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CONFERENCE ABSTRACTS

Abstracts of the Immature Beetles Meeting 2019 October 3–4, Prague, Czech Republic

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The seventh Immature Beetles Meeting was held in Prague on October 3–4, 2019 at the Faculty of Science of the Charles University in Prague. It was organized in cooperation with the Department of Entomology of the National Museum and the Crop Research Institute in Prague. In total, 58 participants from Asia, Europe and North and South America attended the meeting (see the list of participants and group photo in Fig. 1). About 20% of the participants attended the meeting for the first time, and we were pleased to see many of the 'veterans' attending the IBM again. Eighteen oral lectures and four posters were presented, covering a wide spectrum of topics concerning nearly all major clades of polyphagan beetles. The research presented comprised a total of fifteen families (Buprestidae, Chrysomelidae, Cerambycidae, Curculionidae, Dermestidae, Elateridae, Hydrophilidae, Leiodidae, Lycidae, Ripiphoridae, Scarabaeidae, Scirtidae, Silphidae, Staphylinidae, Trictenotomidae) plus two book reports on the guide and identification key to the larvae of the families and major subfamilies of British Coleoptera (book title: *British Coleoptera Larvae – A Guide to the Families and Major Subfamilies*) as well as immature stages of Neotropical beetles (book title: *The Neotropical Immatures Beetles*). All contributions covered a broad range of research topics such as unusual morphological adaptations, fossil larvae found in amber, immature beetles in environments such as dead wood and vertebrate carcasses, DNA barcoding as a tool to associate different life stages to adult specimens, maternal care and many more.

After the second day of the meeting, participants were able to visit the Coleoptera collection of the National Museum, which was enjoyed by all of the participating colleagues. As it has become a tradition for the Immature Beetles Meeting, the discussion about beetle topics continued in traditional Prague pubs on both evenings.

We proudly report that the meeting fulfilled again its primary aim – to bringing both established and newly starting scientists and students who share an interest in immature stages of beetles and associated topics. We hope that the participants were able to gain new insights into the field and that new contacts and cooperations with colleagues from across the world were forged.

For more details on the IBM and news related to immature beetles see the following online address: www.immaturebeetles.eu/ as well as our facebook page at www.facebook.com/ImmatureBeetlesMeeting/.

The next meeting is planned for autumn 2021 and will be probably held at the Charles University in Prague once more again. On the behalf of organizers, we would like to thank again all the participants and colleagues who attended the meeting, shared their research and most importantly contributed to an enjoyable and friendly atmosphere. We hope to see new and old faces again in 2021!

The organizers of the Immature Beetles Meeting

Acknowledgements

We thank all colleagues and students who supported the organization of the Immature Beetles Meeting 2019 by giving oral presentations, presenting posters or attending the meeting to enrich the discussions on the topics presented there. Furthermore, we are indebted to the students who took care of the refreshments and drinks for ensuring that the meeting ran smoothly. Last but not least, we are indebted to the senior team, namely Martin Fikáček, Jiří Skuhrovec and Petr Šípek.

Ivan Čepička (Head of the Department of Zoology, Charles University) kindly supported our initiative to organize the meeting with financial support and provided the space in which the meeting took place. The National Museum in Prague and the Crop Research Institute supported IBM 2019 as well. The meeting was organized as a part of the research activities of the organizers under the partial support of the grant SVV 260 434/2019 (from Charles University) to MS, EAV, DV and the grant of the Ministry of Culture of the Czech Republic (DKRVO 2019–2023/5.I.a, National Museum, 00023272) to MS and DV.

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ORAL PRESENTATIONS

British Coleoptera larvae: a guide to the families and major subfamilies

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In August 2019, a 280-page guide and identification key to the larvae of the families and major subfamilies of British Coleoptera was published by the Royal Entomological Society. Although the British fauna is impoverished at the species level, 103 families are present, so this guide is likely to be useful anywhere in the northern hemisphere at least. I will discuss the history of this work, initiated by and dedicated to Fritz van Emden (1898–1958) and completed over a period of 40 years by a team of six authors and editors.

HAMMOND P. M., MARSHALL J. E., COX M. L., JESSOP L., GARNER B. H. & BARCLAY M. V. L. 2019: *British Coleoptera Larvae. A guide to the families and major subfamilies.* Royal Entomological Society, St. Albans, 280 pp.

Larvae of Cretaceous and Eocene Ripiphoridae (Coleoptera)

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Systematic and morphological overview of Ripiphoridae primary larvae from the mid-Cretaceous and Eocene ambers is presented. Subfamilies Ripiphorinae, and Ripidiinae are each represented by one type of primary larva (triungulinid) from the mid-Cretaceous ambers of Myanmar and USA (New Jersey). Previously disputed identifications and systematic placement of *conicocephalate* larvae from the Cretaceous ambers found in Canada, Myanmar, and Russia are discussed. We refuted the systematic assignment of *conicocephalate* larvae to Strepsiptera. Arguments for their placement within Ripiphoridae are summarized. Taphonomy of *conicocephalate* larvae is discussed in respect of putative phoresy. First known Paleogene larva of Ripiphoridae is presented from the Eocene of Sakhalin amber. The larva belongs to the subfamily Ripidiinae and represents likely a species of the extant genus *Ripidius*. The Sakhalin larva resembles the genus *Ripidius* in the structure of the terminal abdominal appendage, length of the terminal abdominal setae, number and position of finger-shaped sensilla, but differs in shape of head, structure of pretarsus, and shape of femora.

Raising Coleoptera larvae to inform decisions on tree health policy

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Though raising insects in captivity can seem like one of the most fundamental ways to begin to understand their biology, it is sometimes regarded as being overly "basic" and can be undervalued as a study technique by those focussed on more contemporary or fashionable methods. However, rearing insects in captivity allows for detailed observations to be made of the study species, providing vital information on behaviour, growth rates and stages, and allows for straightforward experimental manipulation. As such, experiments or fundamental work on insect biology using captive insects can offer crucial insights into biology, which in term can affect decision making by governmental bodies looking to better understand insect-tree interactions. With globalisation, insects and being transported all over the globe, and whilst many of these new introductions either fail completely or don't significantly alter the natural environment, certain species can become pests, sometimes having drastic impacts on the landscape. A short overview of some ways rearing insects has impacted governmental policy in the UK will be given, with a focus on 'problematic' beetles.

