CZECHOSLOVAK ACADEMY OF SCIENCES

BIOLOGY OF COCCINELLIDAE

CZECHOSLOVAK ACADEMY OF SCIENCES

Scientific Editor Doc. Dr. Josef Mařan
Scientific Adviser Doc. Dr. Karel Hůrka, CSc.

Graphic Design by Petr Drbal

BIOLOGY OF COCCINELLIDAE

Ivo Hodek

with keys for identification
of larvae by co-authors

1973

ACADEMIA,
Publishing House
of the Czechoslovak
Academy of Sciences,
Prague

© Ivo Hodek 1973
Illustrations © Jiří Zelený, Ivo Kovář, G. I. Savoïskaya

To all those scientists
who have now passed on
and who laid the foundation
of our present knowledge of Coccinellidae

Preface

This book provides the first monograph of *Coccinellidae*. Although the group finds inclusion both in Clausen's (1940) "Entomophagous Insects" and in Balduf's (1935) "Entomophagous Coleoptera", reference in these works is limited to three and twenty pages respectively. Moreover, the last thirty years since these books appeared have seen a great deal of work on the group.

The use of insecticides largely destroyed the early attempts at biological control and interest remained low for as long as insecticides appeared quite successful. However, the problems of insecticides soon became apparent, and in the last decade there have been tremendous developments in biological control, particularly in combination with other measures to form integrated control. In these developments aphids and mites, which perhaps include the most widespread crop pests, have received special attention and therefore there has been aroused great interest in coccinellids as potential control agents. Moreover, coccinellids have long proved valuable in the biological control of coccids. Therefore, coccinellids have become of very considerable interest among the entomophagous insects of the world.

It is now quite impossible to compress all the information that exists about the group into a brief volume; to attempt this would even be undesirable, for the important ecological features of coccinellids would then become lost in a morass of less useful details. The underlying aim of the writer has been to survey the group in a way which is instructive and especially includes the type of information likely to be needed by those working on coccinellids. In particular, those who start work on coccinellids will find the book will save many hours of searching the literature and of trying to interpret conflicting statements.

Although it is hoped the book is sufficiently comprehensive for this purpose, it has also been designed to be sufficiently short and readable for use by the unspecialized applied entomologists as well as to interest the layman, who merely has a liking for this group.

To achieve these aims, it has been necessary to make a selection of the available material about coccinellids. This selection has been governed by the following principles:

— papers which identify causal relationships have been given priority over those which are purely descriptive, because the former are more useful in connection with the utilisation of coccinellids in biological or integrated control;

— most stress has been laid on more recent work because this normally gives references to older work; recent reviews which give a good summary of earlier work receive special mention;

— as far as possible, papers are also mentioned which tend to be "hidden" from many workers because either they are in difficult languages or are in inaccessible journals.

In spite of the ecological emphasis of the book, it has been felt necessary to devote the first three chapters (co-written by appropriate specialists) to other topics. Thus Chapter 1 concerns the taxonomy, morphology and anatomy of adults necessary to understand the terminology of the group and the structural features which are relevant to ecology (e. g. variation in mouthparts of groups with different food habits).

While the identification of adult coccinellids presents no special problems because good standard keys have long been available particularly for the Palaearctic fauna, the identification of larvae is still difficult. The only key, even for Palaearctic species, is the key to English species by F. I. van Emden (1949). Only recently has a key to central European species been produced by Klausnitzer (1970), the co-author of Chapter 2. It therefore is worthwhile to include keys to larvae in this chapter of the book. To make their identification as simple as possible, the book features the first colour plates of whole 4th instar larvae of the most common Palaearctic species. There is further a simple pictorial field key.

Chapter 3 discusses the notorious variability of coccinellids on a genetic and zoogeographic basis.

The book has been produced in English because most scientists either have a working knowledge of this language or have easy access to translation facilities. It is hoped that a style of English has been maintained which will be as clear as possible to those for whom English is not a native language. It is hoped that the subject matter has been subdivided in a helpful way but, in any case, overlap between sections has been retained without repetition by the extensive use of cross-references.

The names of authors of coccinellid species are not used in the text (with exception of identification keys) but may be found in the subject index — pars *Coccinellidae*. Also the synonymy of aphids is confined to the index — pars *Aphidoidea*.

July 1971 *I. Hodek*

Acknowledgements

It is a pleasure to express my indebtedness to Dr. H. F. van Emden who made my English more understandable and for his valuable comments. Thanks are also due to Prof. M. J. Way who read and criticized the last chapter.

Grateful acknowledgement is hereby made to many authors who permitted me to use their unpublished data or "in press" manuscripts, esp. to Drs H. D. Brown, G. Iperti, M. Kehat, Lim Sook Ming, Ya. Lusis, G. Moter, H. Sasaji, B. C. Smith, U. Tadmor. Specialists in all parts of the world have greatly helped by sending me reprints of their papers.

For permission to reproduce re-drawn illustrations, thanks are due to the Editors of Annals of applied Biology, Annual Review of Entomology, British Journal of Animal Behaviour, Bulletin of entomological Research, Bulletin de la Société entomologique d'Egypte, Canadian Entomologist, Citrus Magazin, Entomologia experimentalis et applicata, Entomophaga, Fruits, Japanese Journal of applied Entomology and Zoology, Journal of Animal Ecology, Kontyu, Transactions of the Royal entomological Society of London, Zeitschrift für Morphologie und Ökologie der Tiere, Zoologische Jahrbücher. I am indebted to the Director of "Station de Recherches de Lutte Biologique et de Zoologie agricole", I. N. R. A., Antibes, to F. E. Skinner and B. Matsumoto for permission to use their photos.

Contents

1 TAXONOMY AND MORPHOLOGY OF ADULTS

J. KOVÁŘ

1.1 Morphology

Adult coccinellids are of minute to medium size, 0.8—18 mm large. The body (Pl. I, 1—8) is most often oval, sometimes almost 3 times as long as wide. The dorsal surface is convex; the ventral surface is always flat. The body surface is either bare or covered with short recumbent hairs and is more or less shiny. In the *Sukunahikonini*, there are also longer erect hairs in addition to the short recumbent ones. Sculpturing is in the form of fine or coarse punctures, densely arranged.

Head (Pl. II, 1—5). — The individual parts of the cranium (epicranium, frons, genae, clypeus) are fused. The anterior part of the cranium is simple and projects forwards, in the *Chilocorinae* it is strongly widened laterally. The antennae are inserted in front of the eyes in the dorsolateral corners of the frons, but ventrally in the *Chilocorinae*. The lateral part of the cranium bears anteriorly large compound eyes with a finely, in the *Coccidulinae* and the *Lithophilinae* rather coarsely, faceted surface. Anteriorly an indistinct suture separates the gula from the basal part of the labium (submentum), which forms a medial projection. Between this projection and the inner margin of the genae are deep grooves which form the insertions for the basal parts of the maxillae. The inner skeleton of the head — the tentorium — is formed by narrow tentorial arms, the tentorial bridge is missing.

The mouth-parts are of biting type. The labrum is always much narrower than the anterior margin of the cranium and is clearly visible from above except in the *Chilocorinae*.

The massive, wide, sickle-shaped **mandible** has incisor and molar parts on its inner side. The incisor part is formed by two teeth to give the mandible a bifid apex. The molar part is formed by the molar projection (mola) which usually consists of two teeth situated obliquely beside each other. Ventrally a membraneous prostheca is present, growing between the incisor and molar areas and bearing a continuous row of bristles. The outer side of the mandible is simple, strongly curved and concave at the base. The base of the mandible is wide and has two condyles, of which the ventral one is stronger. Both ventral and dorsal sides of the mandible bear both setae and sensillae. According to the food of the beetle, various types of mandible can be distinguished; these differ particularly in the construction of the apex (incisor part) and the mola (molar part) (Strouhal 1926a, b, Pradhan 1938).

The phytophagous type (Pl. III, 1—3) can be characterized as highly specialized, adapted to biting-off and roughly preparing plant tissue, including the tough epidermis. Typically the incisor part consists of four (three) large, apically round or blunt teeth carrying larger or lesser accessory teeth, including the teeth of the "molar region". The distinct molar projection is replaced by a row of coarse teeth which form the molar

part of the mandible (*Henosepilachna, Subcoccinella*). From this typical phytophagous mandible, other mandibles can be derived (*Affidentula*) in which a gradual reduction of accessory teeth (including the teeth of the "molar region" up to the reduction of the subapical tooth) and a strong shortening of apical teeth take place.

The **carnivorous** type is the basic and widely represented type of mandible in the family *Coccinellidae* and corresponds to the general description given earlier. Within this type there are several trends. In aphidophagous coccinellids of the tribe *Coccinellini* (Pl. III, 4—8) both the terminal teeth are comparatively small and split off each other near the top; the ventral tooth is also somewhat smaller. The inner part of the mandible is entirely smooth between the top and the mola; only in some genera (Strouhal 1926b) it is covered with minute, blunt teeth. This dentation is very conspicuous in *Tytthaspis sedecimpunctata* (Pl. III, 9—10), (mycophagous species), and *Bulaea lichatschovi* (phytophagous species). In contrast, such dentation is missing in *Coleomegilla maculata* (polyphagous species, feeding on pollen and aphids). Butt (1951) found the molar region of *C. maculata* to differ from that of aphidophagous species.

The ventral terminal tooth is relatively well-developed in the *Scymnini* (Pl. IV, 11—12), *Coccidulini* (Pl. IV, 5—6), and *Stethorini*. In coccidophagous species the ventral tooth is of approximately the same size as the dorsal one (*Noviini*) (Pl. IV, 3—4), or is reduced (*Telsimiini*), or is quite absent (some *Chilocorini*) (Pl. IV, 1—2). In the subfamily *Sticholotinae* the apex of the mandible is not divided and comprises a single tooth; the molar projection is either reduced or absent.

The **mycophagous** type (Pl. IV, 7—10) can be derived from the basal carnivorous type with a mola and occurs in part of the tribe *Psylloborini*. The apex of the mandible bears two teeth, of which the ventral one divides into a row of further teeth, the size of which diminishes towards the base. The number of teeth in this row is different in different species.

The maxilla (Pl. V, 1—6) consists of cardo, stipes, lacinia, galea and the maxillary palpus. The area called stipes consists of three sclerites which form a tube-shaped structure. The galea articulates with the distal part of the stipes; in the *Epilachninae* it is covered with many relatively short setae and is much longer than in carnivorous coccinellids. The lacinia is oblong and flat and bears setae similar to those on the galea on the ventral side. In carnivorous coccinellids these setae are rather long and thin, in the *Psylloborini* stronger, curved setae are present in addition. The maxillary palpus is four-segmented; the apical segment is securiform, weakly divergent anteriorly or nearly parallel-sided; only in some *Sticholotinae* it is much elongated and conical.

Two parts can be distinguished on the labium (Pl. VI, 1—3): the partly movable prelabium (prementum) and postlabium (mentum + submentum) which are connected

---

Plate I
Shape of the body. 1 — *Hippodamia tredecimpunctata;* 2 — *Paranaemia vittigera;* 3 — *Semiadalia undecimnotata;* 4 — *Subcoccinella vigintiquatuorpunctata;* 5 — *Coccidula scutellata;* 6 — *Hyperaspis reppensis;* 7 — *Henosepilachna vigintioctomaculata;* 8 — *Afissa mystica.* (I. Kovář del.)

Plate II
1, 2, 4, 5 — Head capsules, dorsal aspect; 3 — head capsule ventral aspect. 1 — *Adalia bipunctata;* 2 — *Scymnus frontalis;* 3 — *Propylaea quatuordecimpunctata* (cd — cardo, g — gula, mt — mentum, plb — prelabium, of — occipital foramen, smt — submentum, st — stipes, t — tentorial arm); 4 — *Chilocorus renipustulatus;* 5 — *Ortalia sp.* (I. Kovář del.)

Plate III
Mandibles. 1, 2 — *Henosepilachna elaterii;* 3 — *Subcoccinella vigintiquatuorpunctata;* 4, 5 — *Adalia bipunctata;* 6, 7, 8 — *Anisosticta novemdecimpunctata;* 9, 10 — *Tytthaspis sedecimpunctata* (I. Kovář del.)

PLATE I

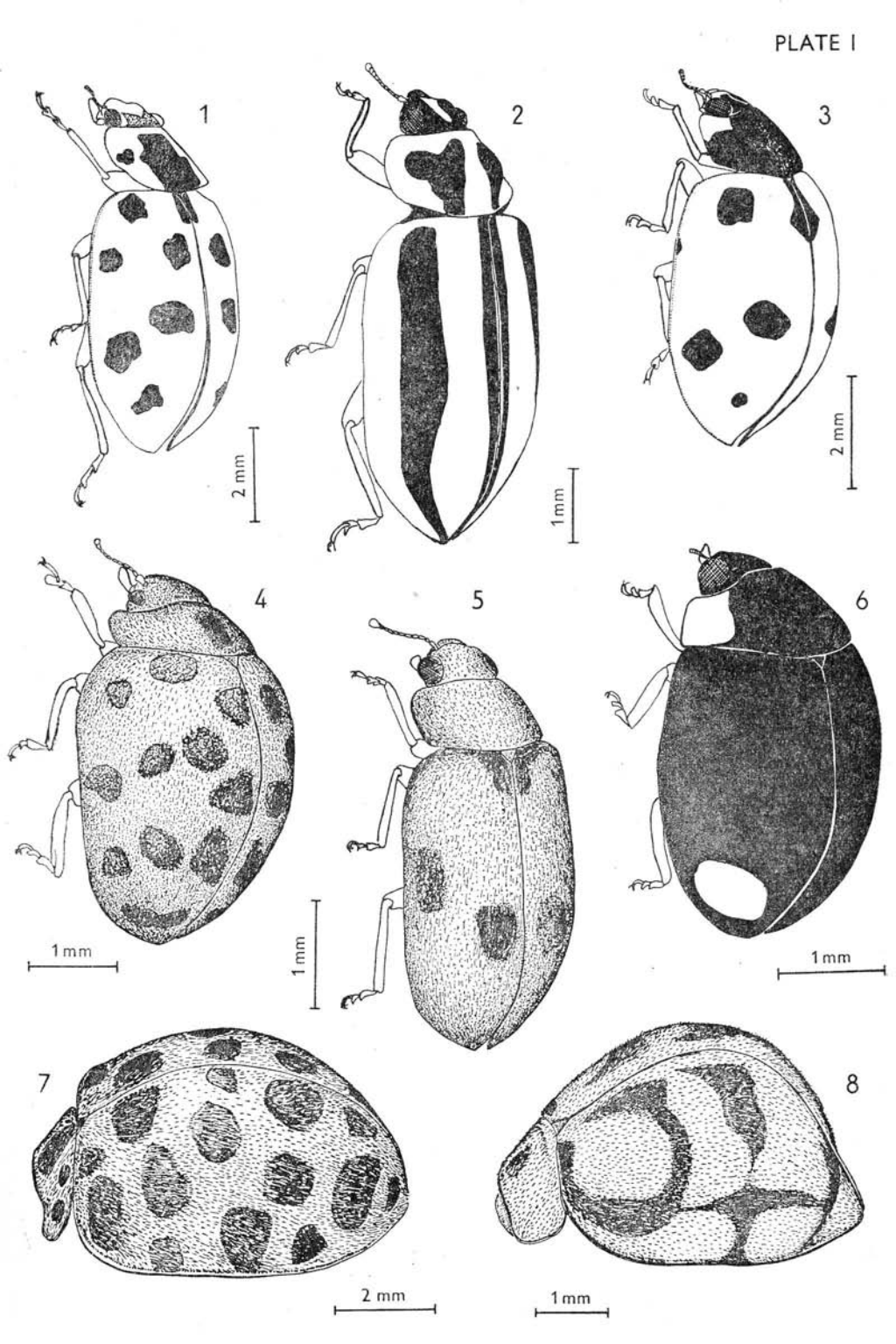
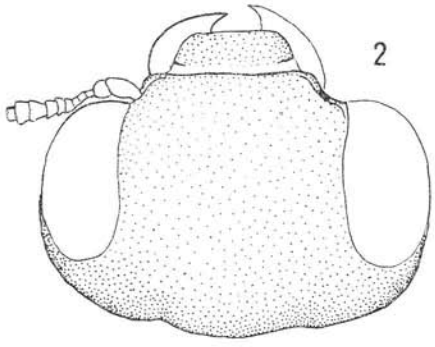
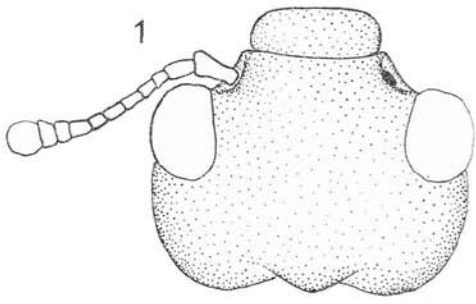
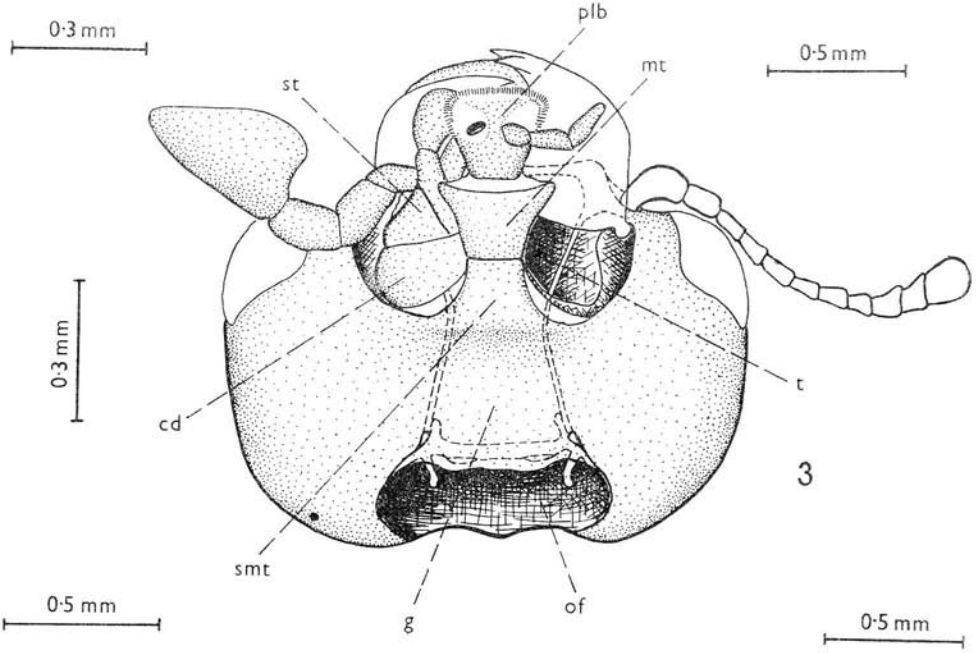
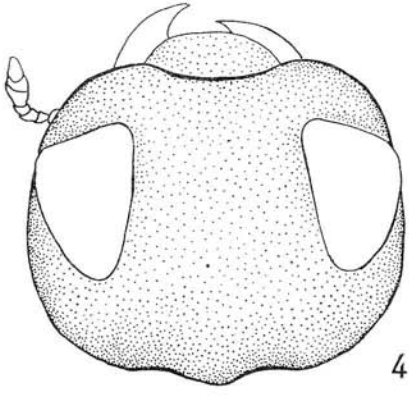


