The immatures of tortoise beetles with bibliographic catalogue of all taxa (Coleoptera: Chrysomelidae: Cassidinae)

JOLANTA ŚWIĘTOJAŃSKA
Zoological Institute, University of Wrocław, Przybyszewskiego 63/77, 51-148 Wrocław, Poland, e-mail: sindiola@biol.uni.wroc.pl

ABSTRACT. List of species belonging to 13 tribes of the cassidoid Cassidinae (tortoise beetles) where immature stages are known and characteristics on tribal level of mature larvae, first instar larvae and pupae, where available, are given. Moreover, discussion of relevance of the larval morphology for phylogenetic classification in Cassidinae is carried out. Until now immatuers of only 250 of approximately 2900 known species of tortoise beetles have been described. Slightly more than a half of species for which immatures are known belong to the tribe Cassidini (136), while in the tribe Spilophorini immatures of two species and in tribes Delocranini and Eugenysini of only one species are known. Remaining tribes are represented by immatures of 4 to 34 species. First instar larvae are known for species of only five tribes: Basiprionotini, Mesomphaliini, Physonotini, Cassidini and Aspidimorphini. Immature stages of cassidoid Cassidinae species are still poorly known in respect of both number of species (8.6%), and low quality of descriptions to date. Due to the poor state of knowledge of preimaginal stages, numerous reversions and parallel evolution, reconstruction of the phylogeny of the Cassidinae using only characters of immature morphology is immensly difficult. Presently, when attempting any such reconstruction, it seems advisable to include all the available characters, derived from the morphology of adults, immature stages, and molecular data as well.

Key words: entomology, morphology, systematics, Coleoptera, Chrysomelidae, cassidoid Cassidinae, immatures.

CONTENTS

INTRODUCTION

Cassidinae immatures aroused scientific interest very early. According to list of references on Chrysomelidae biology by Rupertsberger (1880) the first information on Cassidinae immatures comes from Goedart paper, dating from the 1662 and were devoted to the immatures of *Cassida vibex* and *C. viridis*. Interesting bionomics and morphology of larvae induced early authors to eager describing of immature stages of Cassidinae, even when the name of described species was unknown (Gravenhorst and Scholtz 1842; Ferris and Nissen 1927; Westwood 1939). The first contributions concerned mostly natural history of immatures and data on their morphology was scarce, limited to the shape and body colouration of mature larvae or pupae. In works published before 2003, and even in some after that year, descriptions of stages younger than mature larva are sporadic and limited to statements that earlier instars are identical, only smaller in size (Marques 1932; Zolessi 1968; Buzzi 1975a, 1975b; Hawkeswood 1982; Singh et al. 1985; Chaboo and Nguyen 2004). Some papers, besides figures of mature larva and pupa, illustrated also younger stages (Schultze 1908; Yeung 1934; Garthwaite 1939; Gressitt 1952; Aravena 1960; Artigas 1973; Sankaran and Krishnaswamy 1974; Visalakshi et al. 1980; John George and Venkataraman 1986; Liu and Hsiao 2005; Maia and Buzzi 2008). Unfortunately, these figures portray dorsal habitus of preimaginal stages only and, in most instances (except relatively large drawing of first instar larva of *Cistudinella obducta* in Fiebrig 1910 and photographs from Buzzi and Miyazaki 1999; Buzzi et al. 2000; Córdova-Ballona and Sánchez-Soto 2008), are very small and thus lacking important information on structural details or chaetotaxy. Therefore, publications concerning preimaginal stages are in most instances of diagnostic value only. In papers before 2003, as well as in many published recently, chaetotaxy of Cassidinae larvae is not discussed at all, which renders these contributions completely useless for phylogenetic analyses. Moreover, most of the recent authors working on immature stages of Cassidinae seem not to understand the relevance of chaetotaxy in phylogeny and consequently ignore this problem entirely.