Neotropical Immature Beetles – New Book

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Coleoptera is the most diverse and specious order among Insecta with *ca* of 25,000 genera and 360,000 species, corresponding to 40% of the total of the insects and 30% of the animals, Grimaldi & Engel (2005). Bouchard et al. (2011) present a catalogue with 4,887 names of families groups and Beutel & Leschen (2016) recognize a total of 193 families and 549 subfamilies. A significant portion of that contingent is found in the tropics especially in the Neotropical Region, which is considered the biggest repository of the biodiversity in the planet. About 7,000 genera and 80,000 species are found in the Neotropics and among them approximately 5,000 genera and 30,000 species are from Brazil.

It has been thirty-two years since "*Larvas de Coleoptera do Brasil*" was published by Costa et al. in 1988. The book was of great value to many students and researchers of beetle's larvae all over the world, by presenting original and detailed illustrations of many groups of beetles, many of which were poorly known at the time. Since then a considerable number of families unknown at that time to the Neotropical Region have been described; an updated key to the immature beetles families in Portuguese was published by Costa & Ide (2006). Now, we think it is worthwhile making a new attempt, to produce an English book dealing with some subjects of our early researches yet adding up several new topics, and particularly also taking into consideration the requirements of foreign students.

In fact, the knowledge of the beetle's diversity in the Neotropical Region is still very incipient and most of the existing information is widely dispersed in different publications at regional and global levels (Costa 2000). The present book on "The Neotropical Immatures Beetles" is not a reedition of Costa et al (1988) for many of its topics have been updated elsewhere, such as updated keys and illustration of diagnostic characters in Costa & Ide (2006). This edition aims to improve the knowledge of immature and adult Coleoptera from the Neotropical region.

BEUTEL R. G. & LESCHEN R. A. B. (eds) 2016: *Handbook of zoology. Arthropoda: Insecta. Coleoptera, Beetles. Morphology and Systematics. Archostemata, Adephaga, Myxophaga, and Polyphaga partim , Volume 1*. Walter de Gruyter, Berlin, Germany, 684 pp.

BOUCHARD P., BOUSQUET Y., DAVIES A. E., ALONSO-ZARAZAGA M. A., LAWRENCE J. F., LYAL C. H. C., NEWTON A. F., REID C. A. M., SCHMITT M., ŚLIPIŃSKI S. A. & SMITH A. B. T. 2011: Family-group names in Coleoptera (Insecta). *ZooKeys* **88**: 1–972.

COSTA C. 2000: Estado de Conocimiento de los Coleoptera Neotropicales. Pp. 99–114. In: MARTÍN-PIERA F., MORRONE J. J. & MELIC A. (eds): *Hacia un Proyecto CYTED para el Inventario y Estimación de la Diversidad Entomológica en Iberoamérica: PrIBES 2000*. Zaragoza, v.1, 326 pp.

COSTA C. & IDE S. 2006: Coleoptera, cap.13. Pp 107–145. In: COSTA C., IDE S. & SIMONKA C. E. (eds): *Insetos imaturos: metamorfose e identificação*. Holos Editora, Ribeirão Preto, SP.

COSTA C., VANIN S. A. & CASARI-CHEN S. A. 1988: *Larvas de Coleoptera do Brasil*. Museu de Zoologia, Universidade de São Paulo, São Paulo, vii + 282 pp., 165 pls.

GRIMALDI D. & ENGEL M. 2005: *Evolution of the Insects*. Cambridge University Press, 772 pp.

Click beetles who are not wireworms (Elateridae: Cardiophorinae)

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Cardiophorinae include more than 1000 species and 38 genera, known from all major world biodiversity regions. Due to their remarkable soft-bodied larvae with exodont mandibles they were long considered to be sister to the remainder of Elateridae. However recent phylogenetic studies indicate that they are deeply nested within the phylogeny of Elateridae, near to or within the Negastriinae. This leads us to ask how this very different and seemingly uniform larval type evolved rapidly compared to the gross larval morphology of other similarly aged elaterid groups.

Larval descriptions exist only for genera *Cardiophorus* Eschscholtz, *Dicronychus* Brullé, *Horistonotus* Candèze, *Neocardiophorus* Gurjeva, and *Paracardiophorus* Schwarz. New morphological information is presented on an undescribed southern-hemisphere cardiophorine larva. It is not known whether these newly observed morphological differences represent conserved ancestral states or morphological innovations for locomotion in dense soil. Since larval specimens of Cardiophorinae are rare, I take the opportunity to encourage colleagues to seize opportunities to collect bycatch cardiophorine larvae in more world regions to understand their evolution and diversity.

Association of Leptolycini adult males with immatures and extreme neotenous females in the West Indies (Elateroidea, Lycidae)

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Sexually dimorphic cases of extreme neoteny in beetles are well known in groups such as the „trilobite" larvae of SE Asia (Lycidae) (Másek & Bocák 2014), fireflies (Lampyridae) and New World glow-worms (Phengodidae) (Bocák et al. 2008). In these groups, some females completely lack the characters that define the adult form of a beetle: compound eyes, wings, elytra, 11 antennomeres, ovipositor and a multi-segmented tarsus. These extreme neotenic adults are often termed "larviform" females, and in most cases, the status of a given individual as an adult or larva is not really known. In contrast, the males of these sexually dimorphic species have all the normal adult characters and are immediately identifiable as a beetle. The Leptolycini are unique among other extreme neotenous groups of beetles because of the similar size of the females and males. They also differ from other neotenic lycids in their hyperdiversity and rapid geographic turnover of species. To date, no proven female or immature association with a male Leptolycini has been made and information on feeding, behavior and the morphology are lacking.