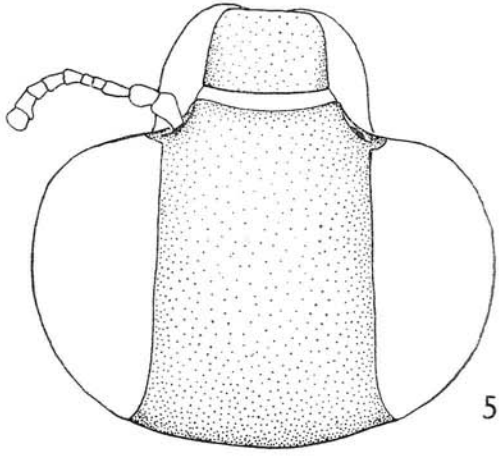
PLATE II

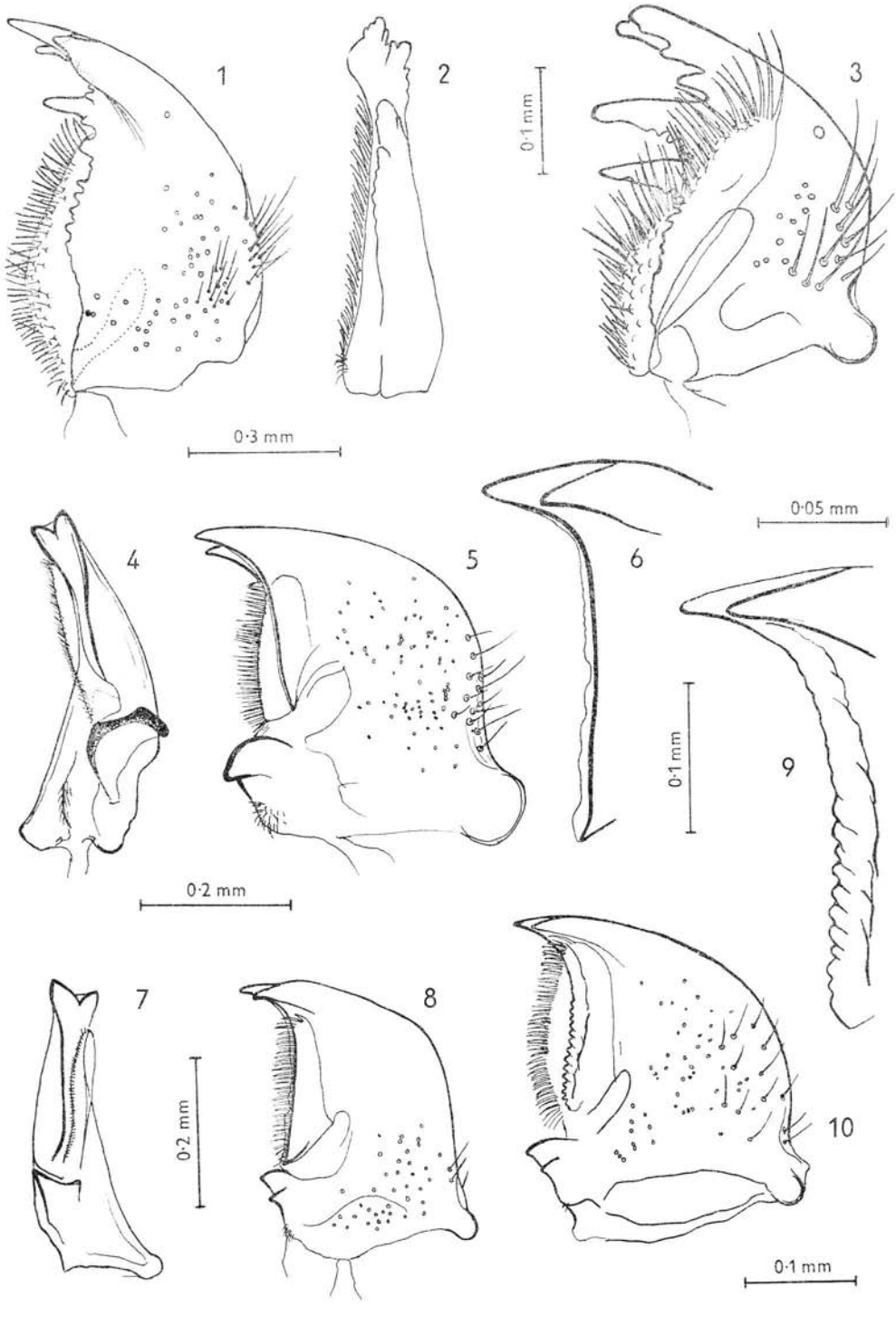











1
2
3
0·1 mm
0·3 mm
4
5
6
0·05 mm
9
0·1 mm
0·2 mm
7
8
10
0·2 mm
0·1 mm

by a membrane. The anterior margin of the prementum is densely covered with fine, spine-like hairs. In most small species the prelabium is nearly quadrate, but in the *Coccinellinae* it projects strongly forwards and in the *Epilachninae*, by contrast, it is narrowed in front. The labial palp is three-segmented with a small basal segment, which is completely missing in the *Noviini*. The medial projection of submentum is more or less wide and is only narrow in the *Sticholotinae*. The basic shape of the antennae (Pl. VI, 4) is eleven-segmented and weakly clavate (*Coccinellinae*, *Epilachninae*). In many groups the number of segments and their size are variable (Pl. VI, 5—7).

Thorax. — The prothorax is bent forwards, the pronotum is convex and sharply separated along its whole length by a distinct ridge from the hypomeron. The anterior margin is most often widely emarginated to cover the basal parts of the head. The prosternum (Pl. VII, 2) most often has the shape of the letter T. Its posterior, the intercoxal process, often bears distinct "prosternal carinae". The front transverse part of the sternum is well-developed, and only rarely very narrow and reduced (*Noviini*). The front coxal cavities are partly closed at the back by a postcoxal process of the hypomeron, which joins medially on to the furcasternum.

Most of the meso- and metanotum is covered by the elytra. The mesothoracic scutellum is the only visible part of the notum. The ventral side of the meso- and metathorax contains both sternal and pleural sclerites (Pl. VII, 1). The mesosternum is small. The mesothoracic pleural region is divided by a pleural suture into two sclerites, the episternum and epimeron. Basally, both these sclerites reach the lateral part of the middle coxal cavity. The metasternum forms the largest part of the ventral side of the metathorax. Medially, small sclerites between the posterior coxal cavities form the exterior part of furcasternum. Almost the whole metasternum is divided by a longitudinal medial suture which is related to the well-developed inner skeleton (metendosternite) (Pl. VII, 3). The metapleuron is divided into the larger episternum and the smaller epimeron.

Legs (Pl. VIII, 1—7) are well-developed and of the running type. The construction of the coxae is regular; the front and the larger hind coxae are transversely oval, the middle coxa is almost round. The femur is elongated, slender (*Coccinellinae*), rather stout, unflattened in most small species, or very stout and flat (*Platynaspini*, *Aspidimerini*). In some groups it has a shallow groove for the reception of the tibia. The tibia is slender or with a spine-like projection on its outer side. The tarsus is of trimerous (*Noviini* and a part of *Scymnini*), tetramerous (*Lithophilinae*) or more usually cryptotetramerous (pseudo-trimerous) type; the tarsal formula 3, 3, 3 or 4, 4, 4 is the same for both sexes.

The **elytra** (Pl. IX. 4—6) are convex to a varying degree and are never truncated

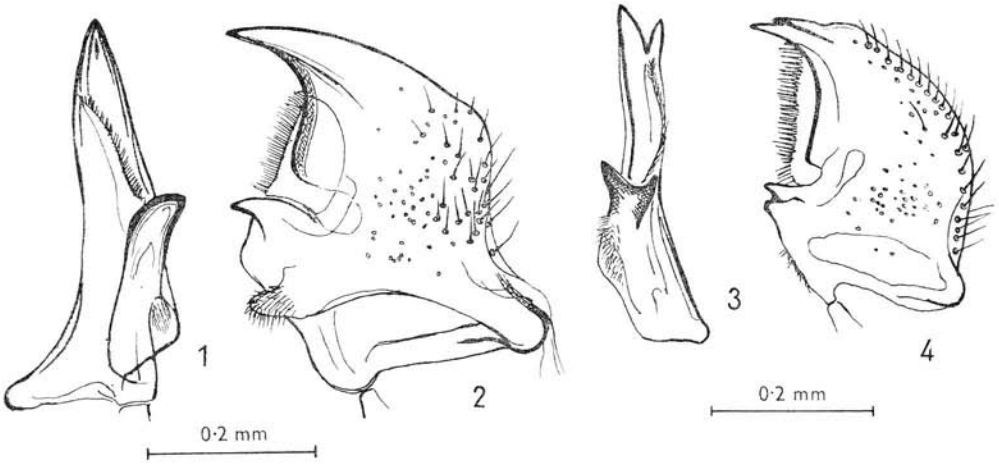
---

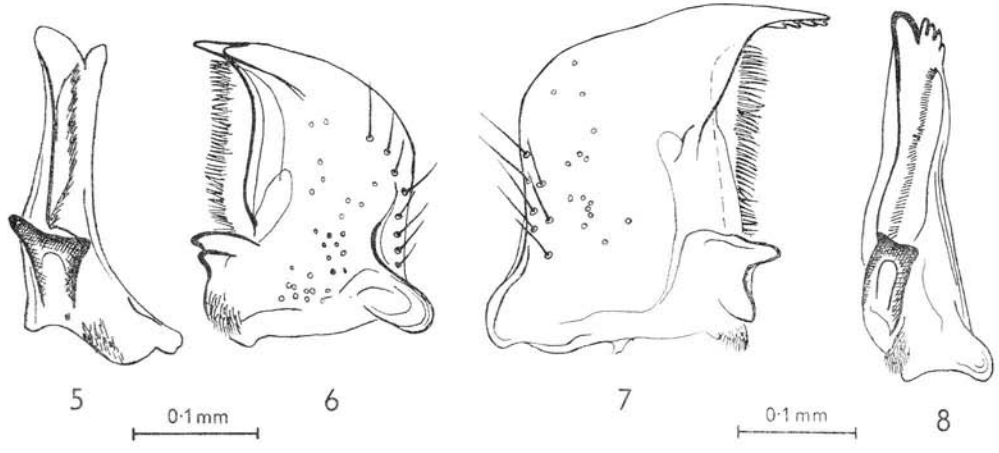
Plate IV
Mandibles. 1, 2 — *Chilocorus renipustulatus;* 3, 4 — *Novius cruentatus;* 5, 6 — *Coccidula scutellata;* 7, 8 — *Thea vigintiduopunctata;* 9, 10 — *Halyzia sedecimguttata;* 11, 12 — *Scymnus abietis.* (I. Kovář del.)

Plate V
1, 3, 4 — maxillae; 2, 5, 6 — galea and lacinia. 1, 2 — *Henosepilachna elaterii* (cd — cardo, g — galea, lc — lacinia, mxp — maxillary palpus, st — stipes); 3 — *Exochomus quadripustulatus;* 4, 5 — *Thea vigintiduopunctata;* 6 — *Adalia bipunctata.* (I. Kovář del.)

Plate VI
1, 2, 3 — labia; 4, 5, 6, 7 — antennae. 1, 7 — *Novius cruentatus;* 2 — *Lithophilus sp.* (lbp — labial palpus, m — mentum, pmt — prementum); 3 — *Henosepilachna elaterii;* 4 — *Adalia bipunctata;* 5 — *Chilocorus renipustulatus;* 6 — *Scymnus frontalis.* (I. Kovář del.)

PLATE IV





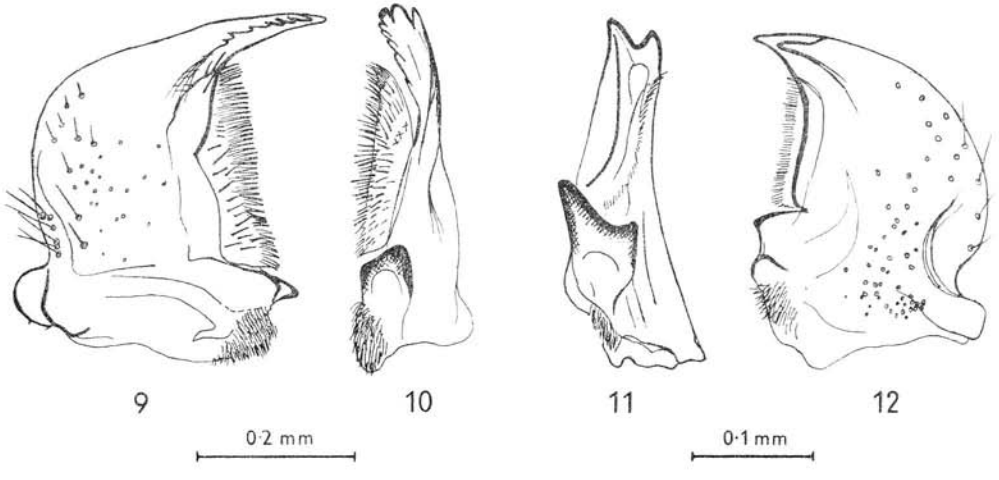
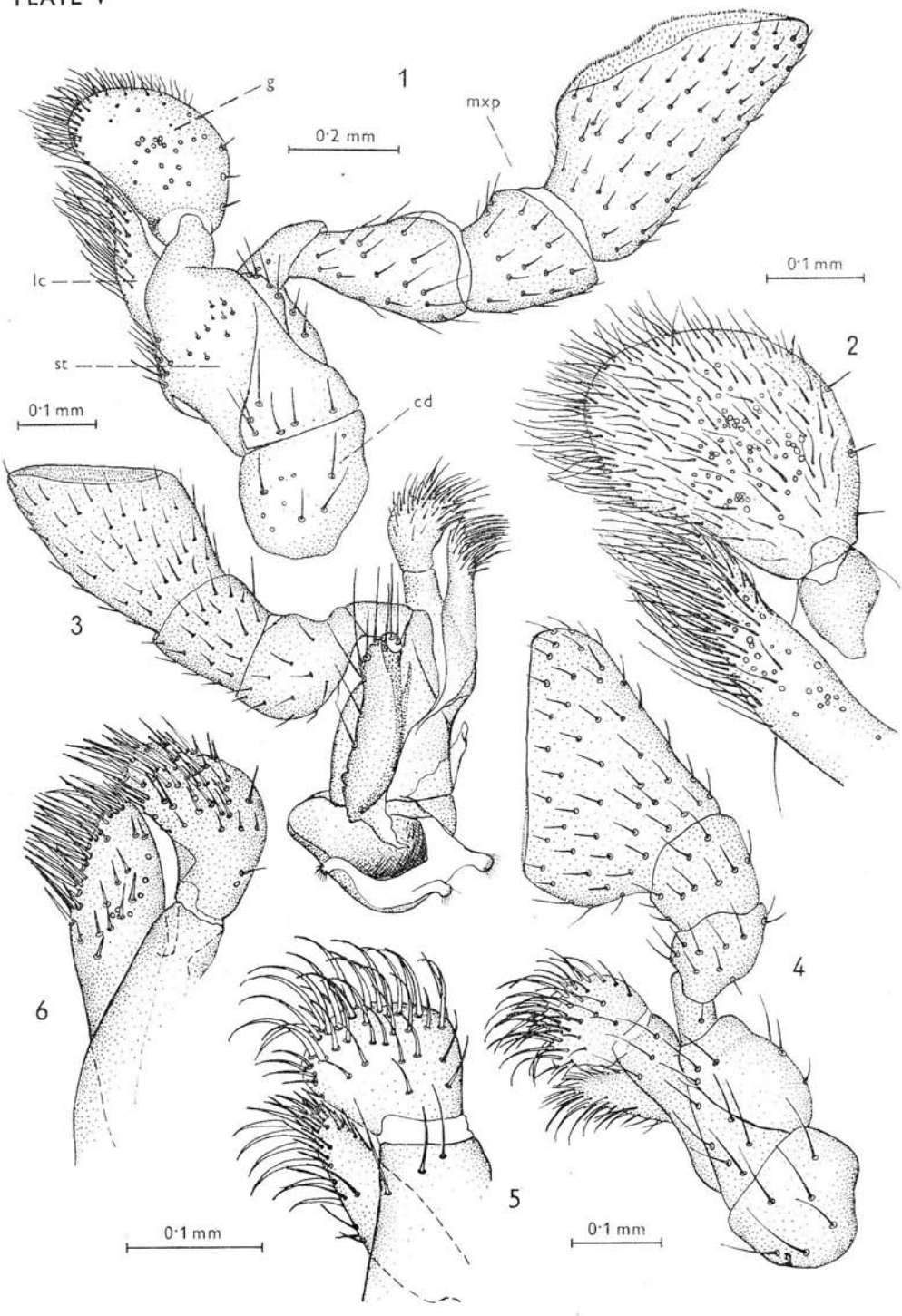
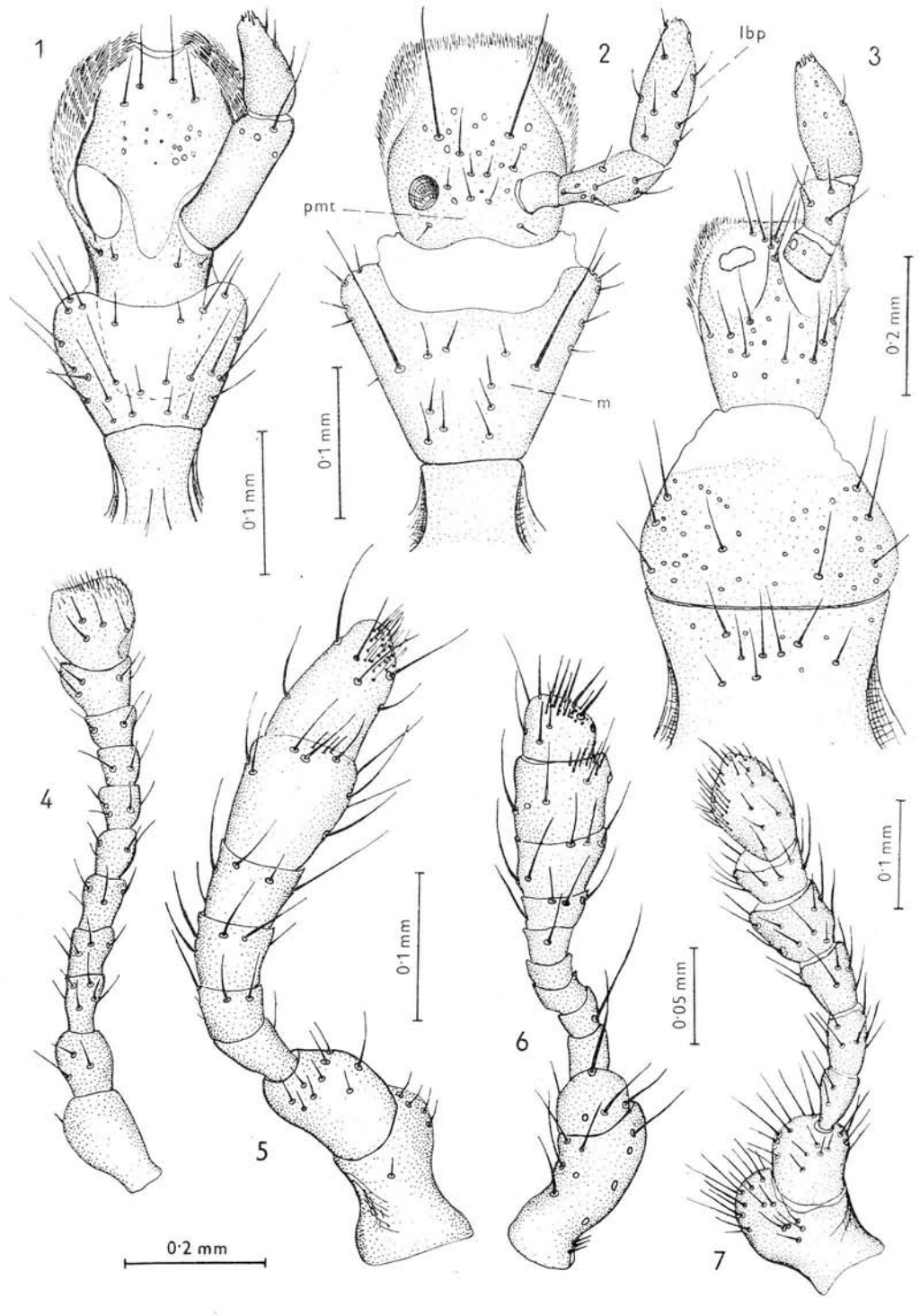


PLATE V




1
2
lbp
pmt
m
3
0·1 mm
0·1 mm
0·2 mm
4
5
0·1 mm
6
0·05 mm
7
0·1 mm
0·2 mm

at the apex. The lateral margin is sometimes expanded outwardly, the ventral flat part of the elytron (epipleuron) is narrowed apically.

