1-5 scores), their frequency within the evaluated region (up to 5 scores), and their naturalness – disturbance tolerance (max. 10 scores). Alltogether max. 20 scores. Frequency means the rate of positive UTM grids compared to the total searched ones in a region. Naturalness is ranked by the species' habitat selection: habitats are characterised by their vegetation (ÁNÉR national system).

Evaluation of a habitat means the sum of additive indices of the occuring isopods standardised by the number of species (Σ (TINI*N_i/N)).

TH 93
Two heterostigmatic mites (Acari: Heterostigmata) associated with beetles (Insecta: Coleoptera) from Iran

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A large number of mites are associated with insects. Mites of the cohort Heterostigmata (Acari: Trombidiformes) exhibit different kinds of symbiotic relationships with variety of insects including Coleoptera. Some preliminary studies regarding to heterostigmatic mites associated with beetles in Golestan province (Northern Iran) in 2009 led to collecting two species of the families Acarophenacidae and Caraboacaridae. Most of acarophenacid mites are parasitoid of host's eggs but caraboacarid mites are usually phoretic under elytra of carabid beetles. We found one specimen of *Acarophenax mahunkai* Steinkraus and Cross under elytra of a tenebrionid beetle, which is the second record of this mite from Iran. We also found two colonies of *Caraboacarus karenae* Nickel and Elzinga under elytra of two carabid beetles. This species has been previously reported from Chile and USA but its record is new to mite fauna of Iran.

TH 94
First record of the *Caraboacarus krczali* Eidelberg, 1994 (Acari: Caraboacaridae) associated with *Calosoma* sp. (Col.: Carabidae) from Iran

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Family Caraboacaridae (Acari: Heterostigmata) is associated with different carabid beetles which adult female mites usually harbor under elytra of the host beetles. This family includes two genera and seven species, and is distributed in throughout the world, except Australasian and Oriental regions. Following a preliminarily study of heterostigmatic mites associated with beetles in Kerman province, Southern Iran in 2009, we found one specimen of *C. krczali* under elytra of one carabid beetle belonging to genus *Calosoma*. It is the first record the *C. krczali* from Iran. Previously, this mite has been found on different species of the *Calosoma* in Ukraine, Russia and Senegal, along with which our recent finding in Iran, it is conceivable that this mite has host specificity on carabid beetles of the genus Calosoma.

TH 95
Effect of temperature on prey consumption of *Typhlodromus bagdasarjani* (Acari: Phytoseiidae) feeding on nymphs of *Tetranychus urticae* (Acari: Tetranychidae)

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Typhlodromus bagdasarjani Wainstein & Arutunjan (Acari: Phytoseiidae) is a generalist predator recorded in plants infested by phytophagous mites. The objective of this research was to determine the prey consumption of different life stages of *T. bagdasarjani* as a biocontrol agent of *Tetranychus urticae* Koch at various temperatures. The experiment was conducted in an incubator under conditions of 60±10% RH, 16:8h (L: D) and temperatures of 15, 20, 25, 30 and 35ºC. Newly laid eggs of the predator were put individually on bean leaf discs, and after the emergence of larva, a given number of *T. urticae* nymphs with corn pollen were added daily to the discs. The number of prey killed per individual predator was recorded daily. The highest daily prey consumption of protonymphs (3.52 preys/day) and deutonymphs (3.96 preys/day) was observed at 25ºC. The total prey consumption of the nymphs was also observed at the same temperature. A similar trend was observed in preovipositon period. During the oviposition period, the highest number of daily consumed preys occurred at 35ºC (10.95 preys/day). However, the values obtained at 20, 25 and 30ºC were not significantly different. In postoviposition phase, the highest and the lowest values for daily prey consumption were observed at 30 and 15ºC, respectively.

The total prey consumption of females during their entire life was highest at 20ºC (432.73 preys) and lowest at 15ºC (274.69). Although at higher temperatures, daily prey consumption was observed to be more, the efficiency of this predator in control of *T. urticae* population would be higher at lower temperatures (20 to 25ºC). This is due to the longer life span of females at these lower temperatures which results to more total prey consumption.

TH 96
Some scutacarid mites (Acari: Scutacaridae) associated with ants (Hym.: Formicoidea) and their nests from Iran

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The nests of social insects provide and entertain a suitable habitat for a vast numbers of arthropods including the mites. Cohort Heterostigmata (Acari: Trombidiformes) harbor a variety of mites associated with ants embracing fungivorous scutacarid mites (Eickwort, 1990). Genera *Imparipes* and *Scutacarus* include the most myrmecophilous species in family Scutacaridae (Khaustov, 2008). Ants associates have been poor studied in Iran. During some samplings on ants and their nests in Northeastern Iran in 2006-2007, five species of the mentioned genera were found. All records are listed below, among which 3 species are marked with an asterisk, showing new species to mite fauna of Iran. Host ants are pointed out in crochet.

1) Imparipes (Imparipes) hystricinus* Berlese, 1903 [Cataglyphis cf. nodus (Brulle)]

2) *I.* (*I.*) *kugitangensis** Khaustov and Chydyrov, 2004 [*Lepisiota semenovi* (Ruzsky)]

3) *Scutacarus subquadratus* Khaustov and Chydyrov, 2004 [*Cataglyphis* cf. *nodus* (Brulle)]

4) S. apodemi Mahunka, 1963 [Camponotus buddhae Forel]

5) *S. transfusionis** Mahunka and Mahunka-papp, 1980 [*Camponotus aethiops* Latreille].

67: Carabid ecology

Room Brussels

Enhanced carabid diversity and abundance in Hungarian set-aside fields

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The practice of setting-aside arable fields for a maximum of three years have been introduced as part of special agri-environmental schemes in Hungary at the Environmentally Sensitive Areas (ESA) in 2002. These fields are sown with a seed mixture after the last harvest and mown once per year at the end of June. We studied the potential benefits of this set-aside management for carabids, comparing one, two and three years old set-asides, winter cereal fields and semi-natural grasslands in the Heves ESA, NE Hungary, in 2008. Five pitfall traps per field (195 traps in total) were exposed three times for one week in May and June; the samples were identified to species . Species richness and abundance of carabids were tested against field type using General and Generalised Linear Mixed Models. Effects of plant species richness, vegetation height and the extent of bare ground were analysed with the same model structure. We collected 23382 individuals of 77 carabid species in total. Species richness was similar in winter cereal fields and semi-natural grasslands and significantly higher in one- and two-years-old set-asides. The abundance of carabids did not differ between winter cereals and grasslands, but was significantly higher in one-year-old set-asides than in cereal fields.All the set-asides had higher abundance than semi-natural grasslands. The plant species richness and vegetation height showed a positive effect on carabid species richness. Owing to the tall, species rich vegetation, younger set-asides provide appropriate habitat for high number of carabid species and especially the one- and three-years-old set-asides harbour high abundance of carabids. This emphasises the importance of maintaining set-aside management in the Hungarian agricultural landscapes.

Spatial pattern and edge effect of carabids along oak-hornbeam forest-grassland transects

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The spatial distribution of carabid species and the influence of edges on their diversity were studied along forest-grassland transects using pitfall traps in the Aggtelek National Park, Hungary. The location of boundaries between the adjacent habitats was identified using a moving window technique and multivariate analyses. Carabids of the forest interior, forest edge and grassland were separated from each other by the ordination, suggesting that all three habitats had a distinct species assemblage. The study revealed a significant edge effect on carabids. Species richness was significantly higher in the forest edge and the grassland than in the forest interior. The study suggested that the elevated species richness of the forest edges was due, in addition to the edge-preferring species, to the presence of species typical of adjacent habitats (forest interior and grassland). This highlights the importance of forest edges in nature management, as they operate as source habitats for dispersal processes contributing to the carabid recolonisation in the adjacent habitats, after habitat destruction. This result also emphasises the significance of forest edges during the succession and regeneration of adjacent disturbed habitats.