To investigate this, Malaise Traps and Flight Intercept Traps (FITs) were used over a month of field work in Puerto Rico in 2017 to collect male leptolycines and pit falls and Berlese funnels to collect the immatures and neotenous females. The collected specimens generated DNA quality data and we were able to associate the different semaphoronts with the use of DNA barcoding. We associated immature stages with adult males of Leptolycini in Puerto Rico of two different genera, *Leptolycus* Leng and Mutchler, 1922 and *Tainopteron* Kazantsev, 2009. Our successful DNA association in Puerto Rico allowed us to confirm a previous association of *Leptolycus* with immatures and females from St. John (U.S. Virgin Islands). Based on these association's confirmations in Puerto Rico and U.S. Virgin Islands, and with the use of morphology traits, we were able to hypothesize further associations between semaphoronts of Leptolycini in Cuba, Hispaniola and Tortola (U.S. Virgin

Islands) and expand the knowledge on the immature and female Leptolycini.

BOCÁK L., BOCÁKOVÁ M., HUNT T. & VOGLER A. 2008: Multiple ancient origins of neoteny in Lycidae (Coleoptera): consequences for ecology and macroevolution. *Proceedings of the Royal Society B* **275**: 2015–2023.
MASEK M. & BOCÁK L. 2014: The taxonomy and diversity of Platerodrilus (Coleoptera, Lycidae) inferred from molecular data and morphology of adults and larvae. *ZooKeys* **426**: 29–63.

Larvae without adults: the case of enigmatic New Zealand hydrophilid larvae

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The subfamily Cylominae is a small primarily terrestrial group of water scavenger beetles (Coleoptera: Hydrophilidae) distributed in the southern hemisphere. Most of them (56 species) are endemics of New Zealand where they form 70% of the hydrophilid fauna. During the fieldwork in New Zealand performed between 2012–2018, we accumulated fresh material of all New Zealand cylomine genera and most species which allowed us to reconstruct the genus- and species-level phylogenies (Seidel et al., in prep.). We were also able to associate field-collected larvae with adults, of which some were already described (Minoshima et al. 2015, 2018) and others are available for descriptions. Among the larval material discovered in New Zealand Arthropod Collection in Auckland were also long series of large ,unusually looking larvae collected in 1970s, characterized by a unique head and prothorax morphology. They did not correspond to any genus with known larvae, and their identity was unclear. In 2012, a single larva of this morphotype was collected in leaf litter in a small patch of lowland forest at the foothills of Mt. Egmont, North Island. Surprisingly, the DNA data did not associate the larva with any known genus. They indicated that the larva is sister to the genus *Saphydrus*. Larva of *Saphydrus* is known and morphologically rather dissimilar: it shares the nasale with 5 teeth and the dorsal microsculpture of the head, but differs in strongly sclerotized labium with fused mentum and prementum bearing a sclerotized ligula-like projection. Based on the chaetotaxy, only the apical membranous part of this projection is homologous to the ligula of other Hydrophilidae, whereas the sclerotized part is a novel structure. Other unusual characters are laterally projecting stemmata, lateral parietal setae situated on tubercles, proscutum with a pair of subquadrate lobes and the presence of pubescent finger-like projections on the abdomen. Despite inspecting all larger collections with New Zealand material, we have at the moment no candidate for the adult of this clade. Its sister relation to *Saphydrus*, which has highly seasonal short-living adults, indicates that the same may be the case for the adults of this lineage. Following all the evidence available, we decided to describe the larvae as new genus and species, with the sequenced third instar larva voucher designated as the holotype. To our knowledge, this is the first description of the new recent beetle genus based on larvae only.

MINOSHIMA Y. N., FIKÁČEK M., GUNTER N. & LESCHEN R. A. B. 2015: Larval morphology and biology of the New Zealand-Chilean genera Cylomissus Broun and Anticura Spangler (Coleoptera: Hydrophilidae: Rygmodinae). *Coleopterists Bulletin* **69(4)**: 687–712.
MINOSHIMA Y. N., SEIDEL M., WOOD J. R., LESCHEN R. A. B., GUNTER M. & FIKÁČEK M. 2018: Morphology and biology of the flower-visiting water scavenger beetle genus Rygmodus (Coleoptera: Hydrophilidae). *Entomological Science* **21(4)**: 363–384.

New description of the larval stage of *Sphenoptera* (*Tropeopeltis*) *servistana* Obenberger, 1930 (Coleoptera: Buprestidae) in Erbil governorate, Kurdistan region, Iraq

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The stem borer *Sphenoptera* (*Tropeopeltis*) *servistana* Obenberger, 1929 is one of the important orchard insect pests in Kurdistan region of Iraq. In spite of sufficient information on the adults but there is a little information known about the larval stage. This work is aimed to describe the larval stage of the insect pest in Erbil governorate for the first time. During the survey 50 larval samples have been collected. The late larval instars of *S. servistana* had been dissected then described and illustrated in details. Clarification on taxonomic consequential and implication of larval characters of all studied specimens are given and demonstration of substantial characters by scanning electron microscope with showing unclear characters by sketching is discussed. The results presented further evidence for the external morphology of *S. servistana* and it supported a basal position of Buprestidae larvae within the family. More comprehensive characteristics have been added to the morphology and will integrate with future study. The combination data set will likely contribute to a better identifying of species evolution in the future.

Suctorial larval mouthparts of the enigmatic *Myrmicholeva* Lea (Leiodidae: Camiarinae)

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Sucking mouthparts are generally connected with bugs or mosquitos but only coleopterologists know about few exceptions among beetles. Cerylonidae and Leiodidae are among them (Stehr 1991). Details about their feeding, habitat, morphology of mouthparts and their function are for most of them unknown. *Myrmicholeva* Lea is Australian genus belonging to Neopelatopini in Camiarinae, Gondwanan subfamily of Leiodidae. The genus and 4 species were described in 1910 with information about "triangular tongue" forming mouthparts of adults. Lawrence & Britton (1994) described these unusual mouthparts more detailed, but for today any illustrations and photos, except whole habitus of adults, do not exist both for adults and for immatures. For today, 4 species are known and about 8 new ones are still waiting for descriptions (Newton 1998). I present here detailed scanning electron micrographs of larval mouthparts for 4 species (*M. acutifrons* Lea and 3 undescribed) with discussion about way of specializations in comparison to other leiodid larval mouthparts. Although all larvae have stylet-like mandibles and maxillary mala and tube-like labrum and labium, there are interesting differences among species, for example in length and proportions, shape of distal edge of labrum and labium and other details, which are presented here.