The **hind wings** (Pl. IX, 1—3) are functional and only rarely reduced (*Lithophilus, Cynegetis, Rhizobius*). The nervature is of cantharoid type, with rather feebly developed veins.

The **abdomen** is ten segmented, the tergal part is represented by eight visible tergites of which only the last visible is well sclerotised. The ventral side includes only five or six visible sternites. The first and second sternites are fused together with the base of the third morphological sternite (the first visible sternite). The first visible sternite is the largest of all the abdominal sternites and bears (except only *Hippodamia*) the femoral line. The length of the seventh sternite (= fifth visible one) is often greater than the preceding sternites. The posterior margin is either round, completely covering the next (= eighth) sternite (*Lithophilini, Serangiini, Telsimiini* and some other tribes), or is similar in shape to the previous sternite and does not completely cover the eighth (*Coccinellinae, Epilachninae*).

Usually the parts of the ninth and tenth abdominal segments are designated as **genitalia.** The female genitalia (Pl. XI, 4, 7, 8) consist of the paired ninth pleurites and a pair of coxites (ninth sternites) and the tenth tergite. The coxites usually carry a stylus. The shape of the coxites is variable and various types can be distinguished. In many coccinellid groups the coxites are very elongate triangular structures and sometimes they function as an ovipositor.

The genital sclerites of the males (Pl. X, 3) are formed by the ninth and tenth tergites and by the elongated, thin ninth sternite (apodema). The male genitalia proper (Pl. X, 1—3) have two parts, tegmen and sipho. The tegmen is variably thick, symmetrical or asymmetrical and consists of a basal piece, paired paramera (= lateral lobes), and a distinct median piece, sometimes erroneously called the "penis" or "aedeagus". The hypomera (= trabes) articulate with the ventral side of the basal piece of the tegmen. The sipho (= penis, aedeagus) is very long, tubular and ventrally curved. Its base is most often broadened and forms a siphonal capsule. The apex of the sipho bears the gonopore, and the shapes of both sipho and tegmen are unique features in species and often used in taxonomy.

Sex can only be determined with some difficulty in coccinellids; the characters for distinguishing males and females cannot be generalized. Males are usually smaller than females and often have lighter colouration on the front part of the head, sometimes even on the front part of the pronotum and also other parts of the body may differ in colour. The length of the antennae is slightly greater in males than in females. The number

---

Plate VII

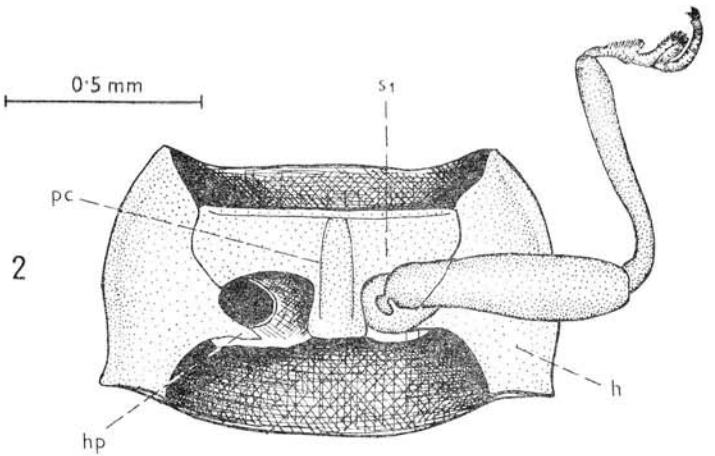
1 — *Adalia bipunctata*, thorax and abdomen, ventral aspect (fl — femoral line, em_2, em_3 — meso- and metaepimeron, es_2, es_3 — meso-and metaepisternum, s_2, s_3 — meso- and metasternum); 2 — *Coccidula scutellata*, prothorax, ventral aspect (h — hypomeron, hp — postcoxal process of the hypomeron, pc — prosternal carina, s_1 — prosternum); 3 — *Propylaea quatuordecimpunctata*, endoskeleton of meso- and metathorax (ms — metendosternite). (I. Kovář del.)

Plate VIII

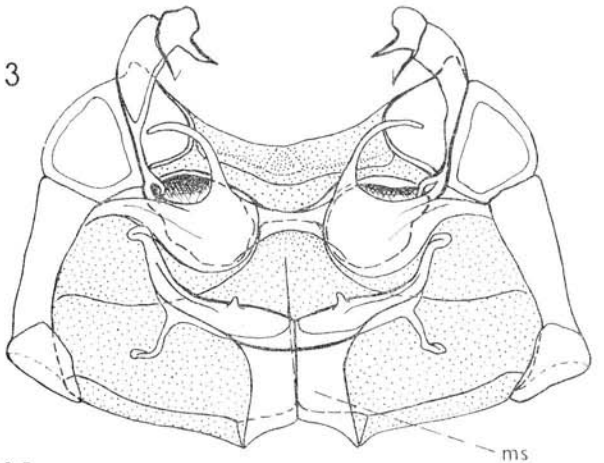
1, 2, 3, 4 — legs; 5, 6, 7 — tarsal claws. 1, 6 — *Lithophilus sp.* (f — femur, t — tibia, ta — tarsus, tr — trochanter): 2 — *Adalia bipunctata;* 3, 5 — *Cryptogonus orbiculus;* 4 — *Chilocorus renipustulatus;* 7 — *Thea vigintiduopunctata.* (I. Kovář del.)

Plate IX

1, 2, 3 — hind wings; 4, 5, 6 — elytra, ventral aspect; 7, 8 — dorsal surface of elytra. 1 — *Scymnus abietis;* 2 — *Semiadalia undecimnotata;* 3 — *Anatis ocellata* (C — Costa, Sc — Subcosta, R — Radius, M — Media, A — Anal vein); 4 — *Chilocorus renipustulatus;* 5, 7 — *Henosepilachna elaterii;* 6 — *Ortalia sp.;* 8 — *Thea vigintiduopunctata.* (I. Kovář del.)



2



3

1

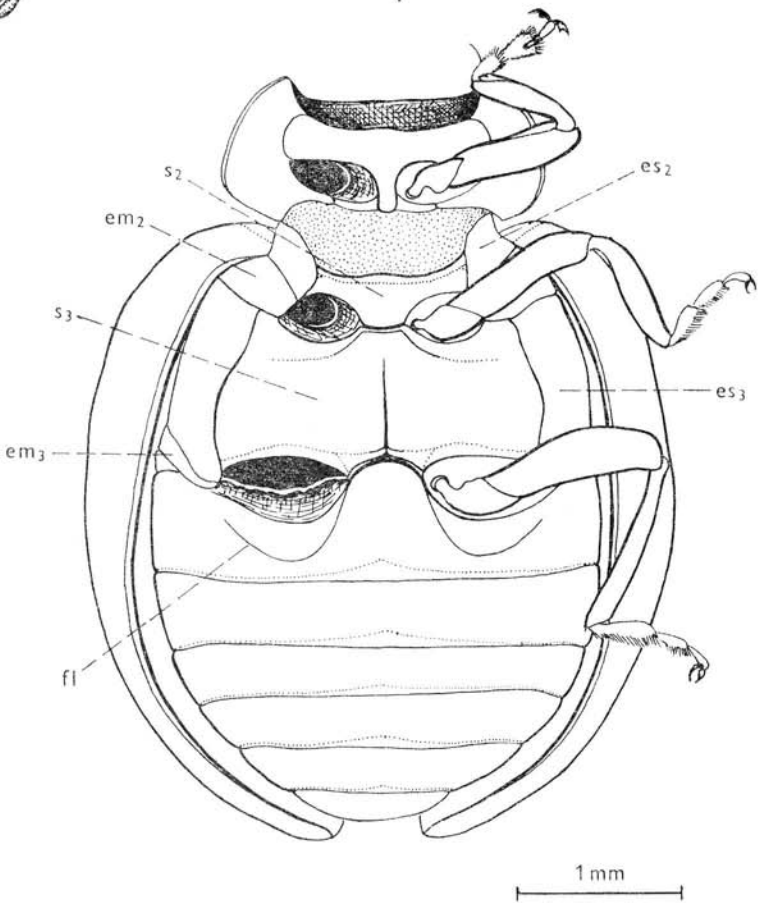


PLATE VIII

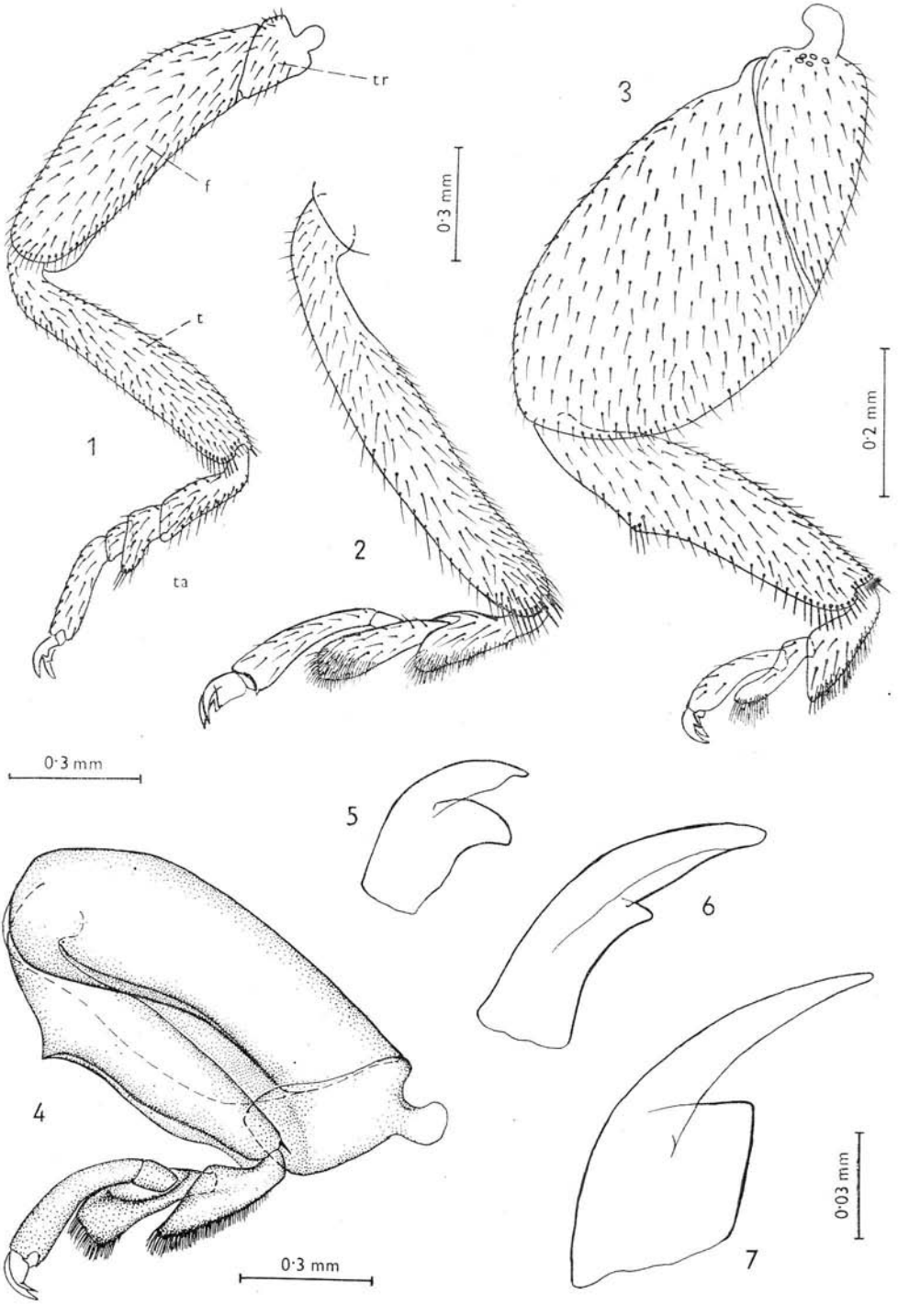
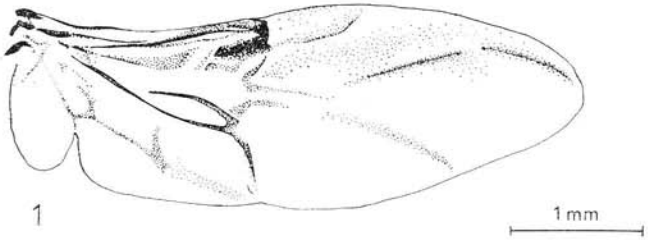
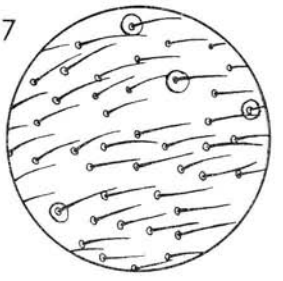


PLATE IX



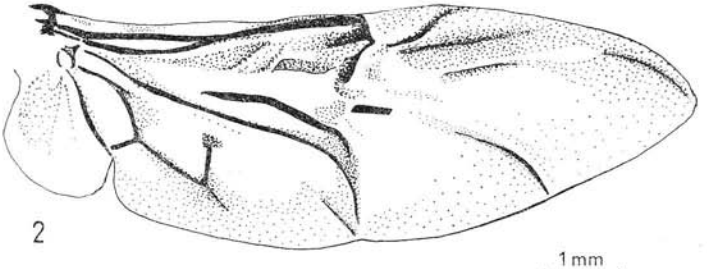
1

1 mm



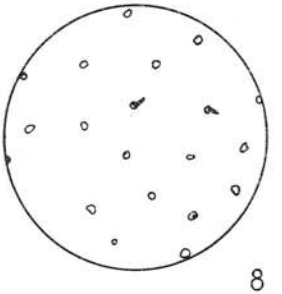
7

0·2 mm

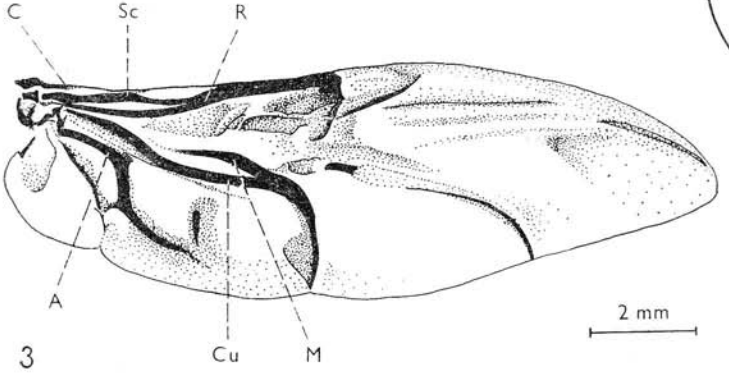


2

1 mm



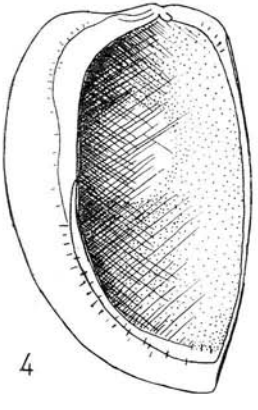
8



3

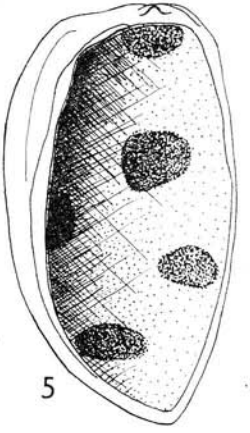
2 mm

1 mm



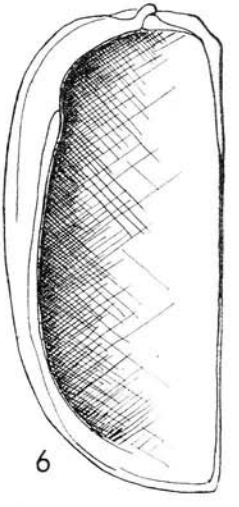
4

1 mm



5

2 mm



6

of visible sternites is usually the same in both sexes. In *Chilocorini*, the sixth sternite of the females is hardly visible, and only slightly visible in the males. To distinguish the sexes, it is possible in most species to use the appearance of the last abdominal sternites, and particularly the construction of the eighth abdominal sternite (= the sixth visible sternite). In many species there are differences in the form of the sixth visible sternite, which, more often in males than in females, is emarginated to a different degree at the middle of the hind margin (Pl. XI, 1—6).