Seasonal dynamics of beetle (Insecta, Coleoptera) assemblages in different dune habitats of the Curonian Spit (Lithuania)

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The investigation of beetle abundance and species composition was carried out in the Curonian Spit in May–October 2008. Pitfall traps were used; which were checked at fortnightly intervals. Nine plots in different dune habitats were selected: burnt *Pinus montana* forest, burnt and cut *Pinus montana* forest, dune pine *Pinus sylvestris* forest (Alksnynė), old-growth mixed forest, grey dunes overgrown with lichen and moss, grey dunes with lichen, moss and *Poaceae* sp., *Alnus glutinosa* forest, white dunes with *Leymus* sp. and bare white dunes. The investigation was aimed at establishing abundance and species composition dynamics of epigeic arthropods in the different habitats of the Curonian Spit. A total of 108 samples were analysed and 5,310 specimens of 237 species belonging to 33 beetle families were identified. Carabidae prevailed in most of the investigated plots. Beetles of this family were the most abundant at the end of August and at the beginning of September. Several *Pterostichus* ssp. were dominant from early June to early September. The greatest number of beetle individuals (range 555-842) in all plots was recorded in August. The greatest number of species (98–105) was found in May–June. The smallest number of beetle species during the study period was captured in mid- September – 43 species and 224 individuals. The highest diversity of species was recorded in old-growth forest from May to June, and in *Alnus glutinosa* forest from June to November.

Comparing seasonal dynamics by a graphical method to assess the reactions of ground beetles (Coleoptera, Carabidae) to urbanisation

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We suggest the adoption of a graphical method, involving a quantification of the seasonal activity and the subsequent comparison by a percentile-percentile graph as an easy way to compare seasonal activities in arthropods. To test the suitability of the suggested method, the seasonal dynamics of three common ground beetles, *Pterostichus melanarius, Nebria brevicollis* and *Carabus nemoralis* was compared along an urbanisation gradient near Sorø, West Zealand, Denmark, during April - October 2004 and 2005. The selected species were sampled in forest or forest fragments in three habitats: rural, suburban and urban. Activity in urban habitats often started earlier, possibly caused by warmer microclimate. The comparative graphs indicated the unsuitability of the suburban habitat for *N. brevicollis,* and the differential suitability as overwintering habitats of the three urbanisation stages for *C. nemoralis*. The method seems suitable to analyse differences in seasonal activity.

Phenological changes in ground beetle (Coleoptera: Carabidae) communities at two Environmental Change Network sites in Scotland

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Climate change - induced phenological changes in the life history of plants and animals can jeopardize interspecific interactions in an ecosystem by the asynchrony caused by shifts of different magnitudes between species. Long-term insect data are rarely available and therefore are less studied in this context. In this study, data collected at two UK Environmental Change Network (ECN) sites over a 15 year period were analysed to investigate whether there is a shift in phenology of ground beetle (Coleoptera: Carabidae) populations. At Glensaugh and Sourhope, pitfall trap transects were established in three vegetation types: blanket bog, dry heather moorland and calcareous grassland. Twenty three species, of which we collected >100 individuals in total were included in the analysis. Minimum, 1st quartile, median, 3rd quartile and maximum measures of ordinal dates of capture events were analysed for evidence of phenological changes.

There were significant or near significant changes in phenological measures of 18 species. Nine species started their seasonal activity earlier. Three further species, the1st quartile or the median of capture dates fell earlier. Four species ceased their activity earlier. The activity period of these and one additional species also became shorter. None of the latest appearances were extended , suggesting that photoperiod plays a more important role than temperature in the cessation of activity. Stopping activity earlier may be caused by unsuitable weather conditions. Moreover, species suffering the greatest loss of the length of their activity were characteristic of bog and dry heather habitats.

Possibility of contacts between arthropods active on the soil surface and on vegetation

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Analysis of intestinal content of some soil surface predators, especially of carabid beetles and spiders shows that these arthropods can eat arthropods that are inhabitants of vegetation including many agricultural pests.

However, an analysis of literature shows that about 40% of all vegetation-active pests never go down to the soil surface, irrespectively of their life stage. Larvae of some other species active on vegetation descend to pupate in the soil.

The capability of arthropods to migrate down or up along grass stems was studied in Central and Southern Russia, using selective collection methods:1) sweep net – collecting mainly vegetation-linked species from upper parts of vegetation; 2) small plastic containers with NaCl solution placed on the soil surface under plants – collecting arthropods falling down from the plants; 3) pitfall traps with awnings above - collecting surface-active species.

We have not observed mass movement on vegetation in either direction. Of hundreds of vegetation-associated arthropods, falling down on the soil surface per day, only 2 - 5 % are not able to return up the stems again. Many of those falling arthropods can be weakened or dead, and provide food for carnivorous surface-active species. If this is a replacement-type mortality, the wide-spread opinion about the considerable role of soil-active natural enemies in regulation of herbivores living on plants in agricultural landscape is very questionable.

S68: Sensory ecology (Pheromones) II.

Room Copenhagen

How can pheromone studies complement taxonomy: A click beetle example (Coleoptera: Elateridae)

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When testing traps baited with a blend of geranyl octanoate and geranyl butanoate (the pheromone components previously described for *Agriotes lineatus*, Coleoptera, Elateridae) in Portugal and in Bulgaria, large numbers of the closely related *A. proximus* were captured. Subsequent field tests conducted in several countries of Europe revealed that largest catches were observed with a 1:1 ratio blend of both compounds in both species at all sites. In electroantennography (EAG), male antennae of both *A. proximus* and *A. lineatus* showed a similar trend of responses to pheromone components occurring in *Agriotes*, suggesting that there were no striking differences between the two species in the perception of these two compounds at the sensory level. In pheromone gland extracts in both species the dominant component was geranyl octanoate, the butanoate was detectable in trace amounts. In volatile collections from females emitting pheromone, the percentage

of the butanoate was larger than in the gland extracts, but again the major component was the octanoate, and collections from both species gave similar results. Thus in this study we found no apparent differences in the two species as far as pheromone composition (gland extracts and volatile collections), pheromone perception (EAG responses) and field responses to pheromone components were concerned. Since pheromonal communication often plays an important role in maintaining reproductive isolation of closely related taxons, the lack of differences here indicates that a taxonomic reinvestigation of the validity of these two species may become necessary. From the practical viewpoint, the 1:1 blend of geranyl octanoate and geranyl butanoate can be used as a bait in pheromone traps for the detection and monitoring of both *A. lineatus* and *A. proximus* in Europe.

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Host odor-related neuroethology in *Drosophila*

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Fruit flies of the genus *Drosophila* are attracted to fruit at different degree of decay. To allow attraction to volatile chemicals emitted by the fruit the flies have evolved highly specific and sensitive detectors on their antennae and palps. In previous studies we could show that differences in dietary width has had a profound effect on olfactory characteristics. In recent experiments we could show that diet specialization also has a strong effect on learning capabilities.

In my talk I will dwell on physiological mechanisms underlying food odor detection in fruitflies. Receptor function and antennal lobe integration of information will be the two main topics, but also recent behavioral data will be included.

Isolation and cloning of olfactory receptor gene from *Bombyx mori*

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The present study is focus on the isolation, identification and expression of olfactory receptor gene in Bombyx mori. The olfactory receptor gene has the molecular weight of 1.5 kb when resolving at 1% agarose gel. It was purified and also sequenced. The gene was cloned in PxPBS2 vector and was transformed into DH_5 alpha *E.coli* strain. It was also confirmed through restriction analysis. Presently the attempt was made to clone the gene into an expression vector for synthesize for more OBP receptor protein for structural analysis. The structural study will help us to know about the attraction of B.mori towards mulberry alone.

Plan ORSA: Design and synthesis of anti-insect Odorant-Reception Suppressing Agents

Jean-François Picimbon

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Odorant-binding proteins (OBPs) are small "*wan*-like" or '*L*-shaped" globular proteins, highly abundant in the antennae of most of all insect species. These proteins mediate reception of odorant molecules at the periphery of sensory receptor neurons. Therefore, they may represent new targets for insect pest management by allowing us to interfere directly with the olfactory ability of specific insect species. Today, the current knowledge about functional binding sites of OBPs may be enough to propose four alternative methods to control insects through the synthesis of OBP-inhibitor chemicals (Odorant Reception-Suppressing Agents, ORSAs). We report on the design of ORSA specifically tuned to moths (MORSA) and aphids (AORSA), and ORSAs specially designed to deal with other insect species (SulfurOxygen-ORSA and PhenylRing-ORSA).