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STEHR F. W. (ed.) 1991: *Immature Insects*. Michigan State University, Kendall/Hunt Pub. Co., Dubuque, Iowa.

A new species of *Periergates* Lacordaire, 1872 (Cerambycidae: Lamiinae: Onciderini) from Costa Rica, with description of all life stages and notes on biology

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A new species of *Periergates* Lacordaire, 1872 (Cerambycidae: Lamiinae: Onciderini) from Costa Rica is described. All life stages (egg, larva, pupa, and adult) are described and illustrated. Girdling behavior in *Periergates* is reported for the first time. Five host plants are recorded for the new species: *Cojoba costaricensis* Britton and Rose (Fabaceae), *Inga sierrae* Britton and Killip (Fabaceae), *Quercus insignis* M. Martens & Galeotti (Fagaceae), *Ardisia costaricensis* Lundell (Primulaceae), *Psidium guajava* L. (Myrtaceae). Finally, a key to the known species of *Periergates* is provided.

Deadwood and marsh beetles – what do we know about larvae of terrestrial Scirtidae?

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Marsh beetles (Scirtidae), the largest family of Scirtoidea, with almost 2000 known species and around 70 genera may be listed among the least known groups of water beetles. About 10 years ago, Jäch & Balke (2008) reported 900 known species, and their estimate of the real number of species was 1700. Today not only the number of 1700 described species is exceeded, but we are aware that this is only a fraction of the real diversity, probably less than 50% of the real number of species.

Larvae of most Scirtidae live in various water bodies, both running and stagnant. Many are associated with phytotelmata (e.g. in Bromeliaceae or Pandanaceae in tropical forests) and species developing in water accumulating in tree holes are often considered saproxylic. Larvae of Scirtidae are long-lived, submerged in water, where they feed on bacteria and other microorganisms with the use of complex mouthparts. Adults are often short-lived, and occur on vegetation close to the areas, where larvae develop. The great diversity of female gonocoxites can be noticed in marsh beetles: from soft and membranous with apical styli to subtriangular and strongly sclerotized, often with subapically articulated styli. Presence of stiff ovipositors suggests oviposition in harder substrates.

Hudson (1934) was the first to realize that not all larvae of Scirtidae live submerged in water. He reported terrestrial mode of life of larvae of the New Zealand species, *Veronatus tricostellus* (White). Crowson (1981) also found a larva in soil in New Zealand. The first detailed descriptions of

New Zealand terrestrial marsh beetle larvae with focus on mouthparts were published by Hannappel & Paulus (1991), but larvae were not identified to genera. In the same paper, Australian larvae of similar morphology, suggesting their terrestrial habits, were described for the first time. Data on ecology of Australian Scirtidae inhabiting eucalyptus logs in Tasmania were collected by Yee et al. (2006). Larvae from Australia were described in detail, and finally attributed to genera by Watts (2014). The only terrestrial larva from SE Asia was described from Borneo by Klausnitzer (2006), and in the same paper additional data on the larva of a New Zealand endemic *Veronatus* Sharp, was provided. The first South American terrestrial larvae were found in Chile (Ruta et al. 2018). During a visit in the New Zealand Arthropod Collection (Landcare Research, Auckland) I examined collection of larvae and studied specimens collected in logs or under rocks in various regions of both South and North Islands of New Zealand.

All known terrestrial larvae develop in water saturated logs or in wet soil under rocks and are secondarily adapted to this kind of habitats. They show several morphological adaptations, e.g. shortened antennae, reduced mouthparts, well developed prothoracic sclerites but on the other hand they have well developed anal papillae – osmoregulatory organs that are functional only in aquatic conditions. Thanks to the study of Watts (2014), we also know that adaptation to terrestrial habitats evolved independently in several lineages of marsh beetles.

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Megatominae larvae (Dermestidae) with major focus on evolution, morphology and ecological function of hastisetae

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Hastisetae are a specific group of detachable setae characterizing Megatominae larvae (Coleoptera: Dermestidae). These setae, located on both thoracic and abdominal tergites, apparently evolved as primary defense of the larva against invertebrate predators. According to the limited observations available these setae act as mechanical obstacle, entangling cuticular structures (spines and hairs) and body appendages (antennae, legs and mouthparts) of the predator; it has been observed however that this kind of hairs may affect vertebrates as well. Although information on the impacts of vertebrate predators of the beetles is lacking, hastisetae have been shown to be a threat for human health as contaminant of stored products (food and fabric), work and living environment. This presentation wants to offer a short review of the present knowledge on Megatominae larvae, highlighting in particular the link between the evolution of hastisetae, larval biology and biological success of the Megatominae. Furthermore, will be presented and discussed future research perspectives intended to fill the existing knowledge gaps.

Neotropical kindergardens: maternal care in Cassidinae (Chrysomelidae)

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Parental care can be broadly defined as ‘any form of parental behaviour that appears likely to increase the fitness of a parent offspring’ (Clutton-Brock 1991). Two basic types of parental care exists among insects, pre- and postovipositional (Royle et al. 2012). Subsocial postovipositional care, characterized by prolonged association between adults and offspring (Eickwort 1981), is the most primitive level of social interaction involving parents and offspring, and it is of interest because analysis of simple parental responses may elucidate ways towards complex eusocial behaviour (Michener 1969).