1.2 Anatomy

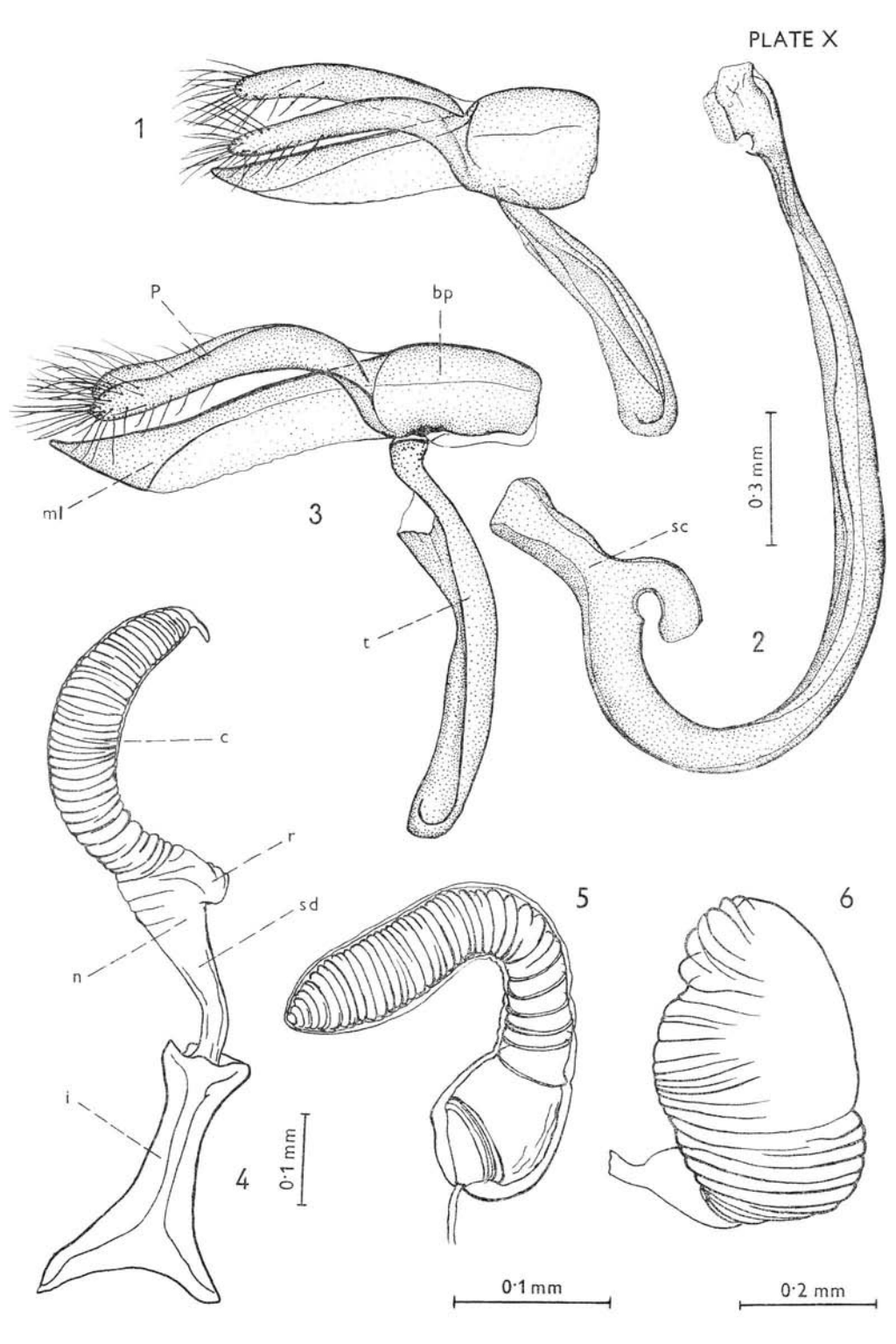
The **female reproductive organs** consist of a pair of ovaries, two lateral oviducts, a median oviduct, a vaginal part, a bursa copulatrix and a spermatheca. The nubmer of ovarioles in one ovary is not constant and often varies even within one species. Robertson (1961) records an average number of 17 ovarioles in one ovary with the range of 2 (*Stethorus punctillum*) to 51 (*Coccinella septempunctata*) for 54 species and 28 genera of *Coccinellidae*. The ovarioles are of the meroistic and telotrophic type; nutrition of the oocytes is provided by the nutritive cells of the germarium. The terminal filaments of individual ovarioles are attached together and fix both ovaria in the abdominal cavity. At the base of the terminal filament, the ovariole is extended into a cylindrical germarium, which contains oogonia and trophocytes or nutritive cells. Ermolenko (1963) compares the construction of "mature" and "immature" ovaries in *Cryptolaemus montrouzieri*. In ovipositing females, the vitellarium contains increasing egg follicles at different stages of maturation, which are separated by distinct notches. Ovarioles lead into the upper expanded parts of lateral oviducts by pedicels. The lateral oviducts are relatively short, simple tubes, united to form a somewhat broader medial oviduct. Williams (1945) and Tanasijević (1958) described a pair of collateral glands extending from the median oviduct in some *Epilachninae*. Posteriorly the median oviduct opens into the vagina by a gonopore. Ventrally there protrudes a pouch-like rather large bursa copulatrix and in some species this has at the top a sclerotized funnel-shaped part called the infundibulum. The bursa is connected with the spermatheca (receptaculum seminis) (Pl. X, 4—6) by a short or longer narrow sperm duct which most often arises from the distal part of the infundibulum or in the *Scymnini*, *Chilocorini* and some *Coccinellini* from the distal part of bursa. In *Menochilus* the sperm duct is extremely long and contorted. The following parts of the spermatheca can be recognized: the distal arched part called "cornu" and two projections at the base of the spermatheca. One of these projections ("nodulus") communicates with the sperm duct and the other ("ramus") with the spermathecal (accessory) gland. Often one (usually "ramus") or both projections are missing, and in *Stethorus punctillum* not only the whole spermatheca, but also the bursa copulatrix is missing.

The **male reproductive organs** lie under the alimentary canal and consist of the testes, the vasa deferentia and the ejaculatory duct. The testis is polyfollicular and the number of testicular follicles is variable like the number of the female ovarioles. The follicles are spherical or oval. The vas deferens is a curved tube which at its

Plate X

1. 3 — tegmen; 2 — sipho; 4, 5, 6 — spermatheca. 1 — *Adalia decempunctata;* 2 — *Adalia decempunctata* (sc — siphonal capsule); 3 — *Adalia bipunctata* (bp — basal piece, ml — median lobus, p — paramera, t — trabes); 4 — *Adalia conglomerata* (c — cornu, i — infundibulum, n — nodulus, r — ramus, sd — sperm duct); 5 — *Scymnus frontalis;* 6 — *Chilocorus renipustulatus.* (I. Kovář del.)

PLATE X



base, near the testis, is swollen and forms the vesicula seminalis. The paired vasa deferentia unite to form a somewhat wider ductus ejaculatorius which issues at the base of the sipho and is approximately of the same length or usually longer than the vas deferens. Two pairs of accessory glands arise from junction of the vasa deferentia. In *Subcoccinella vigintiquatuorpunctata*, there has been observed, in addition to these two pairs, a third pair of accessory glands situated under the vesicula seminalis (Tanasijević 1958).

The **alimentary canel** consists of three histologically distinguishable sections: the stomodeum or fore-gut, the mesenteron or mid-gut, and the proctodeum or hind-gut. The fore-gut is always the shortest section and is composed of the pharynx, oesophagus and crop. The wall of the fore-gut has large inner folds and is composed of cuticular intima, epithelium, basement membrane and muscularis. The oesophagus is much narrower than the pharynx and its intima is thinner and is sometimes provided with teeth. The oesophagus extends into a small conical or pear-shaped chamber — the crop, which lies in the front half of the prothorax. The muscularis of the crop is the most complicated such tissue in the pre-gut. Between the crop and mesenteron there is a constriction which marks externally the position of the oesophageal valve.

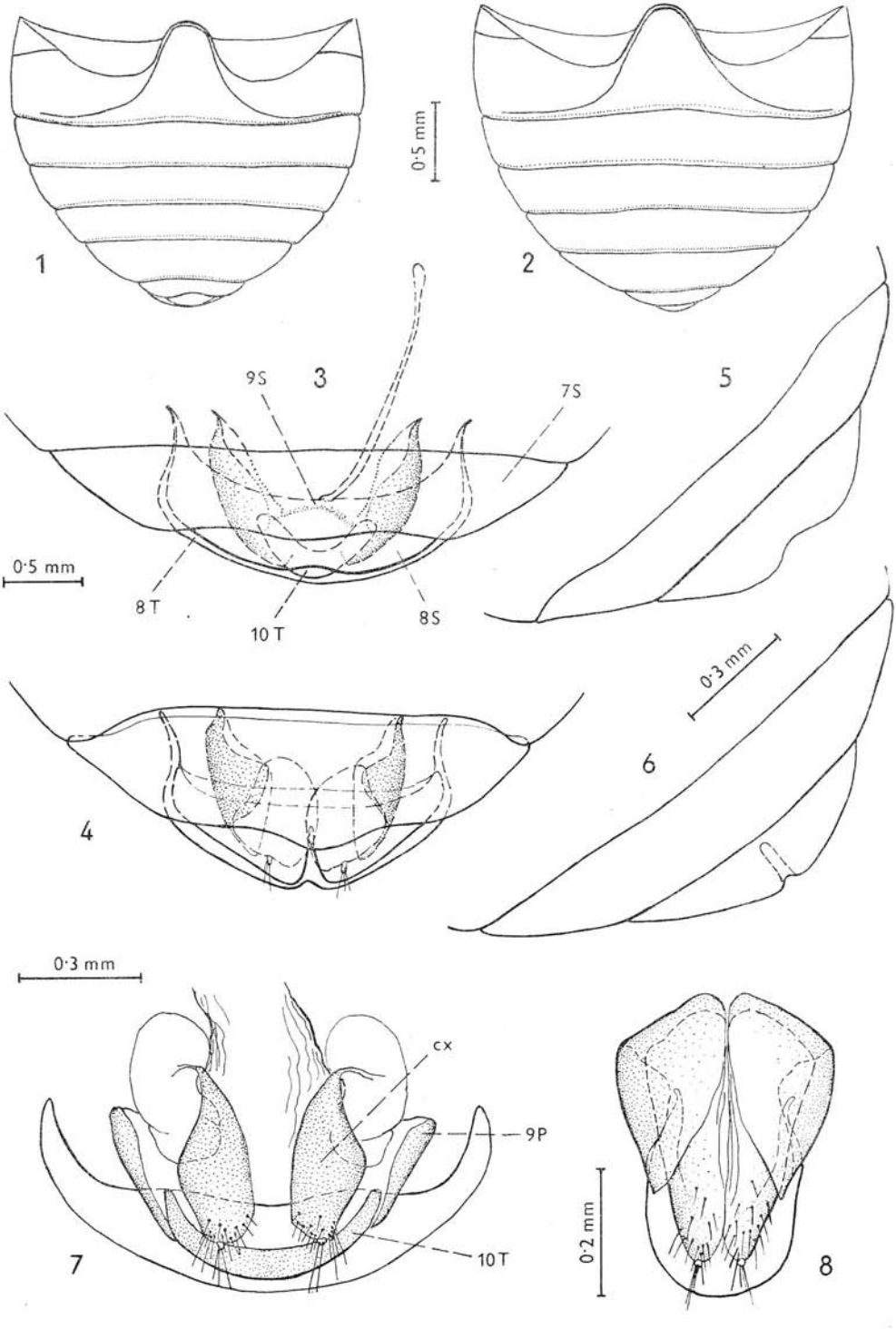
The largest section of the alimentary canal is the mid-gut which reaches to about the fifth abdominal sternite. It is about 5—6 times as wide as the oesophagus, and much wider even than this when filled with food. In carnivorous coccinellids, the mesenteron is simple. In phytophagous coccinellids, however, it has two parts: the wide front part continues into a tube which loops forward to form several spiral loops around it. The wall of the mid-gut is thicker than elsewhere in the alimentary canal, and also has regenerative cells (nidi). In *Hyperaspis vinciguerrae* Hafez and El-Ziady (1952) have observed that the whole epithelial lining is shed after every meal and is immediately replaced by a new one from the nidi. Pradhan (1939) also pointed out that the digestive cells are monophasic and are generally used up completely during one period of secretion. Two types of secretion have been observed in coccinellids, merocrine and holocrine. The continuous or, in *Epilachnaindica*, discontinuous (Pradhan 1936) peritrophic membrane is produced by a small group of cells at the base of the pyloric valves. The mesenteron is closed posteriorly by the pyloric valves, which consist of small folds and are provided with the pyloric sphincter. The intima over the epithelium is already very thin. The six Malpighian tubes arise from the pyloric region and form loose loops in the body cavity; they reach the anterior part of the proctodeum. In cross-section they consist of 2—3 epithelial cells, the cell walls of which often disappear. Their inner border, which closes the central cavity, bears cilia. The outer cover of the tubes is formed by a basal membrane.

The hind-gut consists of the anterior intestine (ileum and colon) and the posterior intestine (rectum) and is usually curved for the first third. The ileum is short and usually straight. Six longitudinal folds are visible in cross-section, the intima is very thin and only the circular muscle is developed. The distal parts of the Malpighian tubes become closely attached to the junction of ileum and colon, and become enclosed

---

Plate XI

1, 2 — abdomen, ventral aspect; 3 — male genital sclerites; 4, 7, 8 — female genital sclerites; 5, 6 — seventh and eighth sternite of abdomen. 1 — *Propylaea quatuordecimpunctata*, male; 2 — *Propylaea quatuordecimpunctata*, female: 3, 4 — *Henosepilachna elaterii* (7S — seventh sternite, 8S — eighth sternite, 9S — ninth sternite, 8T — eighth tergite, 10T — tenth tergite); 5 — *Anisosticta novemdecimpunctata*, male; 6 — *Anisosticta novemdecimpunctata*, female; 7 — *Thea vigintiduopunctata* (cx — coxite, 9P — ninth pleurite, 10T — tenth tergite); 8 — *Scymnus abietis*. (I. Kovář del.)


1
0·5 mm
2
3
9S
7S
0·5 mm
8T
10T
8S
5
4
0·3 mm
6
0·3 mm
cx
9P
7
10T
0·2 mm
8

by a thin peritoneal sheath or fascia. The colon is longer than the ileum; its posterior part widens into a conical chamber. The colon wall is thicker than in the ileum and the intima is heavily chitinised. Between the circular muscle layer and fascia there is a space called the fascial chamber. The Malpighian tubes terminate in this chamber, which is filled with loose connective tissue and blood. Near where the colon leads into the rectum, the fascial chamber communicates with the gut cavity by minute pores or canaliculi. The rectum has six longitudinal folds, a thick intima and robust circular musculature which consists of several layers. The rectum opens to the exterior by the anus.

There is no great difference between carnivorous and phytophagous species in the length of fore- and hind-gut. In phytophagous coccinellids, however, the mid-gut and consequently the whole alimentary canal is considerably longer than in carnivorous species; also the Malpighian tubes are longer in phytophagous than in carnivorous species.

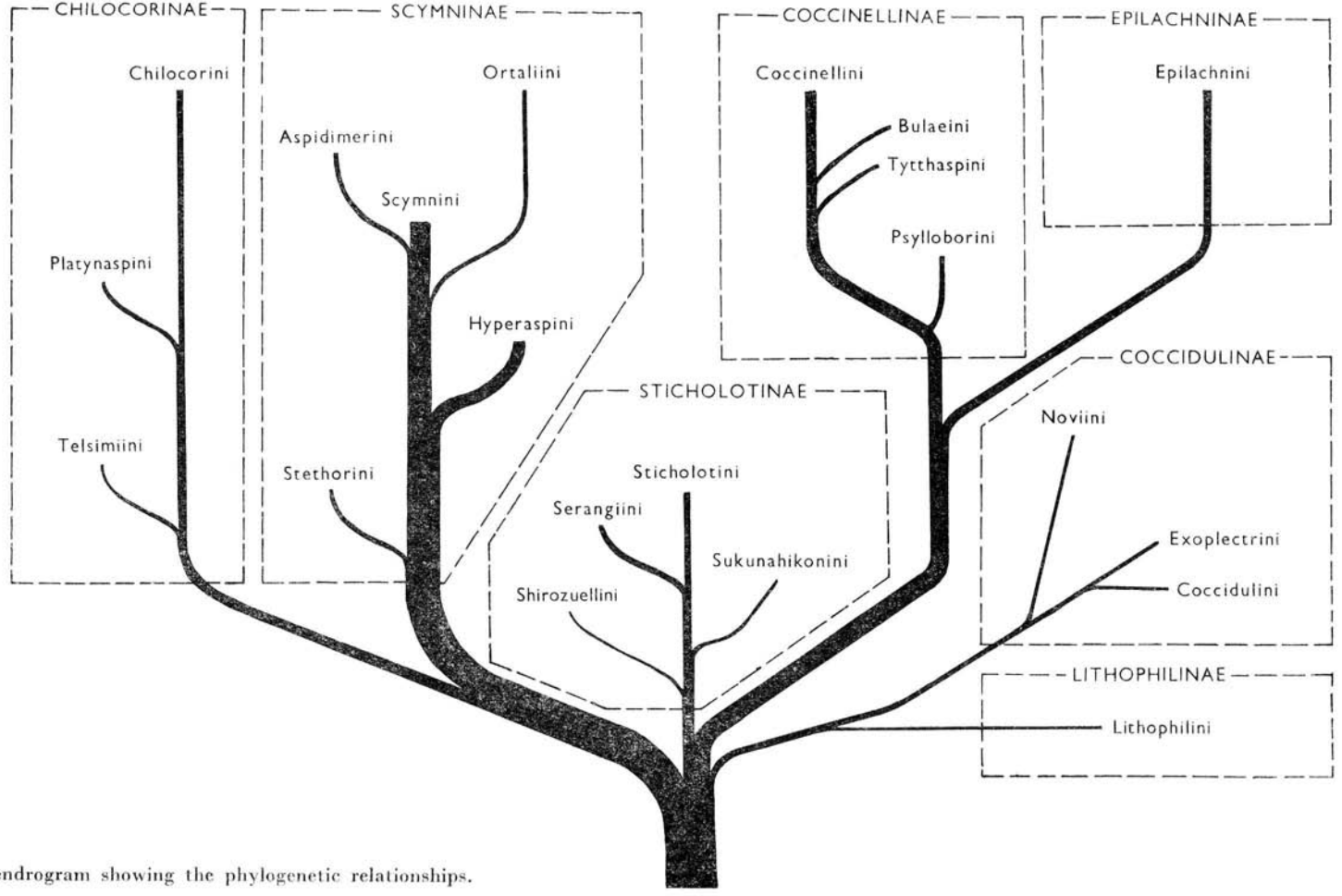
1.3 Phylogeny and taxonomy

The family *Coccinellidae* belongs to the superfamily *Cucujoidea*, section *Clavicornia*, and is related to the families *Corylophidae*, *Cerylonidae* and *Discolomidae* (Crowson, 1955). A historical survey of the higher classification of coccinellids has been given by Sasaji (1968b). Of the earlier authors, Korscheffsky proposed a system which is included in Junk's "Coleopterorum catalogus" (1930—1931) and which gained general acceptance. According to this system, coccinellids were divided into three subfamilies: *Epilachninae*, *Coccinellinae* (*s. lat.*) and *Lithophilinae*. The phytophagous subfamily *Epilachninae* was considered the most primitive by many authors and its relationship to the family *Chrysomelidae* was discussed. The genus *Lithophilus* was classified into a separate subfamily, mainly on account of the different structure of the tarsus. In the older systems the subfamily *Coccinellinae* (*s. lat.*) was very heterogeneous and contained several developmental branches.

Sasaji (1968b) has presented a more modern system based on the comparative morphology of the larvae (Kamiya 1965) and adults, which is in line with recent views on the phylogeny of the order Coleoptera. The phylogenetic development of coccinellids can be represented in a simplified way as follows (see also the dendrogram) (Pl. XII).

The most primitive subfamily of the family *Coccinellidae*, related to the *Clavicornia* groups mentioned earlier, is the new subfamily *Sticholotinae*. This subfamily has been established by Sasaji (1968) to include the tribes *Sukunahikonini*, *Serangiini*, *Sticholotini* and *Shirozuellini*, which have many common characters. The *Sukunahikonini* are comparatively more primitive than the other tribes. The *Shirozuellini*, established by Sasaji (1967), are a specialized tribe of this subfamily, apparently similar to the *Telsimiini* (*Chilocorinae*). The external structure of the tribe *Sticholotini*, which apparently includes the *Pharini*, *Coelopterini*, *Clanini* and *Microweiseini*, is rather variable and this tribe may eventually be split into several tribes.

Very early on, a branch developed from the *Sticholotinae* — ancestor, leading to two recent subfamilies, *Chilocorinae* and *Scymninae*. A strongly expanded clypeus is characteristic for the *Chilocorinae*, and it appears in the *Telsimiini*, *Platynaspini* and *Chilocorini* [also in the genus *Shirozuella* (*Shirozuellini*)]. The tribe *Telsimiini* has the greatest affinity to *Sticholotinae*, whereas the *Platynaspini* and especially the *Chilocorini* are much more derived groups.



Dendrogram showing the phylogenetic relationships.

The subfamily *Scymninae*, which includes the majority of small species, includes the tribes *Stethorini*, *Scymnini*, *Aspidimerini*, *Hyperaspini* and *Ortaliini*. These tribes are characterized by narrow elytral epipleura, often trimerous tarsi, and a thickened femur. The *Aspidimerini* are in close affinity to the tribe *Scymnini* which forms the root of this developmental branch and includes a great number of species. The *Stethorini* very soon separated from the *Scymnini* — ancestor; they are considered as a derived tribe. The tribe *Hyperaspini* is related to the *Scymnini*. The characters of their larvae would suggest that they are the most primitive group of coccinellids; the adults, however, have many derived characters. The tribe *Ortaliini* occupies the most advanced position in the subfamily *Scymninae* (Sasaji 1968b).

The other developmental branch from the *Sticholotinae* — ancestor evidently arises later and independently of the first branch. It leads, on the one hand, to the carnivorous or mycophagous tribes of the subfamily *Coccinellinae*, and on the other hand to the subfamily *Epilachninae*. The development of both groups has been strongly divergent as a result of the different types of nutrition; however, many characters show that they had a common ancestor.