S69: Quantitative ecology

Room Strasbourg

Investigation on spatial distribution of sugarcane pink stem borers Sesamia spp. (Lep.: Noctuidae) by using classical statistics in sugarcane fields in the south of Khuzestan province

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Sugarcane pink stem borers, *Sesamia* spp. are sugarcane key pests in Khuzestan province that damage heavily on total crop and sugar product every year. In this research, spatial distribution of the stem borers population was studied in three sugarcane fields (each equal to 25 hectares) using Cp69-1062 cultivar in the south of Ahwaz city in 2008. Sampling was carried out monthly in seven stages. In order to Sampling and relative estimate of pest population, external symptoms of pest damage (as population index) were used and number of infested stem and internod of sugarcane were recorded in each sampling station. In order to determine the type of pest spatial population distribution, various classical statistics indices were used. In all sampling stages, value of the variance to mean proportion index, index of patchiness and Morisita's index were more than one, and value of 1/k index and Green's index were more than zero, significantly. The obtained results of all indices indicated that spatial distribution of *Sesamia* spp. is aggregated. The regression coefficients of Taylor's b and Iwao's β were determined 1.45±0.065 and 1.18±0.031, respectively. So that, they had significant difference from one and both indicated aggregated spatial distribution for all of the pest life. Based on R^2 and P-values of regression analysis, Iwao's patchiness gave a better fitness for pest spatial distribution data in comparison with Taylor's power law.

Pollen flow mediated by different groups of generalist pollinators

Sergey Lysenkov

Russia

During several years (2004-2009) we investigated patterns of insect behavior which can influence pollen flow in insect-pollinated plants.

Our main result is revealing of the influence of local plant density on pollinator set. Most insect species prefer visit denser plant patches but some others - vice verse. Such differences occur even in very close patches divided by several meters. Even denser center and sparser periphery of one distinct patch face very different pollinator sets. It doesn't bring about pollen limitation (even in obligately cross-pollinated Umbelliferae). But these findings mean that the pool of pollen which can participate in pollination of different individual of the same species depends on local density of the patch in which it grows.

Within one patch most of pollinators fly non-randomly: they visit flowers (or inflorescences) within small area (usually

near 4 mean distances between these object in the patch) and then move to another such area. So pollen flow within plant populations is greatly restricted by these areas.

But beetles and social bees can be good vectors of long-distance pollen flow. First – because of movement patterns differing from other insects – very high frequency of long flights between successive visits. Social bees despite of little mean flight distance and low frequency of long flights can transport pollen to the great distances mostly because of high pollen load. Butterflies have large mean flight distance and rate of moving away but because of very little pollen load aren't good long-distance pollen vectors. Diptera are also bad pollen vectors because of small pollen loads and liow rate of moving away (though Syrphidae possibly are better than Muscoid flies in long-distance pollination).

Leaf beetle diversity (Coleoptera, Chrysomelidae) of Kýzýldað National Park, Ýsparta (Turkey)

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The aims of this study are to determine the leaf beetles species diversity and composition of the Kızıldağ National Park (KNP) and also to analyse how the species have been affected by the some environmental variable factors.

Three different habitat type (herbaceous open area, open forest area and closed forest area) were selected in the KNP. Two sampling area, or replicates, at least 1 km apart per habitat type were selected (6 independent sampling area in total). The sites were sampled every two weeks during April-October in 2009. The specimens were sorted and pinned after that identified according to keys in Warcha³owski (2003). Shannon-Wiener and Simpson diversity indexes and Sørensen and Jaccard similarity indexes were used to determine the species diversity and similarity of the leaf beetle existing in the three habitat types, A canonical correspondence analysis (CCA) was performed to detect the main relations between leaf beetles and six measured environmental variables. Also, nonparametric estimators (ICE, Chao 2, jackknife of first order and jackknife of second order) were used to assess the completeness of the inventory.

Totally 84 species belonging to 9 subfamily were recorded from KNP. While *Oulema melanopus* (%100), *Chaetocnema coyei* (%73) and *Psylliodes instabilis* (%60) were the most frequently collected species, *Calomicrus apicalis* (%58.82), *Psylliodes anatolicus* (%57.66) and *Psylliodes instabilis* (%25.40) were the most abundant species. According to Shannon-Wiener and Simpson diversity indexes, among the habitat types, the highest leaf beetle diversity was the herbaceous open area with the diversity values 2.51 and 0.84 respectively. According to Sørensen and Jaccard similarity indexes, the most similar habitats in terms of the leaf beetle communities were open forest area and closed forest area with the similarity values %34 and %20 respectively. CCA indicates that the most effective environmental variables on the leaf beetle species diversity were the herbaceous and tree layer covers. Also, non-parametric estimators ICE, Chao 2, Jackknife1 and Jackknife2 show that the percentages of the detected leaf beetle species during the field surveys in the KNP were between 63% and 72%.

The floristic composition is one of the most important factors on leaf beetle species diversity. Similarly, CCA results of this study shows that the most important environmental variables affecting the leaf beetle species diversity was floristic structure of the sites. Non-parametric estimators predict that there may be more species of leaf beetles expected in the KNP. However, the field surveys must be periodically conducted to reach estimated species number.

Insect biodiversity improves ecosystem services in Moscow

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The inventory of terrestrial insects in the Moscow City has showed that several systematic groups (Odonata, Orthoptera, Rhopalocera, Bombus, and some other) kept about 70 % of the regional species richness. Such a state of insect biodiversity makes rare drastic increases of pests in semi-natural urban areas - they occur in Moscow no more frequently than out of the city. In fact insects can partially replace the functions of more impacted vertebrate communities in urban ecosystems and ensure the principally complete structure of ecosystem processes (organic production, consumption, and reduction) even in very small green places in the city. So they crucially input in providing citizens with various ecosystem services by the minimally expensive way. The main condition of supporting the sound state of the insect biodiversity in the city is the establishment of the ecological network linking peripheral, periurban, and urban natural areas in the integrated system. The investigations allowed us having estimated parameters of core areas and corridors necessary for supporting insect biodiversity in the city. The Moscow City government has updated the Green Management Regulations according to our proposals aiming to improve ecosystem processes by insect conservation measures. Its successful implementation requires increasing public awareness to the input of insect biodiversity in the ecosystem services in the city.

S70: Life history, reproduction and development of insect

Room Maastricht

Red palm weevil and date palm fruit stalk borer in UAE: serious pests and hosts of phoretic mites

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The Red Palm Weevil, *Rhynchophorus ferrugineus* Olivier (Curculionidae: Coleoptera), is the most serious and difficult to control insect pest on date palm (*Phoenix dactylifera* L.) in the United Arab Emirates (UAE). Fruit stalk borer *Oryctes agamemnon* (Scarabaeidae: Coleoptera) is also an important insect pest attacking date palms in UAE. Populations of these two pests fluctuate throughout the year and peaks are observed in March and November (*R. ferrugineus*) and in May and June (*O. agamemnon*). In 2007-2009, *R. ferrugineus* and *O. agamemnon* larvae, pupae, and adults have been collected. Phoretic mite interactions with the different life stages of these two pests were investigated. Several phoretic mites (Mesostigmata and Astigmata) were found associated with these two pests. *Sancassania* sp. was reported for the first time in UAE associated with *O. agamemnon*. Mite loads on male and female of both insects were assessed. Mite host body distribution was investigated. Project result details will be presented and discussed.

Overwintering of *Thrips tabaci* population under continental climatic conditions

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The relationship among virus, host plant and vector species is of primary importance in connection with the development

of Tomato spotted wilt tospovirus (TSWV) epidemics. According to former studies TSWV can overwinter both on the host plants and within the body of the overwintering *Thrips tabaci* females. We conducted studies in the surrounding of sweet pepper greenhouses in Hungary to know how can *T. tabaci* population overwinter under continental climatic conditions, what is the accurate oviposition period and how long does the lifespan of the overwintered *T. tabaci* females last. Considering that, according to literature data, only the larvae of the vector thrips can acquire the virus from the host plant, from the point of view of the development of TSWV epidemics it has been important to know when the first larval generation appears on weed hosts growing around sweet pepper greenhouses.