Postovipositional parental care is a rare phenomenon in Coleoptera and so far it has been recorded only in 17 out of 189 families (Machado & Trumbo 2018). It includes egg and offspring attendance or transport, viviparity, progressive provisioning, and care following nutritional independence (Royle et al. 2012). Within leaf-beetles it is present only in two (out of 15) subfamilies, Chrysomelinae and Cassidinae. Cassidinae have world-wide distribution with majority of diversity in the tropics and there are nearly 6.400 species classified in 35 tribes (Sekerka 2017). Postovipositional maternal care has been so far reported in only 24 Neotropical species currently classified in two tribes, Mesomphaliini and Eugenysini (Chaboo et al. 2014). The first case ever reported seems to be *Paraselenis flava* (Linnaeus, 1758) (Weyenbergh 1874). Fiebrig (1910) was the first one who provided illustrations of a female guarding egg-mass in *Acromis spinifex* (Linnaeus, 1763). Subsequently other records were published and recently summarized by Chaboo et al. (2014), however most of them being just reports without stronger emphasis on the maternal care. The exception is a detailed study on natural history of *Acromis sparsa* (Boheman, 1854) published by Windsor (1987), which remains the only such a detailed study on cassidne with maternal care. Windsor & Choe (1994) were the first to provide a detailed review on maternal care in Cassidinae and hypothesized two possible scenarios for the origin of maternal care. According to the first, subsociality evolved in a single ancestor. The alternative hypothesis holds that subsocial habits evolved independently in two distinct clades. Their preliminary analysis of morphological, ecological and behavioural data favoured the second hypothesis. Chaboo et al. (2014) analyzed morphological data and stated that subsociality may have originated once with a single loss in *Echoma* Chevrolat, 1836 or as two closely related but independent origins of subsociality. However, the authors regarded the second hypothesis as ambiguous due to the polytomy present in their phylogeny. So far no analysis of subsociality in Cassidinae included molecular data.

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The role of immature stages of beetles in determining the minimum postmortem interval

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Forensic entomologists observe the life stages of necrophagous beetles as a kind of biological clock to estimate the minimum postmortem interval PMI_{min}, or in some cases to validate it (Bala & Sigh 2015, Jakubec et al. 2019). Also, the knowledge of diversity of necrophilous beetles in local carrion fauna can provide evidence of ecological succession, which provides a second clock (Bala & Sigh 2015, Shayya et al. 2018). These evidence sources require taxonomic, morphological, ecological and growth knowledge for adult beetles as well as their immature stages (Bala & Sigh 2015, Matuszewski & Frątczak-Łagiewska 2019). A recent study revealed that, the size at emergence improves accuracy of age estimates in forensically-useful staphylinid beetle *Creophilus maxillosus* (Matuszewski & Frątczak-Łagiewska 2019). For the fauna of Lebanon, there is a need for more taxonomic and ecological knowledge on beetles of forensic relevance.

Adults and immature stages of beetles among Dermestidae, Histeridae, Staphylinidae and Silphidae were collected from ephemeral microhabitats like decomposing pig carcasses, rotting fish and dung. Morphological identification was performed through examining external and internal parts of both adults and immatures and DNA barcoding of the species is currently performed.

Adult beetles like necrophagous *Dermestes frischii* were present during the active decay stage of pig carcasses decomposition and predominant during the advanced decay stage in both seasons spring and summer. This is in accordance with Abd El-Bar et al. (2016) who mentioned their preference to dried carrion. Their larvae were present starting from day 9 postmortem during summer (advanced decay) and from day 20 postmortem (advanced decay) in spring. The necrophilous *Saprinus* spp. were mainly present during the active decay and advanced decay stage, when their preys (Diptera larvae) were present. This is in accordance with Bajerlein et al. (2011) and Kovarik & Caterino (2016). Cleridae were omnivorous during late stages of carcass decomposition and the Silphidae were only present during spring and not summer. Cytochrome oxidase subunits I (COI) gene was proven to have a sufficient discrimination power and is suitable for species identification.

The identification of the immature stages of beetles would support the database of insects of forensic relevance for Lebanon, which could be used as a reference for determining the minimum postmortem interval in future casework. This step of building the database could be enhanced by the DNA barcoding of the immatures.

BAJERLEIN D., MATUSZEWSKI S. & KONWERSKI S. 2011: Insect succession on carrion: seasonality, habitat preference and residency of histerid beetles (Coleoptera: Histeridae) visiting pig carrion exposed in various forests (Western Poland). *Polish Journal of Ecology* **59(4)**: 787–797.

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Challenging the "*Archeopteryx*" of rose chafers: what tells us the larval morphology of *Xiphoscelis braunsi* (Cetoniinae: Xiphoscelidina) about the phylogenetic origin of the group?

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Currently, two new species of the southern African genus *Xiphoscelis* Burmeister, 1842 are recognised and described, *X. braunsi* from the Eastern and Western Cape Karoo (South Africa) and *X. namibica* from the Huns Mountains of southern Namibia and adjacent ranges in South Africa**.** Number of presumably plesiomorphic adult characters shared with a number of putatively primitive genera among the African Cetoniinae resulted to the widely accepted conclusion that *Xiphoscelis* and its relatives represent an ancient lineage of rose chafers, often being called the "the *Archaeopteryx* among rose chafers".

During our field trip to South Africa we managed to collect several larvae of *X. braunsi* along with the conspecific adults. Using this material we explored the phylogenetic relationships of the genus with other Cetoniinae based on the larval characters highlighted in the description of the 3rd instar larva. The larvae of the genus *Xiphoscelis* are characterised by a remarkable subset of morphological characters: i.e., long and dense chaetotaxy of cranium; reduction of sense cone and plate-shaped sclerite of epipharynx; presence of an external tooth on lateral mandibular margin; shape and size of lacinial unci and the reduction of the truncate process of hypopharyngeal scleroma. The outcome of the phylogenetic analysis revealed *X. braunsi* within a clade shared with other South African species *Meridioclita capensis* (Gory & Percheron, 1833) and *Heteroclita haworth* Krikken, 1982. Despite the general topology remained unresolved we question the hypothetical "basal" placement of *Xiphoscelis* among the Cetoniinae (e.g. HOLM & MARAIS 1992, PERISSINOTTO et al. 2003) based on the overall derived state of its larval morphological features. The unique adult morphology may in fact reflect the convergent adaptation to hot and arid conditions they share with several other species occurring in this region, rather than its ancient origin.

New system of Staphylininae rove beetles based on DNA and morphology. Larvae and biology to come!