A complete or partial transition to vegetative food has taken place several times within the originally carnivorous subfamily *Coccinellinae*. The tribe *Psylloborini*, which belongs to this subfamily, has some characters related to the *Epilachninae*. This fact is explained by a secondarily convergent development. A similar tendency, although at another phylogenetic level, is manifested in the tribes *Tytthaspini* and *Bulaeini*, further tribes established by Savoïskaya (1969b).

The subfamily *Coccidulinae* and the related subfamily *Lithophilinae* also have a slight affinity to *Sticholotinae*. Sasaji (1968) included the *Lithophilini* into the subfamily *Coccidulinae* on the basis of their adult character. Klausnitzer (1971a) has divided Sasaji's *Coccidulinae* into two subfamilies on the basis of their larval characters. The subfamily *Coccidulinae* comprises the tribes *Coccidulini* and *Exoplectrini*, which have relatively close affinity. Also the tribe *Noviini* clearly falls with this subfamily, in spite of its having some characters similar to those of the *Scymnini*. The subfamily *Liphophilinae* is most likely the more primitive in this branch, which, judging by the analogy of many characters, had a phylogenetic development similar to the *Epilachninae* — *Coccinellinae* branch.

Some other tribes, such as the *Scymnillini*, *Cranophorini*, *Oeneini*, *Pentiliini*, *Chnoodini* and *Discotomini* have as yet not been sufficiently studied.

A summary of the system of higher categories of coccinellids is given in Tab. 1.01.

Tab. 1.01 Summarized system of higher categories of coccinellids

Subfamily:	*Sticholotinae* (*Pseudococcinellidae*)[1])
tribe	*Sukunahikonini*
tribe	*Serangiini*
tribe	*Sticholotini* (*Pharini*, *Coelopterini*, *Clanini*, *Microweiseini*)
tribe	*Shirozuellini*
Subfamily:	*Scymninae*
tribe	*Stethorini*
tribe	*Scymnini*
tribe	*Aspidimerini*
tribe	*Hyperaspini*
tribe	*Ortaliini*

[1]) Names in parentheses are synonyms.

Subfamily: *Chilocorinae*
- tribe *Telsimiini*
- tribe *Platynaspini*
- tribe *Chilocorini*

Subfamily: *Lithophilinae* (*Tetrabrachinae*)
- tribe *Lithophilini*

Subfamily: *Coccidulinae*
- tribe *Coccidulini* (*Rhizobiini*)
- tribe *Exoplectrini*
- tribe *Noviini*

Subfamily: *Coccinellinae*
- tribe *Coccinellini* (*Hippodamiini*, *Anisostictini*, *Synonichini*)
- tribe *Psylloborini*
- tribe *Tytthaspini*
- tribe *Bulaeini*

Subfamily: *Epilachninae*
- tribe *Epilachnini*

2 MORPHOLOGY AND TAXONOMY OF THE LARVAE WITH KEYS FOR THEIR IDENTIFICATION[1]

G. I. SAVOÏSKAYA and B. KLAUSNITZER

The morphology and taxonomy of coccinellid larvae have as yet been incompletely studied. The subject was first tackled by Böving (1917), and soon afterwards Gage (1920) described 14 species of American coccinellids. A paper by Strouhal (1926) is devoted to larvae of *Coccinellini* and of *Psylloborini*, one by Binaghi (1941a, b) to larvae of *Chilocorini* and some species of *Scymnini* and one by Kapur (1950) to larvae of *Epilachninae*. van Emden (1949) published a key for the larvae of 36 species of British coccinellids. Three larvae of particular taxonomic interest have been described by Capra (1947) (*Bulaea lichatschovi*), Kanervo (1941) (*Calvia quinquedecimguttata*) and Korschefsky (1934) (*Platynaspis luteorubra*).

The work by Kamiya (1965) is especially interesting in that, on the basis of the larvae of Japanese *Coccinellidae*, the tribal phylogeny of the family is discussed. This same author also described 36 species of Japanese *Coccinellidae* and published a key to them (Sasaji 1968, formerly Kamiya). Klausnitzer (1969) described the larva of *Lithophilus connatus* (Lithophilinae); the larvae of this subfamily had not been previously studied. The same author has produced a monograph with a key to 59 species on the mid-European coccinellid larvae (Klausnitzer 1970a) and also other papers concerning coccinellid larvae (Klausnitzer 1970b, c, 1971a, b, c).

Savoïskaya has published a series of works devoted to the morphology and taxonomy (with keys) for 81 species of coccinellid larvae in the Soviet Union; larvae of 47 species were described for the first time (Savoïskaya 1955, 1957, 1960a, b, 1961, 1962a, b, c, 1963, 1964a, b, 1965, 1966, 1968, 1969a, b, 1970a, b, 1971a, b). The same author's detailed study of the morphology of adults and especially of larvae of coccinellids has suggested possibilities for revising the taxonomy of the family *Coccinellidae*.

Two new tribes (*Tytthaspini* and *Bulaeini*) and a new subgenus (*Neococcinella*) have been erected; also the taxonomy of the genus *Exochomus* and the taxonomic status of some other groups of beetles have been changed (Savoiskaya 1969b, 1971a).

[1])This chapter is mostly written by G. I. Savoïskaya. B. Klausnitzer contributed the diagnoses of twelve species (*A. obliterata*, *S. vigintiguttata*, *R. chrysomeloides*, *N. limonii*, *S. interruptus*, *S. alpina*, *A. conglomerata*, *S. lyncea*, *S. impustulata*, *T. trilineata*, *C. decemguttata*, *B. oblongus*), produced the key for the genera *Rhizobius* and *Calvia* and completed the key for the genera *Synharmonia*, *Scymnus* and *Brumus* and gives other additions to the text and references.

2.1 Comparative morphology of the larvae

Larvae of coccinellids in most of the tribes have an elongate, slender body *(Coccinellini, Psylloborini, Scymnini* and others). In the *Hyperaspini* and *Noviini* it is of elongate--ellipsoidal shape and hemispherical in the *Platynaspini.* Usually, the body of the larvae is arched on top and flat below. In the *Coelopterini*, however, the dorsum is not uniformly arched: the head and thorax are flatter than the abdomen, which is closer to hemispherical in shape.

The head of the larvae is frequently square with rounded corners, i. e. of about equal length and width, but in the *Hyperaspini* and *Platynaspini* it is strongly transverse. In the *Serangiini*, the head is elongate (Kamiya 1965). The sides of the head are usually rounded to a greater *(Psylloborini)* or lesser extent *(Coccinellini)* or are straight *(Platynaspini*, particularly the *Chilocorini).*

In most species the head is either completely sclerotized *(Coccinellini, Chilocorini*, etc.) or only in some areas *(Hyperaspini, Stethorini, Platynaspini)*, but in the *Scymnini* the head is sclerotized only very slightly. The frontal suture is nearly always well-developed; it is V-shaped or Y-shaped, usually with an elongate epicranial suture *(Epilachnini, Chilocorini partim)*, though this may be missing *(Coccinellini, Coccidulini, Psylloborini*, etc.). In the 3rd and 4th instar larvae of the *Scymnini, Platynaspini* and *Hyperaspini* the frontal suture itself is absent. A fronto-clypeal suture is well-developed only in the *Epilachnini.*

The antennae are one, two or three segmented. As a rule the first segment is short and wide; the second is usually rather longer, and sometimes even 2—3 times as long as the first and then appears cylindrical. In most coccinellid larvae the third antennal segment is small, slightly sclerotized and hardly noticeable; in some *Coccinellini (Spiladelpha, Hippodamia*, etc.) the *Tytthaspini* and the *Coccidulini* it is cupola (dome)--like. The second segment always has a long and thick seta or a shorter spine.

The mandibles are triangular in shape. In the *Epilachnini* they are equipped with four or five large teeth at the apex. In other coccinellid larvae the mandibles have only one *(Hyperaspini, Platynaspini, Stethorini, Scymnini, Exochomus, Brumus)* or two teeth *(Coccinellini, Chilocorus, Noviini, Coelopterini)* at the apex. However, there may be a row of smaller teeth *(Psylloborini, Anisosticta* from *Coccinellini)* or thick setae *(Tytthaspini)* below the apical tooth. The mandibles in the *Bulaeini* are very unusual; they have a third small tooth in addition to two well-developed apical teeth. The *Bulaeini* are a specialized tribe, whose larvae, like the adults, feed on pollen (see 6. 111). This type of feeding, as well as the structure of the mandibles and of the frontal suture place this tribe near the *Epilachnini.* Moreover, the behaviour of the larvae in the *Epilachnini* and *Bulaeini* is also similar; they are of limited mobility and collect in large groups, both characteristics of phytophagous insects.

The maxillary palpi are three segmented except in the *Noviini* where they are two segmented. The terminal segment of the maxillary palpi is usually robust and wide, although it narrows towards the apex. Only in the *Coelopterini* is it extremely long and narrow, stick-like, and 5—7 times al long as wide. The structure of the galea is rather variable; Kamiya (1965) distinguishes three principal types.

The armature of the galea is also important in taxonomy. The galea in the *Tytthaspini* is covered with dense, short, thin setae, in the *Psylloborini* by dense, short, thick setae and in other *Coccinellinae* with sparse long setae.

The labial palps are one to two segmented. The submentum is of variable shape, but is often cylindrical. In the *Psylloborini* and *Coelopterini* it is narrowed at the base;

in the *Hyperaspini* and *Tytthaspini* it is wider and transverse. In the *Psylloborini* it is covered with dense, stick-like setae, in the *Tytthaspini* with dense, thin, short setae and in most other larvae of *Coccinellidae* with sparse long setae.

The legs are elongate *(Epilachnini, Coccinellini, Bulaeini, Tytthaspini)* or short *(Hyperaspini, Stethorini,* partially *Scymnini)*. The femur and tibiotarsus are usually cylindrical, but sometimes the femora are wide and almost quadrate (some *Hyperaspini, Coelopterini*). A group of setae and a claw are situated at the apex of the tibiotarsus. In most larvae there is a narrow or wide tooth at the base of the claw.

The armature of both thorax and abdomen is rather variable and complex; it has a considerable taxonomical significance. In describing coccinellid larvae it is necessary to follow the strict definition and precise terminology which has been established. If this is not used correctly, identifications at species, generic and sometimes higher taxonomical categories will be difficult.

We follow Gage's terminology for the different structures on the body of larvae: seta, chalaza, tubercule, struma, parascolus, sentus and scolus (Gage 1920). A seta is situated directly on the body surface. A chalaza is also a seta, but is mounted on a small cylindrical or round appendix, which is called a base. A tubercule is a round protuberance covered with setae. A struma is a round protuberance covered by chalazae with low bases. A parascolus is an elongate protuberance covered with chalazae; if it is low then the bases of at least some chalazae are lengthened. A sentus is a horn-like appendix with short branches which bear setae. A scolus has numerous long branches with setae. Senti and scoli are similar in structure and the larvae of some species have structures which intermediate between senti and scoli.

In most species the pronotum has two or four sclerotized plates. Only in the *Lithophilinae* there are six sclerotized plates (Klausnitzer 1969). The notum of both the meso- and metathorax has two plates: they are oval and elongate; rarely round or quadrate. In the *Scymnini*, the plates on the thorax are only very slightly developed; in the *Platynaspini* and *Hyperaspini* they are absent.

The dorsum of the first eight abdominal segments bears a row of six structures (tubercules, strumae, parascoli, senti or scoli), which form dorsal (d), dorso-lateral (dl) and lateral (l) groups. By analogy, the tubercules on the ventral surface of the abdominal segments are called ventral (v), ventrolateral (vl) and paralateral (pl). Thus, for example dl II refers to the dorso-lateral scoli of the second abdominal segment.

Usually a definite type of armature structure is characteristic for each tribe. The larvae of *Hyperaspini* and *Platynaspini* are covered only with chalazae and setae, which also predominate in *Coelopterini*. The *Scymnini* and *Noviini* have tubercules, the *Psylloborini, Tytthaspini* and *Bulaeini* strumae, the *Chilocorini* senti and the *Epilachnini* scoli. Only the tribe *Coccinellini* is exceptional in that the larvae of its different genera have variable structures. They have tubercules *(Neomysia)*, strumae *(Propylaea, Coccinula*, parascoli *Coccinella, Adalia, Adonia, Hippodamia*, etc.), senti (*Anatis*) or scoli (*Harmonia*). Probably, the *Coccinellini* are a polyphyletic tribe.

Most of mature coccinellid larvae possess a well-developed body armature. If this armature is simplified then the larvae are either covered with a white wax-like exudation (*Hyperaspini, Scymnini*) or the sides of the abdominal segments have large gland foramina which produce a secretion (*Coelopterini*). In some tribes, there may be only one of the three above-mentioned types of integument. This suggests that all three types of integuments shown in the *Coccinellidae* possibly result from defensive adaptations, developed in the course of evolution.

There is consistency among coccinellid larvae in the morphological differences between instars, and changes occur in the coloration, proportions and armature of the

body. Larvae of 3rd and 4th instars are brightly coloured and the head and legs are smaller in proportion to the body than in the monochrome 1st and 2nd instar larvae. The 3rd and 4th instar larvae also usually have well sclerotized plates on the thorax, and the abdominal segments have well-developed scoli, senti, parascoli, strumae or tubercules. In 1st and 2nd instar larvae these structures are weakly-developed. By contrast, the frontal suture in 1st and 2nd instar larvae is long and often reaches the bases of the antennae, while in the larvae of the 3rd and 4th instars it is shorter or absent. Antennae, mandibles, maxillae and labium are rather less subject to change with instar.

Because coccinellid larvae show such striking morphological changes with instar, all keys are as a rule suitable for identifying mature larvae.

2.2 Key to the subfamilies, tribes, genera and species of some larvae of the Palaearctic Coccinellidae

2.21 Key to the subfamilies, tribes and genera

1 (6) Frontal suture always developed, Y-shaped, with elongate epicranial suture. Front-clypeal suture complete. Mandibles with four to five large teeth at apex. Galea of maxilla elongate-oval with a truncate apex, bearing numerous setae. Antennae long, three segmented: the second segment longer than broad. Body covered with multi-branched scoli. (Fig. 1—9.) ..... *Epilachninae*, one tribe *Epilachnini*

2 (3) Branches of scoli long, 5—7 times longer than wide. Thorns of scoli short, 2—3 times shorter than the branches or at most of the same length. (Fig. 2, 3, 5.) ..... *Henosepilachna* Li

3 (2) Branches of scoli short, as long or only slightly longer as wide. Thorns very long, thin, 8—10 times longer than the branches.

4 (5) Mandibles widened at base with two large and three smaller teeth at apex. d H scoli with two branches at apex. (Fig. 6, 7.) ..... *Subcoccinella* Huber [*S. vigintiquatuorpunctata* (L.)

5 (4) Mandibles narrow, elongate, only a little widened at base, with one large and three smaller short teeth at apex. d H scoli with four branches at apex. (Fig. 8, 9.) ..... *Cynegetis* Redtb. [*C. impunctata* (L.)]

6 (1) Frontal suture absent or developed, V-shaped, epicranial suture absent (Fig. 50, 111) or present. If present, then the antennae short, with the second segment of about equal length and width. Mandibles at apex with one or two large teeth, below which one more small tooth or a row of smaller teeth are situated (Fig. 10, 15, 51, 109, 112). Galea of maxilla of different shape. Body with setae, chalazae, tubercules, strumae, parascoli or senti, if with scoli, they are two or three branched.

7 (82) Prothorax with two to four sclerotized plates or without any such plates. Apex of tibiotarsi with a more or less thick brush of setae.

8 (81) Terminal segment of maxillary palpi usually wide, robust, no more than thrice as long as wide (Fig. 18, 52). Foramina of secretory glands on abdominal tergites absent or only very slightly developed. Body bare or with long wax-like white exudations.

9 (14) Head of rounded triangular shape. Mandibles with six—seven teeth, the size of which gradually decreases towards the base. Submentum with several stick-like setae. Abdominal tergites with struma (Fig. 10—14). Fungivorous. ..... *Psylloborini*

10 (13) Prothorax with four sclerotized plates. d and dl strumae of different shape.

11 (12) d strumae oval in the horizontal plane; dl strumae round. Mandibles with six teeth. Tooth at base of claw rectangular. (Fig. 11.) ..... *Thea* Muls. [*Th. vigintiduopunctata* (L.)]

12 (11) d strumae round, dl strumae oval in the longitudinal plane. Mandibles with seven teeth. Tooth at base of claw round. (Fig. 10, 12, 13.) ..... *Halyzia* Muls.

13 (10) Prothorax with two sclerotized plates. d and dl strumae both round. Mandibles with

six teeth. Tooth at base of claw round. (Fig. 14.) ..... *Vibidia* Mul. [*V. duodecimguttata* (Poda)]

14 (9) Head of different shape. Mandibles have no more than three teeth at apex. Submentum usually with thin, elongate, rarely short setae. Abdominal tergites with various structures.

15 (16) Frontal suture with acute angle. Mandibles with three teeth at apex. Abdominal tergites with quadrangular strumae. (Fig. 15, 16.) They are feeding on pollen of plants. ..... *Bulaeini* [*Bulaea lichatschovi* (Humm.)]

16 (15) Frontal suture rounded or absent. Mandibles with one or two teeth at apex.

17 (70) Mandibles with two teeth at apex; if one, then maxillary palps or antennae two segmented (in *Chilocorus* the mandibles have two apical teeth and the epicranial suture is present).

18 (19) Maxillary palpi and antennae two segmented. Body of elliptical shape. Abdominal tergites with tubercules. (Fig. 17—21.) ..... *Noviini* (*Rodolia* Muls.)

19 (18) Maxillary palpi three segmented. Antennae one or three segmented. Abdominal tergites with various structures.

20 (25) Antennae one or two segmented. Head usually rectangular, strongly and equally sclerotized. Abdominal tergites with senti. (Fig. 22, 49, 27, 31, 38.) ..... *Chilocorini*

21 (22) Epicranial suture well developed. Mandibles with two teeth at apex. Meso- and metathorax without sclerotized plates. Senti long, thin, 5—13 times as long as wide. (Fig. 23. 26, 27.) ..... *Chilocorus* Leach

22 (21) Epicranial suture absent. Mandibles with one tooth at apex. Meso- and metathorax with sclerotized plates. Senti short, only 3—4 times as long as wide.

23 (24) Prothorax with four sclerotized plates, if with two then the d senti short and triangular. like parascoli. (Fig. 28—33.) ..... *Brumus* Muls.

24 (23) Prothorax with two sclerotized plates, d senti elongate. (Fig. 35, 39, 40.) ..... *Exochomus* Redtb.

25 (20) Antennae three segmented, the last segment sometimes only slightly developed. Head of rounded quadrangular shape.

26 (27) The last antennal segment cupola-like. Mandibles with thick short setae on inner margin. Maxillary palpi, galea and mentum all covered with numerous short setae. (Fig. 50—52.) ..... *Tytthaspini* (*Tytthaspis* Crotch.)

27 (26) The last antennal segment cupola-like or flat. Mandibles without setae on inner margin. Maxillary palpi, galea and mentum all covered by sparse long setae.

28 (31) The last antennal segment always cupola-like. IXth abdominal tergite elongate, posterior margin with a more or less well developed rounded excision. Abdominal tergites with strumae. (Fig. 54, 55.) ..... *Coccidulini*

29 (30) Claws with a rounded quadrangular tooth at base. Setae on the body slightly knobbed (thickened at tip). (Fig. 56.) ..... *Rhizobius* Steph.

30 (29) Claws without a distinct tooth, only widened at base. Setae on the body pointed. (Fig. 57.) ..... *Coccidula* Gyll.

31 (28) The last antennl segment cupola-like or flat. IXth abdominal tergite strongly transverse; if elongate, then posterior margin with a rounded protuberance or with an appendix. Abdominal tergites with scoli, senti, parascoli, strumae or tubercules. ..... *Coccinellini*

32 (37) Apex of IXth segment with a conical or triangular appendix.