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Living in a plant trap: specialisation in mirid bugs *Pameridea roridulae* to the sticky glandular surface of their host plant *Roridula gorgonias*

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Mirid bugs Pameridea roridulae Reut. (Heteroptera, Miridae, Bryocorinae, Dicyphini) live mutualistically on the protocarnivorous plant Roridula gorgonias Planch. (Roridulaceae). The glandular hairy plant surface is an effective, three-dimensional flypaper trap which captures numerous flying insects. However, P. roridulae bugs walk on the plant without hindress, although they frequently come into contact with the sticky plant secretion. They are not trapped by the plant, because they are covered with an anti-adhesive layer of epicuticular grease, which is considerably thicker than in other insects. Additionally, morphology and locomotory characteristics of P. roridulae bugs also contribute to their specialisation for life on the adhesive plant surface. Closely related mirid bug species, living on glandular hairy plant surfaces, avoid the contact with plant adhesive secretion and hold their slim and light body at a large distance from the plant surface by using long and slender legs. Compared to related species, P. roridulae is distinctly stronger and heavier, holds its body close to the plant substrate, and generates strong forces during locomotion to overcome frequent contacts with adhesive plant secretion. In traction force experiments on R. gorgonias leaves, bugs generated maximum forces corresponding to 126 times their body mass, unlike lower forces (ca. 34 times the body mass) generated by related mirid bugs on glandular hairy surfaces of their host plants.

How can *Phytomyza orobanchia* (Diptera: Agromyzidae) and pollinators understand the different languages of the broomrapes (Orobanchaceae)?

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Floral volatile organic compounds (VOCs) are known to attract pollinators. In the case of holoparasitic plants from the genera *Orobanche* and *Phelipanche*, floral scents may also be a cue for the oligophagous agromyzid fly, *Phytomyza orobanchia*, a natural enemy of broomrapes. In order to identify the VOCs that attract pollinators and *P. orobanchia* to its host, dynamic headspace analysis was carried out on seventeen broomrapes. VOCs were trapped from broomrapes growing in the wild in Slovakia as well as in a greenhouse. The headspace samples were analyzed using GC-MS. Although, each broomrape was characterized by a different VOC composition, a typical emission of 49 compounds in the seventeen species was revealed. Some of them are known as kairomones (e.g. 3-methylbutanal, 4-methyl-2-pentanone) and many as attractants (e.g. toluene, ethylbenzene) in Diptera. Field observations indicated a potential host preference of *P. orobanchia* within the genus *Orobanche* for *Orobanche flava*, *Orobanche alba* and *Orobanche reticulata*. Field observations on *O. flava* showed that its pollinators consist of eight bumblebee species and the social wasp *Dolichovespula norwegica*. *O. flava* does not attract other potential pollinators such as honeybees. *P. orobanchia* seems to use floral VOCs as kairomones. By advertising to pollinators broomrapes attract its own enemy simultaneously. The possibilities of using a lure consisting of typical broomrape VOCs will be discussed. The importance of similarity and diversity found in broomrape VOCs for *P. orobanchia* and pollinators will be highlighted.

Biological traits and fertility life table of *Bemisia tabaci* (Genn.) and *Bemisia argentifolii* Bellows and Perring (*B. tabaci* B-biotype) (Hemiptera: Aleyrodidae) on cotton and rapeseed in laboratory

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The aim of this work was to study the fertility life tables and development of sweet potato whitefly, *Bemisia tabaci* (Gen.) and silverleaf whitefly *B. argentifolii* Bellows and Perring (Hem.: Aleyrodidae) on rapeseed, (*Brassica napus* L.) which are economically important in Iran as an oil seed crop. The intrinsic rate of natural increase (r_m), net reproductive rate (R_0) and mean generation time (T) for *B. tabaci* was 0.1286, 30.6760 and 26.77 d and for *B. argentifolii* those above respective parameters averaged 0.1750, 40.75 and 21.27 d. The total survivorship of *B. tabaci* and *B. argentifolii* from egg to adult was 26.63 and 27.67 respectively. The results showed significant differences between the two species reared on either host plant for gross reproductive rate (GRR), net reproductive rate (R_0 or NRR) intrinsic rates of increase (r_m), finite rate of increase (λ), doubling time (DT) and mean generation times (T_c) in both species. Based upon these results, *B. argentifolii* showed a greater reproduction capacity on rapeseed. Thus, rapeseed is suitable host than for two species and this is important factor in host plant selection for optimizing control strategies of these major pests.

Geometric morphometric studies in color morphs of *Cicadatra alhageos* (Kolenati 1857) populations in Iran

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Grape cicada*, Cicadatra alhageos* (Kolenati, 1857) is the most important pest on grape in Iran damaging agricultural products annually. Various color morphs including green, yellow and brown are observed among populations of the species. In this study, in order to find a better view on the population structure of the pest, morphological variation in the color morphs of the species was studied using geometric morphometrics.

Adults were collected from 3 localities in Zanjan and Qazvin provinces. The specimens were categorized based on the pest color in 3 groups of yellow (Y), green (G) and brown (B). Totally 20 and 16 landmarks in fore and hind wings were selected respectively and then digitized. Then matrices of partial warps were computed and subjected to PCA analyses. The analyses were performed using tpsUtil ver. 1.26, tpsDig ver. 2.02 and tpsRelw ver. 1.39.

Result of PCA analyses showed that the green group was divided into two groups (G_1 and G_2) while group G_1 showed a significant difference with G2 and other groups. The groups (Y, B and G_2) were similarity with no significant difference. Examining the male genitalia of the two green groups showed the presence of two species: *Cicadatra alhageos* (Kolenati 1857) known as grape cicada (G2) and *Chloropsalta smaragdula* Haupt (G1). Both species are very similar and can only be distinguished by examining male genitalia. Study on the wings and veins of *Cicadatra alhageos* and *Chloropsalta smaragdula* showed some geometric difference between the two species.

Population dynamic of Western Corn Rootworm (*Diabrotica virgifera virgifera* Le Conte) in Bosnia and Herzegovina

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Diabrotica virgifera virgifera is a corn pest that is present in Bosnia and Herzegovina since 1996. Following its first appearance, it very quickly infested the main corn producing areas in our country. The population size is increasing from year to year, particularly in areas under corn monoculture. In some years, it reached critical values that caused economic damage. The only limiting factor in our conditions is the changing climatic conditions that significantly affect the number and other parameters of population dynamics. Thus this research is important from scientific and practical aspects. The survey was conducted in infested areas under intensive corn production on a total of 30 sites. The aim was to investigate the population dynamics of the Western corn rootworm under climatic conditions of Bosnia and Herzegovina. The study included the emergence and dynamics of adults, population numbers and sexual index as the main indicators of dynamic changes in insect population. Research was conducted between 2003 and 2005. Yellow sticky traps and entomological cages were used to trap the insects. Traps and cages were installed in early June, and the last check was conducted on the 30th of October.

The results indicate that climatic factors have the dominant influence of all the parameters studied. There are major differences in population numbers between years on all studied sites. The time of emergence of adults differed significantly depending on the year of research. Egg-laying period did not overlap in all years. The period of adult activity differed by up to two months. In addition, differences were found in the sexual index caused by the different climatic factors. Many other factors affecting population dynamics were noted, which need to be explored in detail under our production conditions.

Effect of soil moisture level on pupation depth and survival of Oriental Fruit Fly, *Bactrocera dorsalis* Hendel (Diptera: Tephritidae) on mango (*Mangifera indica* L.) in Myanmar

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Mango is the most important commercial fruit in Myanmar. One of the most important constraints in mango production and export is pest infestation. The *B. dorsalis* is an important pest of mango, citrus, guava and cashew in Myanmar. Exposure to unfavourable environment conditions during pupation is known to have a negative effect on the survival of tephritid fruit flies. Oriental fruit fly has been shown that both pupa survival and pupation depth are affected by the moisture content of pupation medium. Tephritid larvae prefer to pupate in moist soils. Excessive water loss during pupation is an important cause of mortality in *Bactrocera dorsalis* (Hendel) in laboratory conditions.

The infested mango fruits were kept and reared in laboratory to reach late third instar larvae. Sandy loam was used as pupation medium. For pupation device clear plastic cups in 12 cm high were used as test containers. Soil moisture was calculated for each treatment independently and was based on oven dried soil. Soil was wetted with tap water to get relative moisture gradients of 0, 20, 40, 60, 80, and 100 %, respectively. Thirty late third instar larvae were placed on the soil surface and allowed to pupate. The CRD design was used in this experiment. Treatments were replicated four times. Containers were marked with numbers, their target moisture levels (0, 20, 40, 60, 80, and 100%) and depth (surface, 0-2 cm, 2-4 cm, 4-6 cm, 6-8 cm, and 8-10 cm). After releasing 48 hours, the distribution of pupation depth and the number of pupae within each layer was recorded. For eclosion test, adult flies emerged from pupae in each container were recorded and then removed until no flies emerged. Eclosion rate and days of adult flies emergence were taken.