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The talk presents the path to, and results of, recent changes implemented in the higher classification of the subfamily Staphylininae, one of the largest lineages of rove beetles. These changes are based on the series of phylogenetic and taxonomic papers gradually published by the author with co-authors, where larval morphology was considered, but only to a minor extent. Larval morphology seems informative for the backbone phylogeny of this lineage, although it was never properly analyzed in large scale due to our very patchy knowledge of the Staphylininae larvae unknown for entire tribes or subtribes. Most recent findings of the larvae for some of them seem well aligned with molecular data driving most recent phylogenetic discoveries. They call for broader and more inclusive studies of the rove beetle biology.

Ecology and taxonomic characterization of immature stages of *Lepidiota* spp. (Coleoptera: Scarabaeidae: Melolonthinae) endemic to Assam, Northeast India

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Lepidiota Kirby, 1828 is one of the speciose genera in tribe Melolonthini of Melolonthinae (Coleoptera: Scarabaeidae) occurring in India. Surveys carried out during 2014–2016 in North and Northeast India yielded five species, viz., *Lepidiota albistigma*, *L. bimaculata*, *L. mansueta*, *L. sticticopetra* and *L. stigma*. Of these, *L. mansueta* and *L. albistigma* were the most predominant species occurring in Assam while *L. bimaculata* was relatively abundant in Uttar Pradesh, *L. sticticopetra* in Uttarakhand and *L. stigma* in Himachal Pradesh. The species, *L. mansueta* adults were also collected from Uttar Pradesh but observed in huge numbers in Majuli Island of Assam. Collections in subsequent years revealed that *L. mansueta* had overlapping generations in Majuli Island while not in Amroha district of Uttar Pradesh. Though both the *Lepidiota* species occur in Assam, species abundance of *L. albistigma* is restricted to lower Assam in Barpeta district, which is an important vegetable growing area and falls under heavy rainfall zone of lower Brahmaputra valley of Assam (26°30′N & 90°54′E) while *L. mansueta* to upper Assam in Majuli Island, a largest river island in the Brahmaputra river (26°57′N & 94°10′E). Interestingly, the adult beetles of *L. mansueta* were found to be non-feeding stage while the adults of *L. albistigma* were voracious feeders on mango and other crops like citrus, litchi, black pepper, arecanut, etc. The larvae of these species are root feeders of plants in general and *L. mansueta* is observed as a serious pest of sugarcane in Assam.

The third larval instars of *L. mansueta* and *L. albistigma* have been studied for their distinguishing taxonomic characters, which have been documented. The larval body shape, thorax, abdomen, spiracles, legs and the raster characters have been studied and described for both the species. The anal slit appeared ‘v’ shape and the raster comprised of a pair of longitudinal palidia, however, septula and the number and arrangement of pali differed in both the species. The head, epipharynx, mandibles, maxillae and hypopharynx have been studied in detail. Epipharynx exhibited asymmetry in shape and haptomerum showed variations in both the species exhibiting varied rows of heli. Plegmatia prominent with slight variations in number of plegmata, 13–14 in *L. mansueta* and 15–16 in *L. albistigma*; setae in chaetoparia and acroparia, the dexiotorma, laeotorma and pternotorma are described. Dexiophoba, laeophoba and haptolachus of both the species are defined. Maxillary lacinia showed variations between *L. albistigma* and *L. mansueta*. Stridulatory area extended from base of stipes to slightly ahead of galea base with a row of 11–12 truncate teeth in both the species exhibited slight differences in the arrangement of stridulatory teeth. The larvae of the scarab species, *L. mansueta* and *L. albistigma* are described for the first time.

Morphological description, bionomy and taxonomical issues of some previously undescribed larval stages of three species of Oxyporinae Erichson, 1839

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For the great majority of species in the megadiverse rove beetle family Staphylinidae immature stages are either unknown or represented by superficial descriptions. Knowledge of the rove beetle immatures lags far behind other Coleoptera families, e.g. Carabidae, Dytiscidae, Hydrophilidae or some phytophagous Coleoptera. Even for the large-bodied, visually attractive highly specialized mycophagous monogeneric rove beetle subfamily Oxyporinae larvae are described only for nine out of 120 known species – and only four of these larval descriptions are detailed enough to describe chaetotaxy. Moreover, the chaetotaxy systems used in these four descriptions are noticeably incongruent with each other, showing conflicting hypotheses for certain setal elements. Very little is known about the biology of the Oxyporinae larvae, although such observations could be useful for understanding their morphology and evolutionary origin of this unique subfamily.

During the expedition to the Russian Far East in 2018 we collected material on the immature stages and explored biology of three *Oxyporus* species from two subgenera: *Oxyporus* (s. str.) *maxillosus*, *Oxyporus* (s. str.) *procerus,* and *Oxyporus* (*Pseudoxyporus*) *melanocephalus*. Their species identity subsequently was verified by means of DNA barcoding.

For these three species data on feeding, mating, oviposition and brood care were obtained for the adults. Also we observed development of their larvae, in particular, their feeding and movements within fungal habitats. A chaetotaxy system of Ashe & Watrous (1984) developed for *Atheta coriaria* was applied to describe the larvae of these species and compare them with the previously described larvae. This necessitated a critical synthesis of all previously accumulated knowledge about *Oxyporus* larvae which is presented here as a digest of the material