33 (34) Apex of IXth segment with an elongate conical appendix. Inner margin of plates on prothorax straight. Plates of meso and metathorax rounded, as wide as long. Claw with a narrow tooth at base. (Fig. 58, 59.) ..... *Propylaea* Muls. [*P. quatuordecimpunctata* (L.)]

34 (33) Apex of IXth segment with a shorter, triangular appendix (Fig. 60). Inner margin of plates on prothorax triangularly cut at base. Plates on meso- and metathorax of oval shape. Claw with a wide, robust tooth at base.

35 (36) Plates of thorax sclerotized, their external margins with four to five short finger-like senti and numerous chalazae. Abdominal tergites with senti. (Fig. 60—62.) ..... *Anisocalvia* Crotch [*A. quatuordecimguttata* (L.)]

36 (35) Plates of thorax slightly sclerotized, covered with numerous short setae, their external margins with only two to four chalazae. Abdominal tergites with parascoli. (Fig. 63. 64.) ..... *Calvia* Muls.

37 (32) Apex of IXth segment without an appendix.

38 (39) Abdominal tergites with a long cylindrical appendix, covered with numerous short chalazae and setae. Plates of thorax with numerous short setae, with chalazae at margins.

Larvae brightly orange with black spots. (Fig. 65.) ..... *Aiolocaria* Crotch [*A. mirabilis* (Motsch.)]

39 (38) Abdominal tergites covered with scoli, senti, parascoli, strumae and tubercules. Plates of thorax of different structure.

40 (41) Abdominal tergites with scoli. d and d1 scoli two to three branched with a more or less long common base. (Fig. 66, 67.) ..... *Harmonia* Muls.

41 (40) Abdominal tergites without scoli, covered with senti, parascoli, strumae or tubercules.

42 (45) Abdominal tergites with senti. Prothorax with two robust plates.

43 (44) d senti on abdomen 1.5 times as long as wide. Pronotum at hind corners and both meso- and metanotum on the outer margins with 3 senti and chalazae. Pale-coloured senti present in positions 1 I, 1 IV-VI, d1 I ..... *Sospita* Muls. [*S. vigintiguttata* (L.)]

44 (43) d senti on abdomen 3 times as long as wide. Hind margin of pronotum with 6 senti in a single row, meso- and metanotum with one sentus in each of the d, d1 and 1 positions. Middle of pronotum with a red patch. Pale-coloured senti present at 1 I and 1 II (Fig. 68, 69.) ..... *Anatis* Muls. [*A. ocellata* (L.)]

45 (42) Abdominal tergites with tubercules, parascoli or strumae. Prothorax with two or four plates without senti.

46 (51) Abdominal tergites with tubercules, covered with numerous slender setae or with sparse setae and one slightly developed chalaza.

47 (48) Tubercules of abdominal tergites large, with numerous slender setae. d I-II tubercules flat, d III-VIII conical. Plates of thorax also covered with numerous slender setae. Base of claw without tooth (Fig. 70—71.) ... *Neomysia* Casey [*N. oblongoguttata* (L.)]

48 (47) Tubercules of abdominal tergites small, only slightly developed, wider than high, with sparse setae and one slightly developed chalaza. Base of claw with a tooth. (Fig. 72).

49 (50) Tibia longer than dorsal edge of femur. d and d1. chalazae on the abdominal sclerites sparse and weak. ..... *Myrrha* Muls. [*M. octodecimguttata* (L.)]

50 (49) Tibia as long as dorsal edge of femur. d and d1 chalazae on the abdominal sclerites more dense and with broader bases. ..... *Aphidecta* Weise [*A. obliterata* (L.)]

51 (46) Abdominal tergites with parascoli or strumae.

52 (69) Inner margin of mandibles without fine teeth. Base of claw in most cases with a tooth.

53 (60) Antennae long, second segment significantly narrower and longer than the first. Third segment well-developed, cupola-like.

54 (55) Head elongated at front on account of the well developed clypeus. Prothorax with two quadrangular plates, truncate behind. Rear of IXth tergite covered with large upturned chalazae. Parascoli of abdomen strongly sclerotized with 10 large chalazae. Base of claw with a tooth. (Fig. 73, 74.) ..... *Spiladelpha* Sem. Dobr. (*S. barovskii kiritschenkoi* Bar.)

55 (54) Head not elongated at front, clypeus normal. IXth tergite without upturned chalazae.

56 (57) Base of claw with a well-developed, robust quadrangular tooth, surrounded with thick clavate setae upturned at apex. Prothorax with four sclerotized plates, if with two then each of them deeply excised in front or on one side. Plates of mesothorax oval, robust and with numerous chalazae. (Fig. 75, 80.) ..... *Semiadalia* Crotch.

57 (56) Claw only slightly widened at base and surrounded with setae which are straight or slightly thickened at the apex.

58 (59) Prothorax with four plates, lateral plates widely separated from medial ones. Bases of d parascoli oval with chalazae distributed uniformly or only along their internal margin. Larvae with orange spots. (Fig. 81, 82.) ..... *Adonia* Muls.

59 (58) Prothorax with two or four robust plates, lying closely against each other. Bases of parascoli round with large chalazae situated at their apex. Larvae completely black or black with the IVth abdominal segment pale. (Fig. 83—85.) ..... *Hippodamia* Muls.

60 (53) Antennae short, second segment only slightly longer than the first. Third segment very small, indistinct.

61 (66) Prothorax with two ovoid-rectangular plates. If plates are excised on the front margin, then not deeply and the larvae are brightly coloured (orange-yellow with black).

62 (63) IXth abdominal tergite elongate-trapezoidal, its apex twice narrow as the base. Base of claw without a tooth. Larvae white with black d parascoli and white 1 parascoli. (Fig. 86, 87.) ..... *Pseudoharmonia* (*P. montana* Sav.)

63 (62) IXth abdominal tergite wide and rounded. Base of claw with a tooth. Larvae coloured differently.

64 (65) Plates of mesothorax round to oval. Abdominal tergites with small strumae, bearing three to four large and several small chalazae. Larvae white or yellow with black spots.

(Fig. 88—90.) ..... *Coccinula* Dobzh.

65 (64) Plates of mesothorax slightly constricted at middle. Abdominal tergites with small parascoli. Larvae pink or red with white and black spots. (Fig. 91.) .... *Synharmonia* Ganglb.

66 (61) Prothorax with four or two plates, completely separated or connected in pairs with more or less wide connections. If two plates, then each is excised on both front and hind margins or very deeply on the front margin only and larvae are pale grey.

67 (68) Parascoli of abdominal segments high or low, but bearing numerous chalazae usually with elongated bases. If bases of chalazae are round, then parascoli have about 10 large chalazae or if less, then base of claw without a tooth. (Fig. 92, 93, 98, 99.) .... *Coccinella* L.

68 (67) Parascoli of abdominal segments low bearing three to five large chalazae with distinctly rounded bases. Base of claw with a well-developed tooth. A yellow spot is situated between the d IV parascoli (Fig. 107, 108.) ..... *Adalia* Muls.

69 (52) Inner margin of mandibles with fine and dense serrations. Base of claw without a tooth. Prothorax with four widely separated plates. Plates of mesothorax round. (Fig. 109, 110.) ..... *Anisosticta* Dup. [*A. novemdecimpunctata* (L.)]

70 (17) Mandibles with one tooth, epicranial and in most cases also frontal suture absent. (Fig. 111, 112.)

71 (76) Head strongly transverse, twice as wide as long. Body oval or broadly oval, covered with chalazae and setae.

72 (73) Second antennal segment cylindrical. Body broadly oval, almost round, without a wax--like exudation. Chalazae situated only on pleurites, the tergites are bare. (Fig. 113, 114.) ..... *Platynaspini* (*Platynaspis luteorubra* Goeze)

73 (72) Second antennal segment flat. Body oval, covered with a white wax-like exudation. Chalazae and setae situated both on tergites and pleurites. (Fig. 115, 116.) .... *Hyperaspini* (*Hyperaspis* Redtb.)

74 (75) Sides of prothorax with two sclerotized plates covered with numerous long setae. .... Subgen. *Hyperaspis s. str.*

75 (74) Prothorax without sclerotized plates. ..... Subgen. *Oxynychus* J. Lec.

76 (71) Head only a little wider than long, not transverse. Body elongate, with tubercules or strumae.

77 (78) Thorax with well-developed sclerotized plates. Tubercules on abdomen also strongly sclerotized. Dorsum without waxlike exudation. (Fig. 119.) .... *Stethorini* (*Stethorus punctillum* Ws.)

78 (77) Sclerotized plates on thorax absent or only slightly developed. Tubercules or strumae on abdomen slightly sclerotized. Dorsum always covered with a white wax-like exudation. ..... *Scymnini*

79 (80) Rear of IXth abdominal segment with two pairs of strong short pointed setae. Strumae of abdominal segments with one to two long setae. (Fig. 120.) .... *Clitostethus* Ws. [*C. arcuatus* (Rossi)]

80 (79) Rear of IXth abdominal segment without strong pointed setae ..... *Scymnus* Kug.

81 (8) Terminal segment of maxillary palpi long, thin, five to seven times as long as wide. Foramina of secretory glands on abdominal tergites well developed. Body covered with a hardly noticeable wax exudation. (Fig. 129—131.) .... *Coelopterini* (*Pharoscymnus* Bed.)

82 (7) Prothorax with six sclerotized plates. Apex of tibiotarsi with no thick brush of hairs, three simple setae are situated a little below the claw. (Fig. 136, 137.) (Klausnitzer 1969) ..... *Lithophilinae* (*Lithophilus connatus* Pan.)

2.22 Key to the species

Henosepilachna Li

1 (2) Second antennal segment short, only a little longer than wide; the third segment only slightly developed. d scoli of prothorax with one branch at apex. (Fig. 1, 2.) .... *H. argus* (Geoff.)

2 (1) Second antennal segment elongate, 1. 5—2 times as long as wide; the third segment cupola-like. d scoli of prothorax multi-branched at apex.

3 (4) d scoli of prothorax long, thin, only slightly thickened at base where there are few

branches which are shorter than those at the apex. (Fig. 3.) ..... *H. vigintioctopunctata* (F.)

4 (3) d scoli of prothorax shorter, significantly thickened at base, where there are numerous long branches, almost as long as those at the apex. (Fig. 4,5). ... *H. elaterii* (Rossi)

Coccidula Kug.

1 (2) Fore tibiotarsus almost to fully half (0.44—0.50) as long as the head is wide. Clypeo--labral suture somewhat obtusely concave. (van Emden 1949) ..... *C. rufa* (Herbst)

2 (1) Fore tibiotarsus stouter, slightly over two-fifths (0.42) as long as head is wide. Clypeo--labral suture straight. (van Emden 1949) ..... *C. scutellata* (Herbst)

Rhizobius Steph.

1 (2) Rear margin of pronotum with a row of chalazae in the middle: the bases of these chalazae only relatively low. Inner margin of meso- and metathoracic sclerites with a single chalaza ..... *Rh. chrysomeloides* (Herbst)

2 (1) Rear margin of pronotum with two rows of chalazae in the middle: the bases of these chalazae are relatively high. Inner margin of meso- and metathoracic sclerites with two chalazae ..... *Rh. litura* (Fabr.)

Rodolia Muls.

1 (4) Tubercules of abdominal segments covered with long and short setae.

2 (3) Tubercules with 4 to 5 long setae. 1 tubercules hemispherical. (Fig. 21) ..... *R. fausti* Ws.

3 (2) Tubercules with one long seta. (Fig. 19) ..... *R. cardinalis* Muls.

4 (1) Tubercules of abdominal segments covered with short. very thick setae. 1 tubercules elongate. at apex widened and narrowed at base. (Fig. 20) ..... *R. limbata* (Motsch.)

Scymnus Kug.

1 (2) Prothorax with two triangular sclerites which are connected together at the front margin. Meso- and metathorax each with two clear dorsal sclerites ..... Subgen. *Nephus* Muls. (*S. limonii* Donisth.)

2 (1) Prothorax with 2 medial sclerites which are separated. Meso- and metathorax without clear sclerites.

3 (14) Sclerotized ring of second segment of maxillary palp is about twice as long on the outer surface as on the inner. Width of the same segment less than twice the length (measured on the outer surface). Second antennal segment short and wide. (Fig. 121.) ..... Subgen. *Scymnus s. str.*

4 (9) Prothorax extended forwards, sometimes in a trapezoidal shape. Prothorax without tubercules and covered with setae, which may form groups of 2—3.

5 (6) IXth segment transverse, straight behind and covered with setae only on margins. (Fig. 122.) ..... *S. rubromaculatus* (Goeze)

6 (5) IXth segment round, covered with numerous setae. Two d, d1 setae, the internal one shorter than the outer.

7 (8) d, d1 setae surrounded by a semicircle of numerous short thorns. (Fig. 123.) ..... *S. pusillus* Sav.

8 (7) Thorns around d, d1 setae not numerous and irregularly placed (Fig. 124.) ..... *S. apetzi* Muls.

9 (4) Prothorax not extended forwards. Tubercules on prothorax more or less distinct.

10 (13) d, d1 and 1 tubercules well developed with one long and several small setae. (Fig. 125.)

11 (12) Middle of pronotum with 2 setae. Tibia with setae set more sparsely. ..... *S. interruptus* Goeze

12 (11) Middle of pronotum with 6 setae. Tibia with setae set more densely. .... *S. frontalis* (F.)

13 (10) d tubercules only slightly developed, replaced by two setae. d1 and 1 tubercules distinct: 1 tubercules with three long and several short setae. (Fig. 126.) ..... *S. nigrinus* Kug.

14 (3) Sclerotized ring of second segment of maxillary palp about 3—4 times as long on the outer surface as on the inner. Width of the same segment twice the length (measured on the outer surface). Second antennal segment elongate, usually cylindrical. (Fig. 127.) ..... Subgen. *Pullus* Muls.

15 (16) Third antennal segment only slightly developed, transparent, indistinct. Legs. antennae and head-sclerites pale yellow (van Emden 1949.) ..... *P. suturalis* Thunbg.

16 (15) Third antennal segment well developed and distinctly noticeable.
17 (20) Second antennal segment longer than first.
18 (19) Legs, antennae and head-sclerites pale yellow (van Emden 1949.). . *P. auritus* Thunbg.
19 (18) Legs and ventrum green. Prothorax with 8 tubercules, each of them with one long and two small setae. d, d1 and 1 tubercules with two setae. (Fig. 128.) ..... *P. subvillosus* (Goeze)
20 (17) Second antennal segment not longer than first. Antennae brown, legs and head — sclerites brownish-red. (van Emden 1949.) ..... *P. haemorrhoidalis* Herbst.

Subgen. *Hyperaspis s. str.*

1 (2) Abdominal tergites covered with numerous long setae, short setae rare ..... *H. desertorum* Ws.
2 (1) Abdominal tergites covered predominantly with short setae and with only a few setae of fair length ..... *H. reppensis* (Herbst)

Subgen. *Oxynychus* Lec.

1 (2) Sides of prothorax subdivided into three lobes. Abdominal tergites with long setae on the back margin. (Fig. 116, 117) ..... *H. alexandrae* (Ws.)
2 (1) Sides of prothorax entire. Abdominal tergites with strong short setae on the back margin. (Fig. 118.) ..... *H. terrea* (Zasl.)

Hippodamia Muls.

1 (2) Prothorax with four closely adjacent plates. Larvae black with pale segment IV. (Fig. 83, 84.) ..... *H. tredecimpunctata* (L.)
2 (1) Prothorax with two plates, with a deep and narrow excision posteriorly. Larvae completely black. (Fig. 85.) ..... *H. septemmaculata* (Deg.)

Adonia Muls.

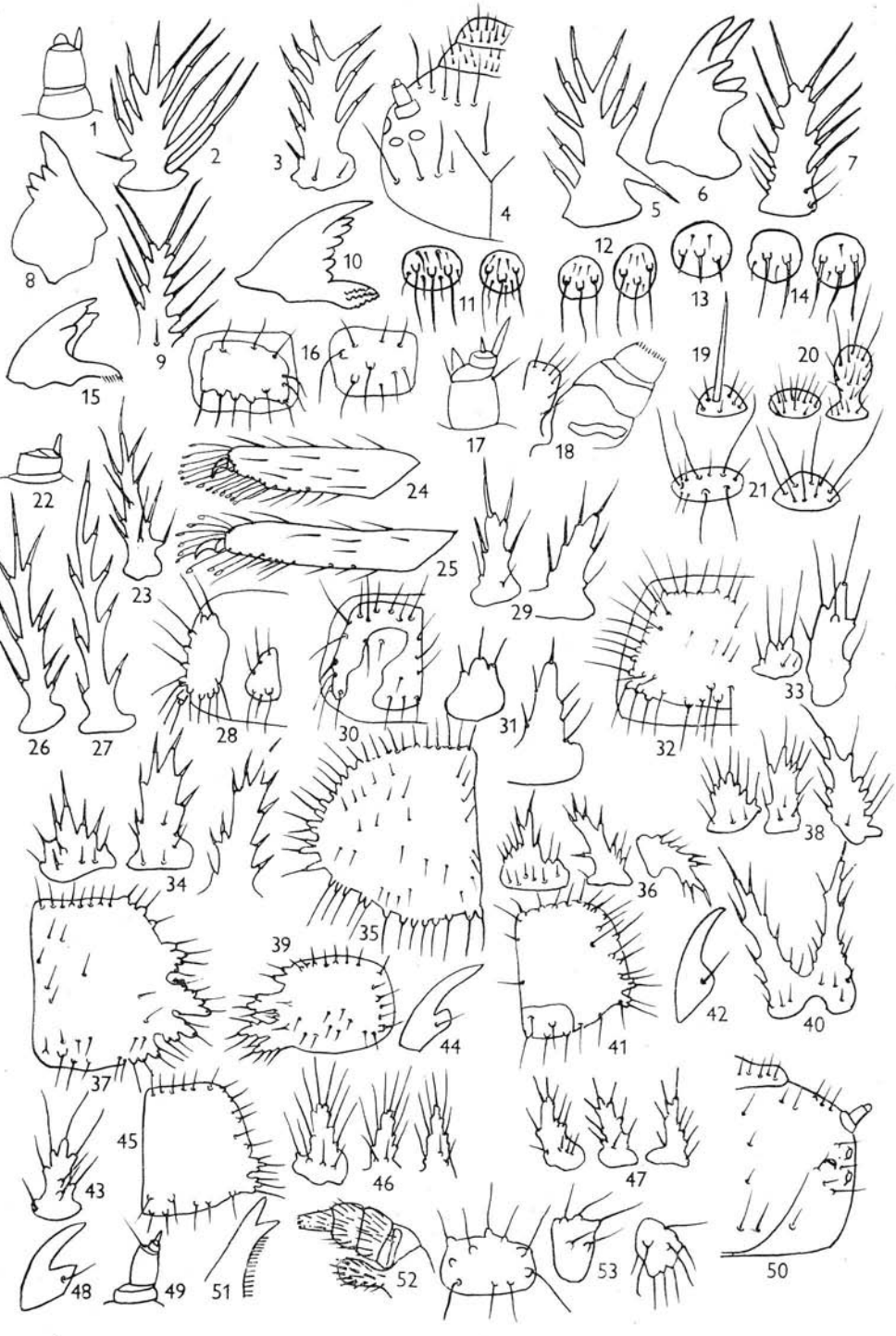
1 (2) Medial plates of prothorax roughly triangular and separated from lateral plates by a narrow gap. d parascoli with six large chalazae of equal size with a triangular base. Larvae brown with small orange spots. (Fig. 81.) ..... *A. amoena* (Fald.)
2 (1) Medial plates of prothorax roughly quadrangular and separated from lateral plates by a wider gap. d parascoli with five chalazae of different size, one of them noticeably the largest, this chalaza has a cylindrical base. Larvae grey, with yellow and orange spots. (Fig. 82.) ..... *A. variegata* (Goeze)

Semiadalia Crotch.