The highest mean values of pupation percent 71.67% was observed at 0-2 cm depth in 20% soil moisture level. The lowest mean values of pupation percent 0.83% was observed at 8-10 cm depth in 80% soil moisture level. Larvae pupated at 0-10 cm soil depth among these treatments in all tested moisture levels. The maximum value of eclosion rate 84.17% was found in 80% soil moisture levels 10 days after releasing larvae. Pupae preferred to eclose in 20-80% moisture level 9 days and 10 days after releasing larvae. The majority of pupae eclosed 10 days after releasing larvae under all soil moisture level in laboratory conditions.

A large number of the immature stages could normally be killed by adverse climatic factors. The results showed that the immature stage development of this pest was inhibited when the soils received too much water, suggested that drench application in fields may be another consideration in suppressing the populations.

Friday, 27 August

Plenary lecture 7

Room Copenhagen

Gall midge sex pheromones

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The gall midges (Diptera: Cecidomyiidae) is an insect family with more than 5000 described species and a high rate of speciation. During their 1-2 day life span the adults will mate and oviposit, using pheromones and plant volatiles to find partners and host plants. Several species are reported as serious pests on economically important crops, e.g. wheat, rice, sorghum, and rapeseed. Due to their small size and sudden appearance in the field, gall midges are difficult to detect and, for want of accurate monitoring methods, farmers commonly use scheduled spraying or spray just in case. An increasing number of gall midge sex pheromones have been identified. These findings open up for development of pheromone-based monitoring systems.

S72: Soil entomology – an ecosystem perspective I.

Room Maastricht

Completing the view of ecosystems: Including the belowground food web

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Most ecological research concentrates on the visible world aboveground. From an ecosystem perspective however, the belowground system is indispensible as most of the biomass produced by plants enters the decomposer system. Furthermore, the belowground system is closely interconnected to the invisible compartment of plants – specifically the roots growing in the soil. The decomposer system recycles dead organic matter thereby forming the basis of plant nutrition. However, decomposer biota not only interact with plants by providing mineral nutrients but also interact with plant roots in various ways by altering the physical, chemical and biological environment they experience. These interactions essentially shape plant performance and, via systemic effects, also the aboveground food web. With the advent of novel technologies, such as stable isotope analysis, fatty acid analysis, molecular gut content analysis and the molecular toolbox for analysing plant performance, belowground interactions are losing their mystery. In particular, the role of soil biota in belowground - aboveground interrelationships is being increasingly uncovered. The talk will highlight these novel developments by focusing on trophic interactions in belowground food webs and the interrelationships between decomposer animals, plants and the aboveground food web.

Root herbivore mediated changes in N status of plants and N-transfer between clover and associated grasses

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Root herbivores are an important functional group in grassland ecosystems. Whilst there is a plethora of information on their impact as pests in productive grassland, few studies of their impact on nutrient transfers have been made. Experiments are described here which are aimed at determining the impact of root herbivory by the specialist herbivore Sitona hispidulus on white clover and the effects of root feeding on the rate of transfer of nitrogen between plants of white clover and perennial ryegrass. In an initial experiment, clover plants, labeled with 15N were grown adjacent to ryegrass plants and were either infested with Sitona larvae or not. Ryegrass plants associated with the infested clover plants had a significantly higher dry matter yield and nitrogen content (75% and 74% respectively) than the uninfested plants, after 33 days exposure to insect herbivory.

In a second study clover seedlings were grown in sand culture in a system of micro-lysimeters which enabled sequential sampling of root exudates. Weevil infestation significantly reduced foliar biomass, total N and C contents and impaired N-fixation. The C:N ratios of the infested plants were significantly increased compared to control plants. The most abundant forms of N in the rhizosphere were NH4+ and amino acids, particularly serine and asparagine.

These studies highlight the important role that root herbivores may play in plant nutrition and nutrient cycling in grass/clover systems.

Spatial distribution of phytophagous soil insects in grassland

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The larval stages of several phytophagous insect taxa are found in agricultural grassland soils. This includes representatives from the Bibionidae, Elateridae, Sciaridae and Tipulidae. Some of these are acknowledged as pests and crop damage observations suggest that they are patchily distributed. However, our ability to define this patchiness is constrained by the sampling scale when using conventional parametric statistics such as mean and variance. Spatially specific studies on these insects are uncommon. Here I present data that shows that it is possible to detect spatial structure.

Elucidation of the C and N flow through the soil invertebrate food web, comparison of a grassland and woodland soil

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Within the soil decomposer food web there is a huge diversity of species, but little niche specialisation creating an "enigma of soil animal diversity". There are few methods that can be used to determine feeding preferences of the soil fauna *in situ*, but a technique using stable isotopes has been developed to track their feeding preferences as they occur. It has been proposed that within the soil faunal food web there are two divergent energy channels; one bacterial and one fungal, which are utilised by different species and are dominant under different ecosystems/management practices. To differentiate between these two energy channels, using a method developed by Murray *et al* 2009 (Soil Biology & Biochemistry 41, 1146-1150) a living bacterium was cultured in $^{13}C/^{15}N$-labelled media (to 99.9 atom% enrichment) and introduced live into intact soil cores, to assess the movement of bacterially sourced C and N within grassland and woodland soils. Overall, soil fauna taxa from the two ecosystems showed differences in their isotopic levels, which was dependent on the feeding strategies and faunal assemblages in these ecosystems. Some of the organisms like the Entomobryomorpha (Collembola) showed a similar level of enrichment in both systems suggesting a preference for bacterial feeding, providing more evidence that the Collembola are not just fungal feeders and have greater flexibility in diet than most food web diagrams suggest.

Soil arthropod communities – A spatial explicit perspective

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The baffling biodiversity in soils poses an interesting scientific problem: how to reconcile this bewildering diversity with the classical niche exclusion principle? Part of the 'enigma of soil fauna diversity' can be explained by the heterogeneous nature of the soil environment, which creates unrivalled potential for niche partitioning. However, the physical, chemical and biological factors that create niches and drive species distributions operate at a hierarchy of spatial scales, from the micro-scale of the individual to the macro-scale of continents. Because our knowledge of the processes operating on larger spatial scales is scarce, we analyzed Collembola communities along gradients of forest fragmentation from different biogeographical regions. Using a meta-community approach, we observed that with an increase in the level of forest fragmentation i) species diversity in the remaining forest fragments declined, and ii) the species composition of small forest fragments was nested within larger fragments. Processes underlying 'nestedness' along the fragmentation gradient were related to species dispersal ability (not rareness) or fragment features, or both. The results indicate that drivers of species distribution at the meta-scale of the landscape are important in governing community structure of Collembola in forest fragments at the meso-scale. This supports the view that the factors at a hierarchy of nested spatial scales interact, and together, determine the distribution of species. This calls for integration of knowledge obtained at different spatial scales if we want to understand how heterogeneity and disturbances affect species distributions and diversity.

S73: Social insects and apiculture I.

Room Rome

Cooperation among worker of *Bombus terrestris* and queens of several bumble bee (Hymenoptera, Apoidea) species in starting colonies

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Our trials in starting colonies of *Bombus terrestris* showed that the development of the queen's brood was positively influenced when one callow worker of the same species was added to the queen. The duration of the brood development was shortened and the body mass of the workers increased. Thus the colony development was more rapid and successful.

Similarly, young *B. terrestris* workers were found to be able to cooperate with queens of *P. lapidarius*, and partially of *B. lucorum*, *M. pascuorum*, *M. sylvarum* and *P. pratorum*. Two positive results only were found in *M. hortorum* and none in *M. ruderarius* as well as in *P. soroeensis*.

The presence of *B. terrestris* worker was the most successful in *P. lapidarius*. In other tested species some cases led to the development of the regular brood, the others to the earlier switch point of the small colony. Queens of *P. hypnorum*, *P. lapidarius*, and *B. lucorum* regularly accepted cocoons of *B. terrestris* to incubate them and lay eggs on them. Alone *B. terrestris* worker was able to produce large queen and male of *M. subterraneus*.