In the past, catalogues of cassidoid Cassidinae species with described preimaginal stages were presented several times. One of the first was a catalogue by Chapuis and Candéze from 1853 with checklist of 18 species in genus *Cassida*. Two catalogues by Rupertsberger (1880 and 1894) and one by Steinhausen (1996) also contain checklist of *Cassida* species. Previously in the paper from 1950 Steinhausen presented descriptions of mature larvae and pupae of European Cassidinae. In Buzzi (1988), besides checklist of species belonging to 10 tribes of Casidinae (Delocranini, Hemisphaerotini, Imatidiini, Omocerini, Goniocheniini, Dorynotini, Stolaini, Ischyrosonychini, Physono-

tini i Cassidini), we also find short characteristics of their preimaginal stages. Cox in his paper of 1996, presented pupae from 7 Cassidinae tribes (Epistictinini, Basiprionotini, Dorynotini, Stolaini, Physonotini, Aspidimorphini, Cassidini) and, similarly to Buzzi (1988), gave short characteristics of this stadium for each species. Short characteristics of preimaginal stages of species belonging to 12 tribes (Epistictinini, Basiprionotini, Hemisphaerotini, Omocerini, Dorynotini, Stolaini, Ischyrosonychini, Physonotini, Aspidimorphini, Basiptini, Cassidini, Charidotini) were presented by Takizawa in 1980. He characterized consecutive stages and gave notes on distinguishing characters of each stage for different tribes.

Maulik's (1919) work devoted to fauna of British India includes information on immature stages of species from tribes and genera of Oriental Region. Compilation by Brovdii (1983) was devoted to Ukrainian species of tribe Cassidini. In this paper, besides adult characteristics, preimaginal stages were described. Preimaginal stages of tortoise beetles were also presented in papers of Kimoto and Takizawa devoted to leaf beetles of Japan (1994) and of Taiwan (1997) as well as in Bordy's (2000) monography of French Cassidinae.

Several works contain keys for identification of preimaginal stages. Among others, keys to cassidoid Cassidinae were present in the above mentioned work of Steinhausen (1950) and the monograph of French Cassidinae by Bordy (2000). Additionally, keys to mature larvae of tortoise beetles can be found in Palij (1959) and Oglobin and Medvedev (1971) devoted to larvae of cassid species of the European part of the former Soviet Union. The paper of Medvedev and Zaitsev (1978) has a key to larvae of species from the Far East. Emden (1962) gave a key to larvae of British Cassidinae and Medvedev (1982) to species of Mongolia. Work by Zaitsev and Medvedev (1983) and Zaitsev (1988) contains keys for identification of larvae of Vietnamese Cassidinae, and paper of Medvedev and Zaitsev (1993) has a key to the genera of the tribe Aspidimorphini of the Oriental Region. In a paper devoted to larvae of beetles of Central Europe Steinhausen (1994) again gave a key to Cassidinae. Lee (1994) presented a key to determination of larvae of the genus *Cassida* in Japan. In Buzzi (1996) there is a key for determination of larvae and pupae of the genus *Anacassis*. Key for pupae of cassidoid Cassidinae was given by Palij and Klepikova (1957) for species from Russia whereas Zaitsev (1992b) gave the key for pupae of species from Vietnam. In 2002 Steinhausen gave a key for determination of pupae of Cassidinae found in Central Europe.

In a series of papers concerning preimaginal stages of Vietnamese cassids, besides describing morphology, authors tried to present conclusions relevant to phylogeny and classification (Zaitsev and Medvedev 1982; Zaitsev and Medvedev 1983; Medvedev and Eroshkina 1988; Zaitsev 1988). However,

insufficiently detailed descriptions are a serious shortcoming in this case. Chaboo (2007) in her cladistic analysis used characters of preimaginal stages in addition to those derived from adult morphology.

Larval and pupal characters were also used as supplemental in establishing of new generic level taxa, e.g. Medvedev (1982) suggested rank elevation of subgenus *Tylocentra* Reitter, 1926 to generic on the basis of larval morphology. Description of two new subgenera of *Cassida* Linnaeus, 1758 on the basis of pupal characters only (Steinhausen 2002) was, to say the least, bizarre and has already been criticized by Borowiec (2007).

Despite long history of research on Cassidinae, immatuers of only 250 of approximately 2900 known species of tortoise beetles have been hitherto described or at least figured (Borowiec and Świętojańska 2008). It means that immatures of 91.4% of known Cassidinae species remain unknown. Slightly more than a half (136) of known descriptions of Cassidinae immatures are devoted to species of tribe Cassidini, 34 to Aspidimorphini and 32 to Stolaini. Moreover immatures of 14 species of Basiprionotini, 9 of Physonotini, 5 of Omocerini, 4 of Notosacanthini, Hemisphaerotini, Dorynotini and Goniocheniini, and 2 of Spilophorini are known, and only one description of immatures of Delocranini (Bondar 1940) and Eugenysini (Chaboo 2002). Most of these descriptions concern mature (fifth instar) larvae and pupae. First instar larvae were described in detail for only 14 species belonging to five tribes: Basiprionotini (*Craspedonta leayana* – Świętojańska and Ghate 2003), Stolaini (*Cyrtonota lateralis* – Świętojańska 2008), Physonotini (*Cistudinella obducta, Physonota alutacea* – Świętojańska and Medeiros 2007; Świętojańska and Windsor 2008), Cassidini (*Cassida denticollis, C. nebulosa, C. nobilis, C. prasina, C. rubiginosa, C. sanguinosa, C. sanguinolenta, C. stigmatica, C. vittata* – Borowiec and Świętojańska 2003; Świętojańska 2004b; Świętojańska 2005a; Świętojańska 2005c) and Aspidimorphini (*Laccoptera foveolata* – Rhane et al. 2004).