1 (6) Prothorax with four or two plates: if two, then each is deeply excised in front and the larvae are without orange patches.

Plate XIII

Fig. 1—53. 1 — antenna; 2 — d scolus of prothorax, *H. argus;* 3 —d scolus of prothorax, *H. vigintioctopunctata;* 4 — head, 5 — d scolus, *H. elaterii* 6 — mandible; 7 — d scolus, *S. vigintiquatuorpunctata;* 8 — mandible; 9 — d scolus, *C. impunctata* (Kapur, 1950); 10 — mandible, *H. tschitscherini;* 11 — d, d1 strumae, *T. vigintiduopunctata;* 12 — d, d1 strumae, *H. tschitscherini:* 13 — d struma, *H. sedecimpunctata;* 14 — d, d1 strumae, *V. duodecimpunctata;* 15 — mandible: 16 — d, d1 strumae, *B. lichatschovi;* 17 — antenna; 18 — maxilla; 19 — d tubercule, *R. cardinalis* (Kamiya, 1965); 20 — d, 1 tubercules, *R. limbata;* 21 — d, 1 tubercules, *R. fausti;* 22 — antenna. 23 — d sentus; 24 — tibiotarsus, *C. bipustulatus;* 25 — tibiotarsus, *C. geminus* (Zaslavskii. 1962); 26 — sentus, *C. renipustulatus;* 27 — sentus, *C. rubidus;* 28 — prothoracic plate; 29 — d II, VIII senti, *B. octosignatus;* 30 — prothoracic plate; 31 — d II, VIII senti, *B. jacobsoni;* 32 — prothoracic plate; 33 — d II ,VIII senti, *B. mongolicus;* 34 — d, d1, 1 I senti, *E. quadripustulatus;* 35 — prothoracic plate; 36 — d, d1, 1 I senti, *E. mongol;* 37 — prothoracic plate; 38 — d, d1, 1 I senti, *E. kiritschenkoi;* 39 — mesothoracic plate; 40 — d VIII senti, *E. undulatus;* 41 — prothoracic plate; 42 — claw, *E. semenovi;* 43 — d I sentus; 44 — claw, *E. nigripennis;* 45 — prothoracic plate, 46 — d, d1, 1 I senti, *E. melanocephalus;* 47 — d, d1, 1 I senti, 48 — claw, *E. nigromaculatus;* 49 — antenna, *E. undulatus;* 50 — head, 51 — mandible, 52 — maxilla, 53 — d, d1, 1 strumae, *T. lineola.* (G. I. Savoïskaya del.)



2 (3) 4th instar larva with average lengths of 0.60 mm for front tibia and 0.79 mm for head-width. ..... *S. alpina* (Villa)

3 (2) 4th instar larva with average lengths of > 1 mm for front tibia and 0.90 mm for head-width.

4 (5) Prothorax with four plates. Parascoli high, elongate. d parascoli increase in height towards posterior body, especially this applies to the bases of the two large apical chalazae. Larvae orange. d1, 1 IV parascoli orange, the remainder brown. (Fig. 75, 76.) ..... *S. undecimnotata* (Schneid.)

5 (7) Prothorax with two plates, very deeply excised in front. Parascoli low, flat. d parascoli almost of the same structure on all segments. Larvae yellowish-brown. d1,1I and IV parascoli white or yellow, the remainder black. (Fig. 77.) ..... *S. notata* (Laich.)

6 (1) Prothorax with two plates, deeply excised at the front corners. Strumae high, elongate, especially parascoli d VIII, which is almost a sentus in structure. Prothorax red, the remaining segments orange. d1, 1 I and IV parascoli orange, the remainder black. (Fig. 79, 80.). ..... *S. przevalskii* Sav.

Tytthaspis Crotch.

1 (2) Larvae wholly pale except for blackish margins to some of the segments of the legs, setae dark brown. (van Emden 1949) ..... *T. sedecimpunctata* (L.)

2 (1) Some abdominal strumae pale in colour.

3 (4) d and d1 strumae of I pale, all other abdominal strumae dark. Bases of the chalazae on the abdominal strumae are high and large ..... *T. trilineata* Weise

4 (3) Larvae light grey with small dark spots situated around the chalazae. Sides of head blackish. Prothorax with two closely adjacent plates, more or less uniformly covered with chalazae. d strumae oval, with 8 chalazae, 4 of which are larger than the others. (Fig. 53.) ..... *T. lineola* (Gebl.)

Adalia Muls.

1 (2) d and d1 abdominal sclerites with areas of isolated setae which have no basal swellings ..... *A. conglomerata* (L.)

2 (1) d and d1 abdominal sclerites with parascoli. Segment IV usually with a pale patch in the middle.

3 (4) Prothorax with two plates, deeply excised at the front corners. Mesothoracic plates also excised in front. Abdominal parascoli with five large and several small chalazae. Larvae creamy-white with black plates. d1 I, 1 I—VIII strumae yellow, the remainder black. (Fig. 106, 107.) ..... *A. decempunctata* (L.)

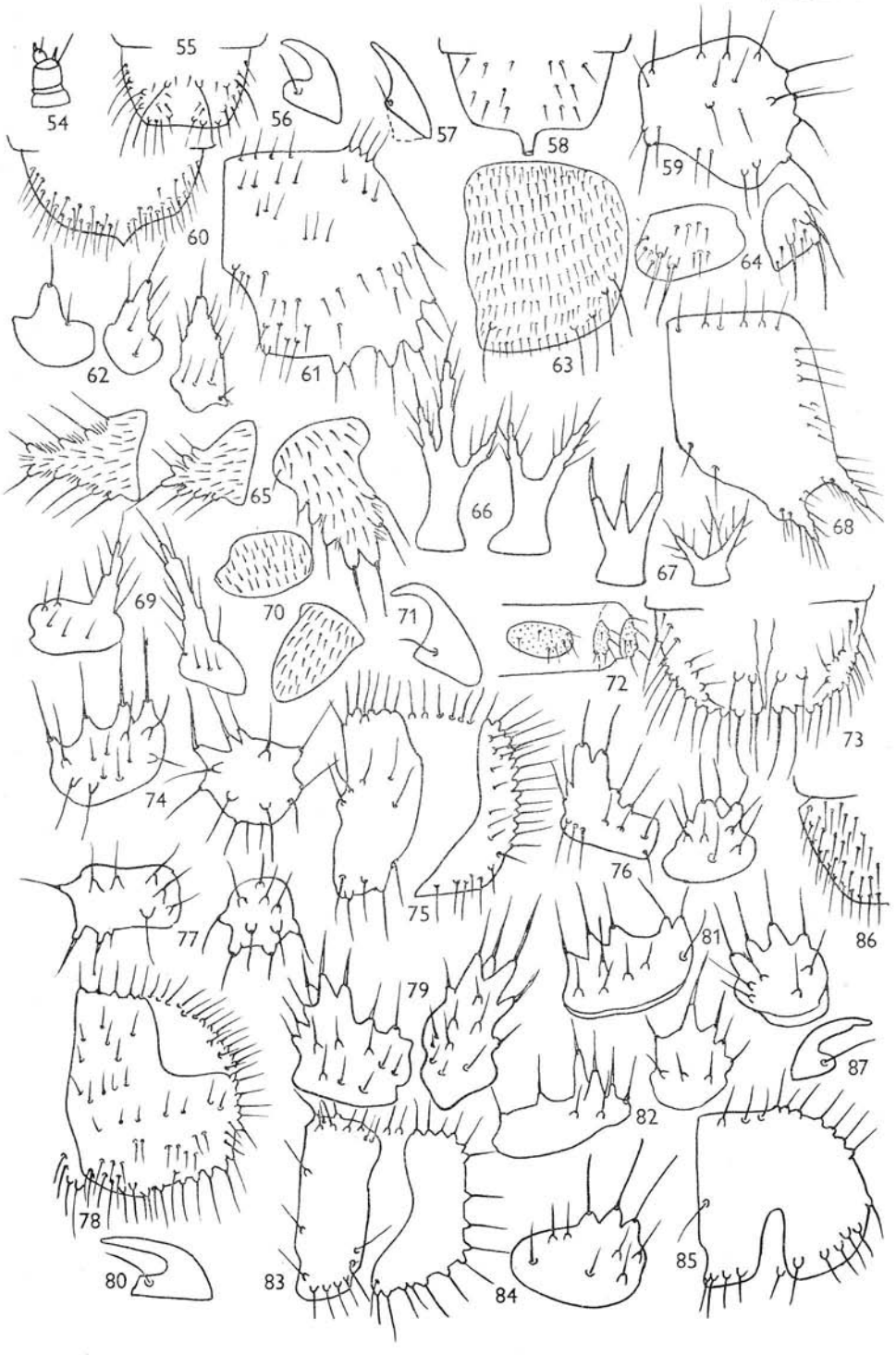
4 (3) Prothorax with four plates. Mesothoracic plates not excised in front. Abdominal parascoli with three large and some small chalazae. Larvae darker, abdominal tergites blackish. d IV, d1 I parascoli orange, the other d and d1 strumae black. 1 I, IV parascoli yellow, the other 1 parascoli white with grey or black apex. (Fig. 108.) ..... *A. bipunctata* (L.)

Coccinella L.

1 (2) d parascoli small with four chalazae, only two of which are large. Bases of chalazae rounded. Base of claw without or with only a very slightly developed rounded tooth. Larvae grey with yellow spots. (Fig. 92, 93.) ..... Subgen. *Neococcinella* Sav. (*C. undecimpunctata* L.)

Plate XIV

Fig. 54—87. 54 — antenna, 55 — apex of abdomen, *Coccidula*, 56 — claw, *R. litura*, 57 — claw, *Coccidula* (van Emden, 1949); 58— IXth segment, 59— mesothoracic plate, *P. quatuordecimpunctata;* 60 — IXth segment, 61 — prothoracic plate, 62 — d, d1 1 II senti, *A. quatuordecimguttata;* 63 — prothoracic plate, 64 — d, d1 parascoli, *C. punctata;* 65 — d, d1, 1 V, *A. mirabilis;* 66 — d, d1 scoli, *H. axyridis;* 67 — d, d1 scoli, *H. quadripunctata* (van Emden, 1949); 68 — prothoracic plate, 69 — d, d1 senti, *A. ocellata;* 70 — d, I, VIII tubercules, 71 — claw, *N. oblongoguttata;* 72 — d, d1, 1 strumae, *M. octodecimguttata* (van Emden, 1949); 73 — IXth segment, 74 — d, d1 parascoli, *S. barovskii kiritschenkoi;* 75 — prothoracic plate, 76 — d, d1 parascoli, *S. undecimnotata;* 77 — d, d1 parascoli, *S. notata;* 78 — prothoracic plate, 79 — d, d1 parascoli, 80 — claw, *S. przevalskii;* 81 — d, d1 parascoli, *A. amoena;* 82 — d, d1 parascoli, *A. variegata;* 83 — prothoracic plates, 84 — d parascolus, *H. tredecimpunctata;* 85 — prothoracic plate, *H. septemmaculata;* 86 — IXth segment, 87 — claw, *P. montana.* (G. I. Savoïskaya del.)


54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87

2 (1) d parascoli larger, often very large, with no less and often more than 8 chalazae. Base of claw with a well developed tooth. Larvae brightly coloured with orange, red, yellow or white spots. ..... Subgen. *Coccinella s. str.*

3 (14) Parascoli of abdominal segments high, finger-like, bases of chalazae elongate, cylindrical. Larvae large (7.0—12.8 mm).

4 (7) Medial prothoracic plates closely adjacent.

5 (6) Prothorax with two plates, not deeply excised in front and behind. Base of claw with a narrow, elongate tooth. Larvae velvet-black; prothoracic tergites (excepting the plates) and d, dl I—II parascoli yellow. (Fig. 94.) ..... *C. nivicola* Men.

6 (5) Prothorax with four plates, the medial and lateral plates connected by broad connections. Base of claw with wide tooth. Larvae black; small spots at the front and back angles of the prothorax and also d, dl I and IV parascoli orange. (Fig. 95, 96.) ... *C. reitteri* Ws.

7 (4) Medial prothoracic plates separated by a light strip, which is wider behind than in front.

8 (9) Medial prothoracic plates rather widened posteriorly and somewhat pear-shaped. d parascoli high, almost equal to abdominal segments by length. (Fig. 97, 98.) .... *C. distincta* Fald. (*divaricata* auct. nec Ol.)

9 (8) Medial prothoracic plates roughly octangular. d strumae smaller.

10 (11) Mesothoracic plates broadly oval, only slightly longer than wide. d parascoli orientated horizontally and very close to each other. Setae of parascoli strong, short, only a little longer than bases of chalazae. (Fig. 99.) ..... *C. transversoguttata* Fald.

11 (10) Mesothoracic plates oblong, significantly longer than wide. d parascoli orientated longitudinally. Setae of parascoli thin, long, 3 or more times as long as bases of chalazae.

12 (13) Base of claw with a narrow and very short tooth, slightly excised on the outer side. Larvae brick-red with black. (Fig. 100.) ..... *C. tianschanica* Dobz.

13 (12) Base of claw with a narrow but long tooth with a straight outer side. Larvae grey with yellow and orange spots. (Fig. 101, 102.) ..... *C. septempunctata* L.

14 (3) Parascoli of abdominal segments not high, sometimes flat. Bases of chalazae triangular, often with round corners; of equal height and width. Larvae smaller (4.5—7.0 mm).

15 (16) Prothorax with four plates, medial plates quadrangular. Setae of parascoli dark, thin, strong and very long, 5 times as long as bases of chalazae. Larvae black, dl I, IV, VI, VII and l I, IV parascoli orange. (Fig. 103.) ..... *C. quinquepunctata* L.

16 (15) Prothorax with two plates, each of them more or less deeply excised in front and behind. Setae of parascoli shorter, 3—3.5 times as long as bases of chalazae.

17 (18) Prothoracic plates slightly excised in front and behind. d parascoli not high, with 7 chalazae, the bases of which are elongate-triangular. Larvae black with small light spots. dl, 1 I, IV parascoli whitish. (Fig. 104.) ..... *C. hieroglyphica* L.

18 (17) Prothoracic plates broadly excised in front and behind. d parascoli flat, very low, with 10 chalazae having small, round bases. Larvae light-grey with large white spots and black plates and parascoli; though dl, 1 I, IV parascoli white. (Fig. 105.) .... *C. trifasciata* L.

Plate XV

Fig. 88—137. 88 — prothoracic plate, 89 — d, dl, 1 II strumae, *C. elegantula;* 90 — mesothoracic plate, *C. principalis;* 91 — mesothoracic plate, *S. conglobata;* 92 — d, dl, 1 II parascoli, 93 — claw, *C. undecimpunctata;* 94 — claw, *C. nivicola;* 95 — prothoracic plate, 96 — claw, *C. reitteri;* 97 — medial prothoracic plate, 98 — d II parascolus, *C. divaricata;* 99 — d II parascolus, *C. transversoguttata;* 100 — claw, *C. tianshanica;* 101 — d II parascolus, 102 — claw, *C. septempunctata;* 103 — d parascolus, *C. quinquepunctata;* 104 — d parascolus, *C. hieroglyphica;* 105 — d parascolus, *C. trifasciata;* 106 — prothoracic plate, 107 — d II parascolus, *A. decempunctata;* 108 — d II parascolus, *A. bipunctata;* 109 — mandible, 110 — claw, *A. novemdecimpunctata;* 111 — head, 112 — mandible, *O. alexandrae;* 113 — antenna, 114 — abdominal segment, *P. luteorubra;* 115 — antenna, 116 — abdominal segment, 117 — prothorax, *O. alexandrae;* 118 — prothorax, *O. terrea;* 119 — d tubercule, *S. punctillum;* 120 — VIIIth and IXth abdominal segments. *C. arcuatus* (van Emden, 1949); 121 — antenna, *S. nigrinus;* 122 — IXth segment, *S. rubromaculatus;* 123 — d, dl, setae, *S. pusillus;* 124 — d, dl setae, *S. apetzi;* 125 — d, dl, 1 tubercules, *S. frontalis;* 126 — d, dl, 1 tubercules, *S. nigrinus;* 127 — antenna, 128 — prothorax, *P. subvillosus;* 129 — head, 130 — maxilla and labium, *P. balkhashensis;* 131 — foreleg, *P. tsharinensis;* 132 — metathoracic plate, 133 — abdominal segment, *P. pilosus;* 134 — abdominal segment, *P. heptapotamicus;* 135 — abdominal segment, *P. auricomus;* 136 — prothorax, 137 — tibiotarsus, *L. connatus* (Klausnitzer, 1969). (G. I. Savoïskaya del.)


88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137

Coccinula Dobz.

1 (2) Prothoracic plates closely adjacent, covered with numerous uniformly distributed chalazae and setae. Larvae grey, but the 1st abdominal segment white, excluding the brown d strumae. Also small white spots are situated between the thoracic plates. (Fig. 88, 89.) ..... *C. elegantula* (Ws.)

2 (1) Plates of prothorax widely separated: chalazae and setae are not numerous here and mainly situated on the margins. Larvae are differently coloured.

3 (4) Larvae slender, coloured white with brown plates and strumae. Large white spots between thoracic plates. Two white strips along abdomen between d and dl strumae ..... *C. sinuatomarginata* (Fald.)

4 (3) Larvae more robust, yellow or orange with black plates and strumae.

5 (6) Prothoracic plates more or less deeply excised in front. Tibiotarsi slender, long, 9—10 times as long as wide. Larvae bright yellow, almost orange, with black plates and strumae. (Fig. 90.) ..... *C. principalis* (Ws.)

6 (5) Prothoracic plates with straight front margin. Tibiotarsi 5—6 times as long as wide. Larvae yellow with black plates and strumae. ..... *C. quatuordecimpustulata* (L.)

Synharmonia Gglb.

1 (2) Margins of prothoracic plates more or less uniformly covered by chalazae. Larvae reddish-brown with bright white and red spots. 1 parascoli red, white and black. .... *S. oncina* (Ol.)

2 (1) Chalazae on prothoracic plates principally situated on hind and hind outer margins. Between parascoli d IV there is a diffuse pale patch which stretches from the anterior to the posterior limit of segment IV.

3 (4) Segments I—VIII with a wide evenly defined pale mid-line. ..... *S. lyncea* (Ol.)

4 (3) Mid-line of segments I—VIII broken up segmentally into patches of varying size.

5 (6) Patch in mid-line of segment III large, extending forward past the front margin of the dorsal sclerites. Pale patch in mid-line of segment IV usually joined to the dl patches. ..... *S. conglobata* (L.)

6 (5) Patch in mid-line of segment III small, mainly restricted to the posterior margin of the segment. Pale patch in midline of segment IV usually not joined to the dl patches. ..... *S. impustulata* (L.)

Harmonia Muls.

1 (2) Parascoli of abdominal segments with elongate thin bases, d scoli have three branches, dl scoli two branches. Prothorax with six senti d, dl, 1 I; dl II—III: d, dl IV—V scoli all of orange colour, the remainder black. (Fig. 66.) ..... *H. axyridis* (Pall.)

2 (1) Parascoli of abdominal segments with short and wide bases, d and dl scoli have three branches. d IV, dl I—IV scoli yellow, the remainder dark. (Fig. 61.) .... *H. quadripunctata* (Pont.)

Halyzia Muls.

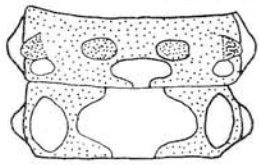
1 (2) d strumae with one large long chalaza. (Fig. 12.) ..... *H. tschitscherini* Sem.

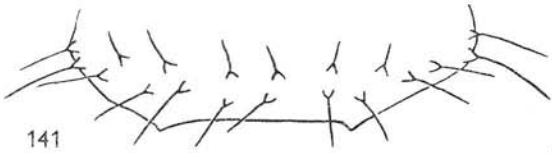
2 (1) d strumae with several more or less large chalazae bearing thickening, short setae. (Fig. 13.) ..... *H. sedecimguttata* (L.)