Closely related pollen generalist bee species differ in their ability to develop on the same pollen: evidence for the need of physiological adaptations for pollen digestion

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Bees collect enormous amounts of pollen to feed their larvae. To limit excessive pollen losses, flowers have evolved various morphological adaptations against bees. Growing evidence suggests that pollen might also be chemically protected rendering its digestion by bees difficult. To test the hypothesis that bees need physiological adaptations to digest pollen, we compared the larval performance of two very closely related and highly pollen generalist bee species on four different pollen diets. Pollen of *Sinapis* supported larval development in both *Osmia bicornis* and *Osmia cornuta*, while pollen of *Tanacetum* did not. *O. bicornis* managed to develop on *Ranunculus* but not on *Echium* pollen, while *O. cornuta* managed to develop on *Echium* but not on *Ranunculus* pollen except for two *Ranunculus* grown larvae that developed into dwarfish adults. The striking difference of the two tested bee species to develop on the same pollen demonstrates for the first time that bees require physiological adaptations to digest certain pollen. We provide indications for our postulate that the strong pollen competition between bees and flowers has selected for protective pollen properties and emphasize the remarkable analogy of bee-flower and herbivore-plant interactions.

Enemy specification in red wood ants

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Innate template for enemy specification in red wood ants *Formica aquilonia Yarr* was investigated by means of initiating collisions between ants and predatory carabid beetles, their competitors for space. In field and laboratory experiments we revealed that red wood ants actively attack ground beetles and scarce them away their feeding territories. Surprisingly, ants easily distinguish not only between members of Carabidae and Tenebrionidae but also between predatory ground beetles (such as *Carabus regalis*, *Pterostichus melanarius*, *P. magus*, *P. oblongopunctatus*) and non predatory species (*Harpalus smaragdinus* and *Amara nitida*). We assumed that ants identify potential enemies by means of a specific innate template rather than basing on their individual and social experience. In order to test this hypothesis, we conducted field and laboratory experiments in which live beetles and models with several characteristic features were presented to ants. In natural situations ants respond selectively to different features of possible competitors such as coloration, the presence of "offshoots" (legs, antennae), body symmetry, rate of movements, and smell. Comparing behaviour in members of natural ant colonies and of naïve laboratory reared groups we revealed that naïve ants that lack of experience of collisions with competitors react aggressively to an integral and realistic image of an enemy. This enables us to suggest that red wood ants enjoy an innate template of an enemy. At the same time, it definitely demands experience from ants to select key features and grasp significant details in order to interpret the whole image of a potential competitor.

Myrmecofauna on trees in Mediterranean Maquis

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The natural woodland in Israel is considered as endangered biodiversity hotspot. For the first time, we characterized and quantified the arboreal activity of ants in the Mediterranean Maquis. The ants were collected twice on dominant tree

species: *Quercus calliprinos*, *Pistacia palaestina*, *Crataegus aronia*, *Styrax officinalis* and *Olea europea*. We used two sampling methods: visual screening of the trunk and pitfall traps that were fixed on the branches. We identified 25 ant species (12% of the known Israeli fauna), belonging to the Myrmicinae (12 species), Dolichoderinae (2 species) and Formicinae (11 species). Only one invasive species was detected. The trapping methodology yielded 19 species whereas 14 were found in during the visual survey. *Tapinoma erraticum* and *T. israele* were the most abundant species seen during the visual surveys. *Camponotus sanctus* and *C. truncatus* were the most common trapped. There was no difference in number of ant species among the sites, in both methods. The highest Shannon index of biodiversity was calculated from the visual survey on *P. palaestina.* While the ant species number was the highest on the most common tree, *Q. calliprinos,* and the smallest on *S. officinalis*. *Q. calliprinos* trees were more often populated by ants than other tree species. The β–turnover index indicated an enrichment of the ant community due to the tree biodiversity. Similarity index was highest in comparison between ant assemblage on *Q. calliprinos* and the *O. europea*. *Monomorium venustum* and *C. sanctus* had the highest niche breadths (which measures the degree of utilization of the different tree species), measured following the Levins' index.

Possible complex relationships between red wood ants and small rodents

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Red wood ants are known to affect significantly invertebrate communities. Ants force litter-dwelling beetles and spiders out their feeding territories, but at the same time carabides use ant cemeteries as an additional source of food. In boreal zone several vertebrate species can use ants as routine prey, such as frogs, lizards, and birds. Surprisingly nothing is known about ants' relations with mass small rodents dwelling on their territories. Combining field observations and laboratory experiments, we assume complex relationships between rodents and red wood ants. In order to estimate levels of influence of red wood ants on small rodents, habitable holes were recorded on plots 40x40 m placed on ants' territories and outside. Digging activity of small rodents was essentially less on ants' territories, and habitable holes were recorded not nearer than 10 m from ant hills. However, being forced out territories controlled by ants, rodent turned out to use red wood ants as mass prey. In laboratory we conducted experiments with striped field mice *Apodemus agrarius* caught on ants' territories. We put mice one by one into containers (22 l) together with 4-8 individuals of *Formica aquilonia*, and analyzed video records by Noldus Observer XT 7.0. Mice quickly killed ants and ate them completely. Specific behavioural stereotype of hunting was revealed that was unknown before. Mice killed, in average, 0,4 ants per minute, and they behaved easy-tempered. It is likely that rodents penetrate periphery of ants' settlements in order to use additional food recourses.

S74: Diptera taxonomy I.

Room Brussels

The potential of wing-shape data to resolve morphologically cryptic species within the *Bactrocera dorsalis* fruit fly species-complex (Diptera: Tephritidae)

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Certain species of the predominantly south-east Asian *Bactrocera dorsalis* species-complex are taxonomically indistinguishable, with high levels of intra-specific morphological variation. The most problematic species are *B. dorsalis sensu stricto, B. papayae*, *B. carambolae*, and *B. philippinensis*. This group is thought to have recently diverged, occurs across allopatric and sympatric distributions, and causes significant economic losses to regional horticulture.

As part of a larger project, using multiple techniques to resolve the species, wing-shape was selected and measured for each of these four species. Specimens were sourced predominantly from collections held in Brisbane, Australia, where they had been identified to species by the original species authors. We selected 15 wing landmarks for 245 individuals, covering three populations of each of the above listed species, plus one outgroup-species population (*B. tryoni*), which were analysed using geometric morphometric techniques.

Results demonstrate a strong potential for wing shape to discriminate among these species. Intra-specific populations clustered together in multidimensional space, while remaining discrete from other species. Over 80% of flies could be accurately identified based on wing shape.

We discuss how this technique can be used with other biological information to understand species limits in this group, together with its capacity to be applied as a relatively simple diagnostic procedure.

Taxonomic approach to the *Dinera carinifrons* species-group (Tachinidae) using different identification methods

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For many years the taxon *Dinera carinifrons* (Fallén, 1817) was considered to be a single species with a wide trans-Palaearctic distribution. However, Ziegler & Lange (2001) reported the occurrence of two taxa previously confused under this name in the European Alps, and a closely related species was recently described by Zhang & Shima (2006) from China and Japan. So the question arises of how many taxa are actually present in the *D. carinifrons* species-group?

In the two first stages of this study, the partial sequences of the genes 12S+16S rRNA were studied using Bayesian inference (BI) and the morphological data were evaluated by Artificial Neural Networks (ANN). These two alternative methods produced very similar results. The unity of the *D. carinifrons* species-group and the validity of two species in Europe were supported. Altogether three Palaearctic taxa were confirmed in this group.

The study was supported by the Research Fellowship of the Czech Science Foundation (GAČR 526/09/H025) and the Masaryk University grant (MSM No. 0021622416).