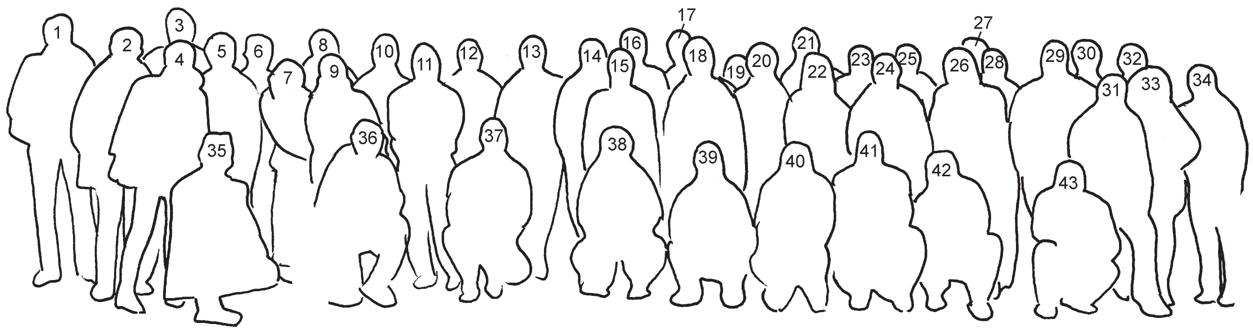

Fig. 1. Most participants of the Immature Beetles Meeting 2019 during the first day (Prague, 3rd October 2019): 1 – Petr Švácha, 2 – Jordan Rainey, 3 – Enrico Ruzzier, 4 – Aleksandra Kilian, 5 – Robert Angus, 6 – Fang-Shuo Hu, 7 – Alicia Hodson, 8 – Michel Perreau, 9 – Kolla Sreedevi, 10 – Petr Máslo, 11 – Eugenio Nearns, 12 – Jiří Hájek, 13 – Jiří Skuhrovec, 14 – Filip Trnka, 15 – Karolina Mahlerová, 16 – Albert Damaška, 17 – Rafal Ruta, 18 – Jan Růžička, 19 – Max Blake, 20 – Karol Szawaryn, 21 – Ondřej Kouklík, 22 – Ashleigh Whiffin, 23 – Michael Ivie, 24 – Josef Jelínek, 25 – Robin Kundrata, 26 – José Luis Navarrete-Heredia, 27 – Emmanuel Arriaga-Varela, 28 – Mark Volkovitsh, 29 – Vinicius Ferreira, 30 – Peter Hlaváč, 31 – Hume Douglas, 32 – David Sadílek, 33 – Brigitta Wessels-Berk, 34 – Donna Ivie, 35 – Matthias Schöller, 36 – Max Barclay, 37 – Lukáš Sekerka, 38 – Santiago Montoya-Molina, 39 – Hee-Wook Cho, 40 – Jarin Qubaiová, 41 – Wand Khalis Ali, 42 – Tomáš Lackner, 43 – Jiří Kolibáč.

ever examined, species diagnoses if provided, outline on the chaetotaxy pattern, as well as data on fungal hosts and behaviour for each species. The present work shed light on the previously unknown or misunderstood morphological details of the *Oxyporus* larvae. In particular, some setae, campaniform sensillae and also some undecided type of sensilla (*pls*) were explored on their tergites. As a result, larva of *O. maxillosus* is redescribed, larvae of *O. procerus* and *O.* (*P.*) *melanocephalus* are described for the first time. Morphological details of the larvae, the data on COI sequences, as well as noticeable difference in the female reproduction behaviour between some species from the subgenera *Oxyporus* s. str. and *Pseudoxyporus* suggest that they could be given a status of separate genera.

ASHE J. S. & WATROUS L. E. 1984: Larval chaetotaxy of Aleocharinae (Staphylinidae) based on a description of Atheta coriaria Kraatz. *Coleopterists' Bulletin* **38**: 165–179.

Larval morphology of the jewel beetles of the subfamily Polycestinae and its significance for the taxonomy and phylogeny (Coleoptera: Buprestidae)

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Jewel beetles (Buprestidae) is one of the largest coleopteran families (approx. 15,300 species). The subfamily Polycestinae (13 tribes, 82 genera, about 1300 species) which is considered rather primitive, takes the 4th place in the family being significantly inferior to Agrilinae, Buprestinae and Chrysochroinae. In the same time, polycestine larvae demonstrate almost the entire spectrum of morpho-ecological and functional adaptations and evolutionary trends inherent in Buprestidae and can serve as a model group for studying of morphogenesis of many larval characters, development of classification and phylogeny of the entire family. The larvae of about 100 (8%) species from 24 (29.6%) genera and 11 tribes of Polycestinae have been described so far; the larvae of Perucolini and Bulini are still unknown; the larvae of Acmaeoderini are best studied, while the larvae of other groups are known only for individual or very few species. Larval characters of some polycestine genera and tribes were analyzed by VOLKOVITSH & HAWKESWOOD (1999) and VOLKOVITSH & BÍLÝ (2015).

General structure of buprestid larvae is determined by their endobiont habitat inside plant tissues or exobiont soil dwelling. Schizopoid, julodoid (both exobionts), buprestoid, agriloid, and trachyoid (all endobionts) morpho-ecological types of buprestid larvae are recognized; the polycestine larvae are predominantly buprestoid while the larvae of *Paratrachys* are trachyoid. Several morpho-ecological subtypes are distinguished within the buprestoid type depending on the habitats (subcortical, xylophagous or grassy stem borers, etc.) and the hardness of the food substrate (VOLKOVITSH 1979). Trachyoid type inherent to leaf-miners occurring only among Polycestinae and Agrilinae. Polycestine larvae can be recognized by a single pronotal groove (also Gabellinae) and presence of additional lobe on stipes (except prospherioid genera); from Galbellinae they differ by additional lobe on stipes, structure of palatine sclerites and latero-basal sclerite of maxillary cardo.

Three phyletic lineages are established within Polycestinae: prospherioid, polycestioid, and acmaeoderioid (VOLKOVITSH 2001). The grounds to distinguish polycestioid and acmaeoderioid lineages are supported by molecular studies (EVANS et al. 2015) while the separation of presumably most primitive Gondwanian prospherioid lineage is supported only by absence of additional lobe on larval stipes (plesiomorphy), the most advanced larval states were found in Prospherini. Within polycestioid lineage, larval characters in part support the affinity of Thrincopygini and Polyctesini, while *Chrysophana* differs sharply from all other genera of Polyctesini. Unique larval synapomorphies were found in all studied genera of Polycestini and Tyndarini but these were not found within acmaeoderioid lineage, except Paratracheini. Within the latter the most primitive states are found in Ptosimini (*Ptosima* still retains microsetal areas on prementum, while in *Sponsor* these are completely lacking). Larvae of Acmaeoderina demonstrate the most advanced states of many characters, as such complete reduction of microsetal areas on labrum, prementum and integuments. The most advanced trachyoid larvae of *Paratrachys* in spite of extreme specialization resulting from leaf-mining habit, retain many states of buprestoid type (proventriculus, buprestoid spiracles etc.). Still enigmatic is a taxonomic position and relationship of Haplostethini which based on molecular study is suggested to re-surrect as a separate subfamily (EVANS et al. 2015). However, the general larval morphology of *Mastogenius* is very similar to that in Polycestini and acmaeoderioid taxa which give grounds to treat Haplostethini as a member of acmaeoderioid lineage or as belonging to a separate phyletic lineage within Polycestinae. This study demonstrates a great importance of larval morphology for the taxonomy and phylogenetics not only in Polycestinae but of the entire Buprestidae family.