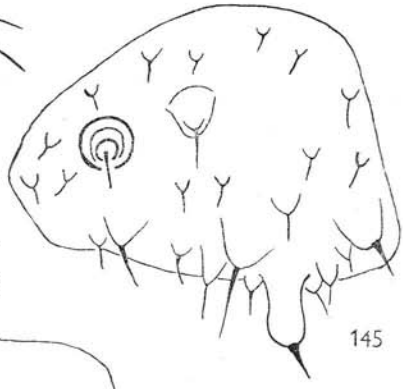
Plate XVI

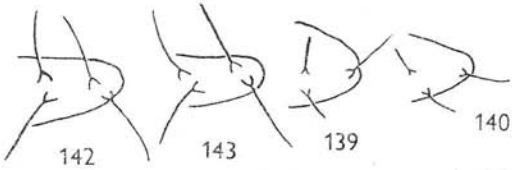
Fig. 138—160. 138—140: *Rhizobius chrysomeloides*, L4; 138 — Hind margin of pronotum; 139 — inner part of mesothoracic sclerite; 140 — inner part of metathoracic sclerite; 141—143: *Rhizobius litura*, L4; 141 — Hind margin of pronotum; 142 — inner part of mesothoracic sclerite; 143 — inner part of metathoracic sclerite; 144 — *Synharmonia impustulata*, L4, pigmentation of third and fourth abdominal segment; 145 — *Aphidecta obliterata*, L4, struma d 3 (by van Emden, 1949); 146—147: *Calvia decemguttata*, L4; 146 — ninth abdominal segment; 147 — struma dl 5; 148—153: *Sospita vigintiguttata*, L4, 148 — prothoracic sclerite; 149 — mesothoracic sclerite; 150 — metathoracic sclerite; 151 — sentus dl 6; 152 — sentus d 7; 153 — sentus 1 3; 154—157: *Semiadalia alpina*, L4; 154 — mesothoracic sclerite; 155 — struma d 3; 156 — struma dl 3; 157 — struma 1 3; 158 — *Adalia conglomerata*, L4, verruca d 2; 159—160: *Brumus oblongus*, L4; 159 — parascolus dl 7; 160 — parascolus 1 3. (After B. Klausnitzer I. Kovář del.)

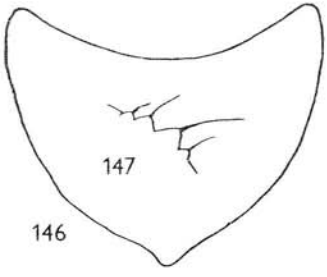

138

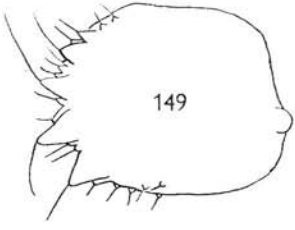

144


141

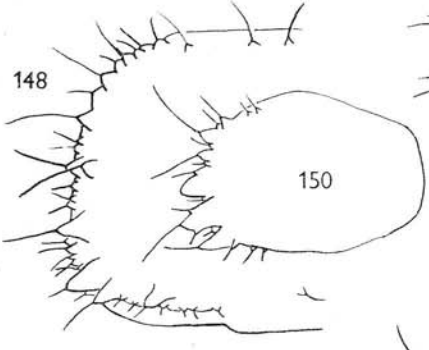

145

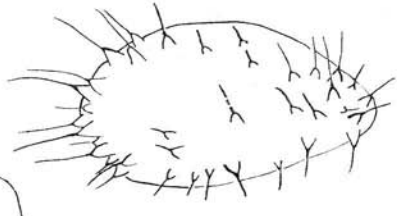

142 143 139 140


147 146

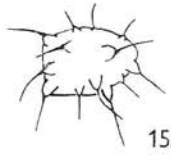

149


151 152


148 150

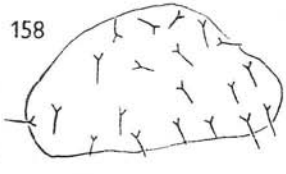

154

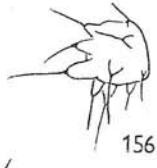

153

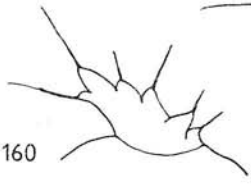

155


157


159


158


156


160

Calvia Muls.

1 (2) d1 IV strumae dark, 1 strumae all pale. Larva bi-coloured and with general appearance resembling a *Psylloborini* larva. ..... *C. decemguttata* (L.)
2 (1) Struma d1 IV often more or less pale, but usually not white, at least strumae 1 II—III show darkening. Segments I—V with a white medial stripe. .... *C. quinquedecimguttata* (F.)

Pharoscymnus Bed.

1 (2) Head elongate. 3/4 as wide as long. Prothoracic plate covered with numerous setae. Mesothoracic plates oval. Larvae black. (Fig. 129, 130.) ..... *Ph. balkhashensis* Sav.
2 (1) Head rounded. as wide as long. Prothoracic plate with few setae.
3 (4) Frontal suture rounded posteriorly. Front tibiotarsi thin, elongate, 8 times as long as wide; femora quadrate, four times as wide as tibiotarsi. Larvae black. (Fig. 131.) .... *Ph. tsharinensis* Sav.
4 (3) Frontal suture pointed posteriorly. Front tibiotarsi robust, only 3 times as long as wide; femora thinner, only 1.5—2 times as wide as tibiotarsi.
5 (6) Metathoracic plates oval, only slightly narrowed at internal margin, straight behind, without a protuberance. Setae on abdomen on round sclerotized plates. Larvae black. (Fig. 132, 133.) ..... *Ph. pilosus* Sav.
6 (5) Metathoracic plates very narrowed at internal margin, with a round protuberance behind. Setae on abdomen without sclerotized plates at base.
7 (8) Front tibiotarsi almost uniformly thin, elongated, 5 times as long as wide. On abdominal segments 4 large setae are situated between the foramina of the secretory glands. Larvae brown with black head. (Fig. 134.) ..... *Ph. heptapotamicus* Dobz.
8 (7) Front tibiotarsi rounded and widened at base, only 3 times as long as wide. On abdominal segments 6 large setae are situated between the foramina of the secretory glands. Larvae black. (Fig. 135.) ..... *Ph. auricomus* Sav.

Chilocorus Leach.

1 (4) First abdominal segment white, senti not very long, only 5 times as long as wide, with about ten branches.
2 (3) Tibiotarsus 3.5 times as long as wide. Base of claw with a short wide tooth. (Fig. 23, 24.) ..... *Ch. bipustulatus* (L.)
3 (2) Tibiotarsus 5 times as long as wide. Base of claw with a long narrow tooth. (Fig. 25.) (Zaslavskiĭ 1962) ..... *Ch. geminus* Zasl.
4 (1) First abdominal segment black. Senti narrow, long and with more than 10 branches.
5 (6) Senti 7 times as long as wide. Branches of senti very short with long setae 10 times the length of the branches. (Fig. 26.) ..... *Ch. renipustulatus* (Scriba)
6 (5) Senti 11—13 times as long as wide. Branches of senti long, with short strong thorns of about the same length. (Fig. 27.) ..... *Ch. rubidus* Hope

Exochomus Redtb.

1 (8) External margins of prothoracic plates with three large senti and numerous chalazae with elongate bases. Senti of abdominal segments large, bearing about 15 long branches ..... Subgen. *Exochomus s. str.*
2 (7) Plates of mesothorax of round oval shape with long multibranched senti on external margins. d VIII senti three to four times as long as wide.
3 (6) External margins of thoracic plates with senti and chalazae forming a continuous row. Branches of senti of abdominal segments cylindrical, elongate, with dark short strong setae which are shorter than the branches. Base of claw with a wide transverse tooth.
4 (5) Plates of prothorax with branched senti. d I—II senti of triangular shape, with one more or less large branch at apex. (Fig. 34.) ..... *E. quadripustulatus* (L.)
5 (4) Plates of prothorax with unbranched senti. d I—II senti elongate, with two distinct branches at apex. (Fig. 35, 36.) ..... *E. mongol* Bar.
6 (3) External margins of thoracic plates bear senti separated by spaces. Branches of senti on abdominal segments of about equal length and width, slightly rounded at the apex, with long, light setae which are longer than the branches. Claw at base narrow, elongate. (Fig. 37, 38.) ..... *E. kiritschenkoi* Bar.
7 (2) Plates of mesothorax round, on external margins there are short senti having short branches. d VIII senti six times as long as wide. Base of claw with a robust, strongly

transverse tooth. (Fig. 39, 40.) ..... *E. undulatus* Ws.

8 (1) Plates of prothorax with impoverished armature, i. e. with only two low parascoli and several chalazae with short round bases on the external margins. Senti of abdominal segments not large, bearing about 10 short branches. .... Subgen. *Parexochomus* (Bar.)

9 (14) Senti of abdominal segments with very short branches at apex of which long, thin setae are situated. Legs long, of tibiotarsus 6 to 8 times as long as wide.

10 (13) Parascoli of plates of prothorax with two straight-sided branches of equal size at apex.

11 (12) Base of claw widened with rounded sides, without a tooth. Larvae dark grey, almost black. (Fig. 41, 42.) ..... *E. semenovi* Ws.

12 (11) Base of claw with a well-developed, elongate narrow tooth. Larvae light. (Fig. 43, 44.) ..... *E. nigripennis* (Er.)

13 (10) Parascoli of plates of prothorax with one rounded branch at apex. Base of claw with a tooth. Larvae cream-coloured with black plates and senti. (Fig. 45, 46.) .... *E. melanocephalus* Zubk

14 (9) Senti of abdominal segments with distinct although small branches, at apex of which shorter strong setae are situated. Legs short, tibiotarsus only 3 times as long as wide. Base of claw with a wide transverse tooth. Larvae coloured light-cream with darker plates and senti. (Fig. 47, 48.) ..... *E. nigromaculatus* (Goeze)

Brumus Muls.

1 (2) Pronotum with two sclerotized plates. ..... *B. oblongus* (Weidenbach)

2 (1) Pronotum with four sclerotized plates.

3 (4) Medial and lateral plates of prothorax completely separated. External margins of thoracic plates with senti. d senti slightly increase in length towards the back end of the body. Larvae orange in colour. (Fig. 28, 29.) ..... *B. octosignatus* (Gebl.)

4 (3) Medial and lateral plates of prothorax are connected in front or fused into one plate. External margins of thoracic plates with chalazae. d senti markedly increase in length towards the back end of the body. Larvae dark.

5 (6) Plates of mesothorax almost quadrate. d I—II senti caplike, d VII—VIII senti stick-like. All senti with short strong setae. (Fig. 30, 31.) ..... *B. jacobsoni* Bar.

6 (5) Plates of mesothorax oval, elongate. d I—II senti short, d VII—VIII senti elongate--triangular. All senti with long thin setae. (Fig. 32, 33.) ..... *B. mongolicus* Fleisch.

2.23 A simple key for field use

B. KLAUSNITZER and I. KOVÁŘ

As a supplement to the preceding key, a further key for 46 European species and genera has been drawn up which is based on the easiest characters, above all setae and colouring. A hand lens should provide adequate magnification. The key applies only to the 4th instar larvae. It aims to help those who are put off the identification of ladybird larvae by the complicated morphological examinations normally entailed. Users of the key who have no specialized knowledge of the systematics of coccinellid larvae will find that it gives them an outline knowledge of the subject. After some initial practice, the identification of larvae can be speeded up by the use of the separate dichotomous key for coloured symbols which also figures the most important morphological details which are frequently mentioned in the text.

1 Larvae with white wax secretions. 2

— Larvae without wax secretions. 4

2 Body elliptical. ..... *Hyperaspis*

— Body elongated. 3

3 Tip of the 9th abdominal segment with a large seta on each side. ... *Clitostethus arcuatus*

— Tip of the 9th abdominal segment without large setae. ..... *Scymnus*

4 Body broadly oval, with marginal setae. ..... *Platynaspis luteorubra*

— Body elongate. 5

5 Larvae small (up to 3 mm long). In doubtful cases they can be distinguished from I—II instars of all coccinellid larvae by the characteristic colouration of the head: see colour plate. ..... *Stethorus punctillum*

— Larvae usually substantially larger. 6
6 Meso- and metathorax with two setose processes laterally. 7
— Meso- and metathorax with only one setose process laterally. 11
7 Upper side of abdomen with strumae. Body pale with lightbrown sclerites. ..... *Tytthaspis sedecimpunctata*
— Upper side of abdomen with senti or parascoli. 8
8 Parascoli and pronotum: see colour plate. ..... *Brumus oblongus*
— Senti with distinct branches. 9
— Senti without distinct branches. 10
9 Upper side of head dark. L 1, dl 1 pale. Pronotum: see colour plate. ..... *Exochomus quadripustulatus*
— Upper side of head in front — pale. L 1 dark, dl usually dark. Pronotum: see colour plate. ..... *Exochomus nigromaculatus*
10 D, dl, l 1 pale. ..... *Chilocorus bipustulatus*
— D, dl, l 1 dark. ..... *Chilocorus renipustulatus*
11 Head with front-clypeal suture. Frontal suture Y-shaped. 12
— Head without front-clypeal suture. Frontal suture ʊ— shaped. 14
12 Branches of scoli long, thorns of scoli short. ..... *Henosepilachna*
— Branches of scoli short, thorns of scoli very long. 13
13 Base of d and dl abdominal scoli: see colour plate. ..... *Subcoccinella vigintiquatuorpunctata*
— Base of d and dl abdominal scoli: see colour plate. ..... *Cynegetis impunctata*
14 9th abdominal segment with caudal tip. 15
— 9th abdominal segment rounded. 20
— 9th abdominal segment ± truncate to weakly sinuous. 18
15 Upper side of abdomen with senti. Dl, l 1; d, dl, l 4, l 5—7 white. .. *Calvia quatuordecimguttata*
— Upper side of abdomen with strumae. 16
16 D 2, l 3, pale, dl 4 dark. Colouration of abdomen: dl 1, d 4, and l 1—8 yellow. ..... *Calvia decemguttata*
— D 2, l 3, dark, dl 4 pale. 17
17 1 with a small and 4 with a large yellow median spot. 2, 3, 5—8 with white median spots. Meso- and metathorax with yellow dorsal spots. Dl 1; d, dl 4; l 1, 4—8 white. ..... *Propylaea quatuordecimpunctata*
— Abdominal segment 1—5 with pale median stripe. Dl 1; l 4, white to yellowish, l 1, d 4 and l 5—8 white, dl 4 greyishbrown. ..... *Calvia quinquedecimguttata*
18 Larvae on deciduous and coniferous trees and in the herbaceous vegetation of dry habitats. Tarsal claw: see colour plate. ..... *Rhizobius*
— Larvae on riparian vegetation (banks of lakes, rivers, etc.) Tarsal claw: see colour plate. 19
19 D, dl 1—8 dark. Setae on 9th abdominal segment: see colour plate. ..... *Coccidula rufa*
— D, dl 1—8 pale. Setae on 9th abdominal segment: see colour plate. .... *Coccidula scutellata*
20 Ground colour of abdomen yellow. 21
— Ground colour of abdomen light grey to black. 23
21 Head dark brown, legs short, dl 1 yellow. ..... *Thea vigintiduopunctata*
— Head pale yellow with dark spots, legs long, dl 1 black. 22
22 L 1—5 blackish, l 6—8 yellow. ..... *Halyzia sedecimguttata*
— L 1—3 black, l 4—8 yellow. ..... *Vibidia duodecimguttata*
23 All abdominal sclerites uniformly coloured. 24
— Some abdominal sclerites distinctly paler or darker than the other ones. 25
24 Body grey. D, dl 1—8 dark, l 1—8 pale . ..... *Adalia conglomerata*
— Body brown, thorax on each side with a dark brown spot. D 1—8 darker than dl, l 1—8. ..... *Anisosticta novemdecimpunctata*
25 Dl 2—3 pale. Parascoli trifurcate.
Dl 1—4, d 4 orange yellow. ..... *Harmonia quadripunctata*
— Dl 2—3 dark. 26
26 L 2 pale. 27
— L 2 dark. 31
27 L 3—4 dark.
Upper side of abdomen with senti. L 1—2 white to red. Posterior margin of the pronotum with a median pale spot. ..... *Anatis ocellata*
— L 3—4 pale. 28
28 D, dl 4 pale. Between the d 4 there is extensive pale spot. 29
— D, dl 4 dark. 30

29 Abdominal segments 1—8 with broad, pale median line. D 4; dl 1 and 4 pale. ..... *Synharmonia lyncea*
— Abdominal segments 1—8 with pale spots. Meso- and metathorax with white and vermilion median spot. D 4; dl 1 and 4; l 1—8 white. ..... *Synharmonia conglobata*
30 Ground colour brown to greyish brown. Chalazae of d, dl strumae weak and sparse. ..... *Myrrha octodecimguttata*
— Ground colour pale greyish brown. Chalazae of d, dl strumae with a rather large base and dense. ..... *Aphidecta obliterata*
31 Dl 4 dark. 32
— Dl 4 pale. 37
32 D, dl, l 4 dark. 33
— Some of both d or l 4 completely or partly pale at least. 34
33 Body greyish brown. Dl, l 1 yellow to orange. Pronotum: see colour plate. ..... *Adonia variegata*
— Body completely dark except only dl, l 1. Pronotum: see colour plate. ..... *Hippodamia septemmaculata*
34 Middle of 4th abdominal segment dark. D 4 completely dark. Abdomen with senti or verrucae. 35
— Middle of 4 th abdominal segment usually with pale spot. D 4 partly pale. Abdomen with parascoli. 36
35 Abdomen with senti. Dl 1, l 1. 4—6 yellowish white. ..... *Sospita vigintiguttata*
— Abdomen with verrucae. Dl 1, l 1, 4, 6 reddish yellow. ..... *Neomysia oblongoguttata*
36 L 2, 3, 5—8 dark (sometimes l 4 is dark also); l 1, 4 yellowish to orange. Ground colour darker. Dl 1 and middle of the 4th abdominal segment yellowish organe. Colouration variable. ..... *Adalia bipunctata*
— L 1, 3—8 whitish: l 2 dark. Ground colour paler. Dl 1 yellow. Middle of 4th abdominal segment white to yellowish. ..... *Adalia decempunctata*
37 Dl 1, 4; l 1 pale. Pronotum: see colour plate. ..... *Adonia variegata*
— D 4; Dl 1, 4; l 1, 4 pale. Pronotum: see colour plate. ..... *Hippodamia tredecimpunctata*
— Dl 1, 4; l 1, 4 pale. 38
38 Upper side of abdomen with strumae. Abdomen between the d and dl with a pale longitudinal stripe. Pronotum: see colour plate. ..... *Coccinula*
— Upper side of abdomen with parascoli. 39
39 Prothorax with four plates: see colour plate. 40
— Prothorax with two plates: see colour plate. 42
40 Dl 6—7 red. Pronotum: see colour plate. ..... *Coccinella quinquepunctata*
— Dl 6—7 black. 41
41 L of metathorax dark. Dl, l 1 and 4 orange red. Pronotum: see colour plate. ..... *Coccinella septempunctata*
— L of metathorax pale. Dl, l 1 and 4 whitish. Pronotum: see colour plate. ..... *Coccinella distincta*
42 Ground colour of abdomen orange — brown. Dl, l 1 and 4 dark orange. Pronotum: see colour plate. ..... *Semiadalia undecimnotata*
— Ground colour of abdomen grey or greyish-black. Dl, l 1 and 4 yellow or white. Pronotum: see colour plate. 43
43 D parascoli: see colour plate. ..... *Coccinella undecimpunctata*
— D parascoli: see colour plate. ..... *Coccinella hieroglyphica*