Cloning and bioinformatic characterization of a 18S ribosomal RNA gene from *Tabanus bromius* (Diptera: Tabanidae)

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The fly family Tabanidae (horse flies) includes an estimated 4500 extant species distributed throughout the world. The biology and taxonomy of horse flies has an important historical legacy, but modern phylogenetics-based revisionary work has lagged behind other dipteran groups due to a generational reduction in the number of horse fly

taxonomists and to a perceived "difficult" morphology which is often homogeneous for many standard dipteran characters and highly adapted in others. The literature on the Tabanidae fauna of Turkey, it was found that 156 species and 12 subspecies have been reported. *Tabanus bromius,* sometimes called the Band-eyed Brown Horsefly, is a species of biting horseflies. It is one of the smaller European *Tabanus*, at about 13.5-15mm body length.18S ribosomal RNA (rRNA) gene has been isolated from *Tabanus bromius*. By using 18S RNA universal primers the product was about 1870 bp long. Overall, the Tabanus 18S rRNA gene is 95,5% homologous with those of human, and mouse.

Ulidiidae (Diptera) of Russia

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Russian fauna of the family Ulidiidae s.str. includes 21 species of the 5 genera.

The genus *Euxesta* (about 100 species) is most diverse in Western Hemisphere. The only one species (*E. pechumani*) has been introduced into Russia and it was recorded from North Ossetia-Alania and near Sochi.

The genus *Physiphora* includes 24 species. One cosmopolitan species *Ph. alceae* has been registered in Russian fauna. It is widespread in temperate and south area of European part of Russia (including Caucasus) and Altai.

The genus *Ulidia* (18 species) is distributed mainly in semi-arid and arid areas of Palaearctic. Three *Ulidia* species occur in Russian fauna. Two of them (*Ul. albidipennis, Ul. erythrophthalma*), are found to occur in European part of Russia (including Caucasus) and the third (*Ul. kandybinae*) – in West (Krasnoyarsk) and East Siberia and in Russian Far East (Sakha Republic).

The most diverse fauna of the genus Timia is in arid regions of Central Palaearctic. North borders of areas of 10 species reaches the Russian territory. Most of these species (T. carbonaria, T. erythrocephala, T. nigripes, T. (E.) abstersa, T. (E.) camillae, T. (E.) melanorrhina, T. (E.) nigrimana, T. (E.) pamirensis, T. (E.) xanthaspis) are registered from the south of European Russia. 3 species are recorded from Siberia: *T. kerzhneri* (Chita Region)*, T. nigripes* (Omsk), *T. (E.) pamirensis* (Chita Region).

The genus *Homalocephala* includes 24 spesies in the World fauna. 6 species are registered from Russia. 4 of them (*H. albitarsis, H. angustata, H. apicalis H. bimaculata*) are Holarctic. *H. ozerovi* is widespread in Russian Far East and *H. mamaevi* is Beringian.

Oriental Teratomyzidae (Diptera)

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Practically the first descriptions of Teratomyzidae from the Oriental region will be published in a forthcoming paper (most probably in co-authorship with Prof. T. Saigusa). A new species of the genus *Teratomyza* Malloch, 1933, s. str. is described and compared to *T. chinica* Yang, 199[8]. A new genus with 11 new spp., related to the genus *Vitila* McAlpine & Keyzer, 1994, are described. The new genus is characterised by the following features: Head with a pair of vertical callus; frons shiny, without stripes; first flagellomere elongated in a number of species, and also scape elongated; wings patterned, shiny, mostly dark with a clear "window" distally to apex of R2+3 below costa; vein R2+3 approximated to costa, at least in its middle section; only 1 pair of katepisternal setae; male surstylus with broad base and apically, or apically and caudally, with short thick black teeth; ejaculatory apodeme large; female with 2 large spherical or ovoid spermathecae, sclerotised part of duct thick short and structured. The male genital structures are compared to those of the formerly known genera.

Taxonomic problems in the genus *Phalacrotophora* (Diptera: Phoridae)

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Specific relations within the genus Phalacrotophora Enderlein, 1912 – as many other genera close to Megaselia Rondani, 1856 – are quite intricate. Several attempts have been made to separate the apparently distinct species into subgenera, but all of these are recently rejected. This does not mean that the taxonomy of the genus has become clear; it shows merely that the former divisions are not be hold on.

My work on the European species resulted in separation of three distinct groups within the genus. The first group involves the species with one or more distinct setae on the anepisternum, the second with bare anepisternum, with two scutellar setae plus additional two setulae, the third is with bare anepisternum, with four almost equal-sized setae on the scutellum and a typical ratio in the length of fore tarsomeres.

Recently I have entered studying the Oriental fauna to establish a basis for a world revision of the genus later. It seems that grouping for the European species is valid also for the Oriental fauna.

It should be noted that the keys published hitherto for the Palearctic and the World genera of Phoridae contain several difficulties in identification of the species to the genus Phalacrotophora. All the unclear relationships in the known species, as well as the high number of undescribed ones necessitate a world-wide revision of the genus.

Floral host plant range of syrphid flies (Syrphidae: Diptera) under natural conditions in Southern Punjab, Pakistan

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Syrphid flies are very important group of insects in ecosystem from viewpoint of pollination and biological control. Floral host preference of 15 most abundant syrphid fly species was assessed towards 11 agricultural and 40 non-agricultural plant species in 28 families under natural field conditions. *Coriandrum sativum*, *Cirsium arvense*, *Launaea procumbens*, *Prosopis juliflora*, *Allium cepa*, *Ranunculus muricatus* and *Daucus carota* were visited by maximum number of syrphid fly species ($\geq$9). *Eristalinus aeneus*, *Ischiodon scutellaris* and *Episyrphus balteatus* were the most frequent floral visitors and also visited maximum number of plant species. There was a positive relationship between abundance of syrphid fly species and the amount of available floral resources along the flowering weeks. Fifteen syrphid most preferred plant species were identified including 8 agricultural plant species and 7 non-agricultural plant species. *Parkinsonia aculeata* and *Mangifera indica* were the most preferred plant species by syrphid flies from agricultural and non-agricultural plant species, respectively. Most of the syrphid species preferred white and yellow colored actenomorphic flowers.

S77: Soil entomology – an ecosystem perspective II.

Room Maastricht

Click beetle dispersal in agricultural land: A study using molecular markers

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The soil-inhabiting larvae of click beetles (Coleoptera: Elateridae), known as wireworms, are worldwide agricultural pests, causing loss of crop quality and/or yield. Three species are thought to cause the majority of damage in the UK;

Agriotes obscurus, *A. sputator* and *A. lineatus*, but little is known of their dispersal and the rate and scale at which this occurs. Risk assessment has previously involved trapping adults over one season using sex pheromone traps, adding trap catches for all species together, and then predicting the number of wireworms present in the soil. However, recent studies have shown that there are limitations in relating adult pheromone trap catches to wireworm distribution, and that there may be interspecific differences in average walking speed and response to pheromone traps, suggesting differences in dispersal ability between species. In this study, amplified fragment length polymorphisms (AFLP's) were used as molecular markers to assess the genetic relatedness of populations of *A. obscurus*, *A. sputator* and *A. lineatus* over three scales in agricultural land: within farm, between farm and between regions in the UK (South Devon, Somerset, Cambridge and Scotland). The results are presented and the ecological and pest management implications discussed.

Comparison of soil weevils' faunas (Coleoptera: Curculionoidea) in Serbia

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A lot of weevils are partially or permanently soil inhabitants. We present a review of soil weevils, collected at more than 30 localities in Serbia, since 1995. This comprised 977 adult specimens. Their identification resulted by registration of 23 species from two families. Only one *Ubychia* species was from Raymondionymidae, while 22 species belong to Curculionidae. Of the Curculionidae, 14 belonged to Cryptorhynchinae (genera: *Acalles, Acallocrates, Echinodera, Kyklioacalles* and *Ruteria*), seven to Entiminae (*Barypeithes, Brachysomus* and *Eurosphalmus*) and there was one species of Molytinae (*Aparopion*). According the FaEu data, ten species were initially registered for Serbia and Montenegro. By region, seven species were registered in the soil of Vojvodina, six in West Serbia, 17 in Central Serbia and 16 in East Serbia. According to qualitative similarities across the latitudinal gradient (excluding Vojvodina), all West Serbian species were similar to those from Central Serbian, while samples from the East of Serbia contained two "original" species - *Brachysomus carpathicus* and *Barypeithes araneiformis*. For the Central Serbian soils, four species were characteristic (but our earlier research excluded *Ubychia holdhausi* from this list). Among them is *Eurosphalmus zerchei*, described in 2006, and not yet mentioned in FaEu. *Aparopion costatum* is the only species common to all parts of Serbia, except Vojvodina. These results confirmed Central Serbia as a bridge between West and East.