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POSTERS

Morphological characters of immature stages of Palaearctic *Mecinus* species and their systematic value in Mecinini (Coleoptera, Curculionidae, Curculioninae)

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The Mecinini is a tribe of the subfamily Curculioninae (Curculionidae) and comprises six genera: *Cleopomiarus* Pierce, 1919; *Gymnetron* Schoenherr, 1825; *Mecinus* Germar, 1821; *Miarus* Schoenherr, 1826; *Rhinumiarus* Caldara, 2001 and *Rhinusa* Stephens, 1829. The larvae of Mecinini develop in roots, shoots, leaves and flowers, many of them causing the organs of the host plants to swell or develop into galls. Recently the mature larvae of five *Cleopomiarus* species and three *Miarus* species, and the pupae of four *Cleopomiarus* species and two *Miarus* species were described in detail for the first time.

Now, we start to study the material of mature larvae and pupae of 14 *Mecinus* species namely: *M. circulatus* (Marsham, 1802); *M. collaris* Germar, 1821; *M. heydenii* Wencker, 1866; *M. ictericus* (Gyllenhal, 1838); *M. janthiniformis* Toševski & Caldara, 2011; *M. janthinus* Germar, 1821; *M. kaemmereri* Wagner, 1927; *M. labilis* (Herbst, 1795); *M. laeviceps* Tournier, 1873; *M. pascuorum* (Gyllenhal, 1813); *M. peterharrisi* Toševski & Caldara, 2013; *M. pirazzolii* (Stierlin, 1867); *M. pyraster* (Herbst, 1795); and *M. sicardi* Hustache, 1920. Both larvae and pupae were redescribed or completely described and illustrated for the first time. The general shape of the bodies, the structure of the mouthparts, chaetotaxy, cuticular processes and colouration were studied and analysed in order to evaluate their taxonomic value.

The first result shows really huge morphological variety within genus in larval and pupal stages as well (e.g., the structure of spiracles, number and distribution of setae, presence/absence of asperities, number of labial and maxillary palpi, and shape of urogomphi). The division into species groups (e.g., *M. circulatus* group, *M. collaris* group, *M. heydenii* group, *M. janthinus* group and *M. simus* group) seems justified but final taxonomic order within *Mecinus* genus requires further investigations.

Reduction of eyes in last-instar beetle larvae: a special observation in Trictenotomidae, based on *Trictenotoma formosana* Kriesche, 1919

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The phylogenetic position of Trictenotomidae Blanchard, 1845 was a puzzle for coleopterists for over a century. The only larval description for this peculiar family was published in the early 20th century (GAHAN 1908). However, Gahan's described specimen was in poor condition and the description itself is incomplete. Recently, LIN & HU (2018, 2019) unraveled the biology of *Trictenotoma formosana* Kriesche, 1919. For the first time there is fresh immature stages material available for Trictenotomidae, including first- and last-instar larvae and pupae.

Stemmata, or simple eyes, are innervated laterally from the brain's optic lobes, and typically there is a group on each side of the head in larval Holometabola. The number of stemmata in larvae is used widely in morphology-based phylogenetic analysis. An uncommon difference between first-instar and last-instar trictenotomid larvae were uncovered during our study. While first instar larvae have 2–5 stemmata on each side of the head, stemmata are absent in last-instar larvae. The ontogenetic importance of this phenomenon remains unknown.

The presence of a series of longitudinal ridges on the tergites and sternites is one of the most important features of trictenotomid larvae compared with other Tenebrionoidea. The ridges are not present in first-instar larvae, but long setae are present instead. We herewith hypothesize that the longitudinal ridges of last-instar larva and setae of the first instar might be homologous.

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Cerambycid larvae in semi-desert and desert habitats of southern Mongolia

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The conditions prevailing in the arid zone of Central-East Asia pose difficult requirements for their inhabitants. The fauna of these areas, although it is not exceptionally diverse, due to numerous unique habitats does abound a great number of highly specialized endemic taxa. The exception in this case is neither the Gobi Desert nor the representatives of longhorn beetles (Coleoptera: Cerambycidae).

We present the results of our expedition to the south-eastern Mongolia related to the immature stages of the cerambycids inhabiting this region. Searching for larvae was performed by two different methods in semi-desert and desert areas: by digging in the soil under clumps of grass of the genus *Achnatherum* (= *Lasiagrostis*) and cleaving branches and underground fragments of stems of various shrubs and prostrate shrubs. After pouring boiling water, the larvae were fixed in 96% ethanol as intended to utilize in DNA analysis.

The results of this survey provide new knowledge regarding the genera of *Eodorcadion*, *Anoplistes* and *Chlorophorus*, whose bionomy in these vegetation zones is still very poorly understood.

Larval morphology of *Heterotemna tenuicornis* (Coleoptera: Silphidae: Silphinae)

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Heterotemna tenuicornis (Brullé, 1864) is an endemic species of carrion beetles from Canary Islands, belonging into the genus *Heterotemna* Wollaston, 1864. Distribution of this species is restricted to Anaga Mts., on north-eastern part of Tenerife Is. *Heterotemna* is the last genus of carrion beetles with unknown immature stages. Our study presents the first description of all three instars of the larva of *H. tenuicornis*. Observed characters of external morphology are compared to other larvae from the same subfamily of carrion beetles. Described characters were photo-documented, and measured. Detailed description of all three instars brings not only new information about the endemic species but also can be used in future taxonomic studies of the subfamily Silphinae.