Collembola population of pine forests in a gradient of industrial pollution

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The purpose of this –study was to investigate the collembolan population in the natural broken pine woods in area affected by Timber Industry Complex (TIC) emissions. The nature of these emissions includes hydrogen sulphide, sulphurous anhydride and a mineral dust. This research focused on three sites located at different distances from the enterprise: 1.3 km, 5.0 km and 6.5 km. As a control site, the bilberry-cowberry pine forest (80 km from TIC) used. At each site, soils in the vicinity of the TIC were examined for collembolan population densities. In 2008, in a pine forest 6.5 km from the TIC, there is a density surge (more than 140,000 individuals per m2). The number of species was reduced, however the collembolan species structure did not vary. Many years of research have shown that in all of the investigated pine forests, two species dominate, namely Isotomiella minor and Folsomia quadrioculata, which are widely distributed all over the European northeast of Russia. However, in a pine forest that was 1.3 km from TIC the latter species was F. diplophthalma rather than F. quadrioculata. With increasing proximity to the TIC, the abundance of various Onychiuridae species was reduced, while the number of I. viridis and P. notabilis, on the contrary, increased. It was shown that in pine forests that were 80 km, 6.5 km and 5 km from the enterprise, forest species of collembola prevail. At 1.3 km from TIC their share falls up to 26 % while the share of euritopic species achieves 60 % and more. As a whole, changes in collembolan community over a gradient of industrial pollution changes stage by stage: first the share of wood species is reduced, a specific and ecological variety of a grouping further grows, then of the size of the community falls.

This work was supported by the framework of Biological Science Branch of Russian Academy of Science project «The condition estimation and soil fauna monitoring of middle taiga forests of the European Northeast of Russia (by the example of a timber industry complex).

Frog-biting midges – A return to biosystematics

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My 2008 monograph on Corethrellidae (Zootaxa: 1804), with its single genus *Corethrella*, is summarized as an example of an holistic approach to systematics. It was recently recognized that female *Corethrella* have biting mouthparts and find their male anuran frog hosts by their call. As such, abundant fresh and diverse material of this previously rare group was made available. The revision recognizes 97 extant (52 new) and 7 fossil (2 new) species. There is evidence of coevolution between *Corethrella* and anurans and fossil *Corethrella* are known from the Early Cretaceous. Female *Corethrella* also are vectors of *Trypanosoma*, present only in male frogs, and these *Trypanosoma* form an early lineage within that genus of protozoa. Clearly there is an ancient ecological relationship between *Corethrella*, anurans and the *Trypanosoma*. Phylogenetic analysis of *Corethrella* shows evidence of Gondwanan distributions as well as dispersal. Phylogenetic interpretation of larval habitat types shows that lineages have repeatedly invaded arboreal habitats, with some lineages diversifying within these.

My approach to cladistic analysis accented the careful study of each character, with broad outgroup comparisons. The importance of weighting character states is vital to producing phylogenetic trees that depict real genealogies. It is suggested that modern systematics has overemphasized comparison of parsimonious trees at the cost of understanding character states. Furthermore, our role as systematists is to use our phylogenetic information to interpret bionomic information. Systematists are encouraged to produce a broader story relating how their group diversified as living organisms.

S78: Social insects and apiculture II.

Room Rome

The specialization in groups of ants tending aphid colonies

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Data are reported on a comparative analysis of the work organization of different ant species in multispecies communities while honeydew collection. Different ants have been found to use definite schemes of interaction with aphids; ranging from the individual foraging by unspecialized ants to "professional specialization" in groups of ants tending

separate aphid colonies (teams). The functional differentiation in ant teams was found to depend on the size of an ant colony. Red wood ants from the large colonies demonstrate the most complicated interaction characterized by the clear division of a number of functions and by the largest number of specialists ("shepherds", "guards", "scouts" and "transporters"). Other ants demonstrate simpler schemes based on a partial division of labour or individual foraging by unspecialized ants. Besides, changing of the requirements for carbohydrate food of an ant colony as well as the number of available trophobionts were found to lead to reorganization of the ants' work regulating the depth of their specialization. On the whole, the specialization in the ant teams tending aphids seems to be facultative. A tendency for the functional differentiation in the ant teams to deepen is observed as the ant colony size increase and also as a consequence of insufficient food resource at both intra- and interspecies levels.

The study was elaborated within a joint research project of the HAS and the RAS and was funded by the RFBR (09-04-00152).

The protection of aphids from aphidophagous by different ants

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The investigations of the role of different ants from multispecies communities in the protection of aphids from aphidophagous were carried out in 2006-2009. 1200 colonies of aphids tended by 16 ant species (*Formica* – 8, *Camponotus* – 2, *Lasius* – 4, *Myrmica* – 1, *Tetramorium* – 1) characterized by different colony size and territorial organization were explored. The aphidophagous registered belong to 11 families: Hymenoptera – 2; Coleoptera – 1; Neuroptera – 3; Diptera – 2; Heteroptera – 3. The comparative analysis of the correlation of aphid colonies with and without aphidophagous from explored aphid colonies tended by different ant species was conducted. *Formica* s. str. ants with numerous colonies and large protected feeding territories were shown to provide aphids with the highest protection degree. The proportion of the aphid colonies with aphidophagous for these ants is 1.5-2 times as low as that for the ant species with smaller colonies and partially protected territories and is 3-6 times as low as that of the ants with the smallest colonies and non-protected feeding sites. Besides field and laboratory experiments have shown that *Formica* s.str. ants are the most aggressive and actively attack both mobile (adults) and slowly moving (larvae) of aphidophagous whereas other ants protect aphids mostly from the mobile insects or do not protect them at all.

The study was elaborated within a joint research project of the HAS and the RAS and was funded by the RFBR (09-04-00152).

How ants of the genus *Formica s.str.* influence on spatial distribution of carabid beetles and spiders

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Ants of the genus *Formica s.str.*strongly influence on spatial and temporal distribution of another litter-dwelling predatory invertebrates forcing them out from ant foraging territories (Reznikova, Dorosheva: Pedobiologia, 2004). In this study the effect of different *Formica* species on carabids and spiders is compared in forest and steppe landscapes, in relation to the parameters of ants' abundance and activity. Abundance and species richness of carabids and spiders were compared by means of pitfall trapping, within a large settlement of *Formica aquilonia* consisted of more than 100 ant-hills; in territories occupied by single colonies of *F. polyctena*, and in foraging territories of *F. pratensis*. The studies were carried out in 1998 - 2009, in mixed pine-birch forest (Novosibirsk), in fir-cedar forest in Altai Mountains, and in Altai steppes.

In the ant foraging territories from 0 to 15 carabid species and from 0 to 11 spider species were collected. To what extent ants affect the spatial distribution and species richness of invertebrates, depends on sizes of ant mounds and of whole settlements, related population densities, and ants' mode of life. In particular, *F. pratensis* colonies, with their foraging routes deepen as tunnels, impact on invertebrates much less than *F. aquilonia* and *F. polyctena* with similar colony sizes. In short - term experiments we destroyed foraging routes of *F. pratensis*, thus increasing ants' dynamic density from 1.3-2.5 до 15.3.-19.2 per minute/ 10 cm ^{2}. We observed essential decreasing in numbers of spiders but not carabids in the plots with increased number of ants.

Control of wax moth, *Galleria mellonella* L. (Lep.: Pyralidae) with male sterile technique

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In this study, the control of wax moth using male sterile technique(MST) with gamma-ray were examined. In order to determine the safe and effective dosage of gamma-ray to sterilize male pupae of the wax moth , an experiment was conducted in a complete randomized design with 5 treatments and 5 replicate with 50 male pupae in each replicate. Treatments included different levels of gamma-ray dosage with zero, 250, 300, 350 and 400 gray.

Release ratio of sterile to normal males was also studied in a similar experiment. Treatments included sterile-males, normal-males and virgin-females with the ratios of 1:1:1, 2:1:1, 3:1:1, 4:1:1 and 5:1:1. The possible parthenogenesis reproduction of this pest was also studied. The results showed that the best dosage to sterilize male pupae of the wax moth was 350 grays of gamma-ray. The best release ratio was four sterile males, one normal male for each normal female(4:1:1). Also females cannot produce offspring without males.

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