In the present work a list of immatures of species belonging to 13 tribes of the subfamily Cassidinae sensu Borowiec (1999) is given. These tribes are: Aspidimorphini Chapuis, 1875; Basiprionotini Hincks, 1952; Cassidini Gyllenhal, 1813; Delocranini Spaeth, 1929; Dorynotini Monros et Viana, 1949; Eugenysini Hincks, 1952; Goniocheniini Spaeth, 1942; Hemisphaerotini Monros et Viana, 1951; Mesomphaliini (= Stolaini) Chapuis, 1875; Notosacanthini Hincks, 1952; Omocerini Hincks, 1952; Physonotini Spaeth; 1942, Spilophorini Chapuis, 1875. Tribe Imatidiini is excluded, according to decision of Monros and Viana (1947) who merged it with hispine tribe Cephaloleini, which was subsequently confirmed by Staines (2002). In literature compilation only papers discussing morphology of immature stages were included. Also, references lacking descriptions but with keys, photographs or drawings of preimaginal stages of given species were included. Publications

treating only natural history of immatures were ommited. Moreover, this contribution incorporates characteristics of mature larvae, first instar larvae and pupae where available that are relevant on the tribal level.

Additionally, a discussion of phylogenetic relationships within Cassidinae based on analysis of morphological characters of larval stages and comparison of conclusions with the hitherto published classifications (Borowiec 1995; Hsiao and Windsor 1999; Chaboo 2007) is given.

BIBLIOGRAPHIC CATALOGUE

Tribe: Notosacanthini Hincks, 1952

1. *Notosacantha castanea* (Spaeth, 1913a) – **Lee and Cheng 2007**: 184-185 (ootheca, mature larva, pupa).
2. *Notosacantha sauteri* (Spaeth, 1914a) – **Kimoto and Takizawa 1997**: 457 (pl. 112 fig. 3 – pupa), 533; **Lee and Cheng, 2007**: 186-187 (ootheca, mature larva, pupa).
3. *Notosacantha siamensis* (Spaeth, 1933) – **Medvedev and Eroshkina 1988b**: 698-700 (larva, pupa); **Kimoto and Takizawa 1997**: 457 (pl. 112 fig. 4 – larva, pupa, after Medvedev and Eroshkina 1988b).
4. *Notosacantha vicaria* (Spaeth, 1913a) – **Rane et al. 2000**: 197-204 (larva, pupa).

Tribe: Delocranini Spaeth, 1929

5. *Delocrania cossyphoides* Guérin, 1844 – **Bondar 1940**: 101-102, figs 31B, 31C (egg, larva); **Genty et al. 1978**: 326, 327 (photo of eggs and larva).

Tribe: Hemisphaerotini Monros et Viana, 1951

6. *Hemisphaerota cyanea* (Say, 1824) – **Woodruff 1965**: 1-2 (larva); **Beshear 1969**: 168-170 (photo of eggs and larva).
7. *Hemisphaerota palmarum* (Boheman, 1856) – **Candéze 1861** (as *Porhyraspis palmarum*): 66-67, pl. V (figs 5, 5a-5c) (larva); **Latreille 1817** (as *Cassida ampulla*): 352 (faecal shield of larva); **Chaboo and Nguyen 2004**: 171-184 (imm. stages).
8. *Spaethiella crassicornis* (Spaeth, 1910a) – **Bruch 1939** (as *Hemisphaerota crassicornis*): 19-25, pl. I (figs 1-5), pl. II (figs 2-4) (imm. stages); **Fiebrig 1910** (as *Hemisphaerota crassicornis*): 204-205, pl. 9 (figs 30a, 30b) (egg).
9. *Spaethiella tristis* (Boheman, 1850) – **Olliff 1884** (as *Porphyraspis tristis*): 436-437 (larva); **Bondar 1940** (as *Hemisphaerota tristis*): 110-111, figs 33A, 33B, 33D (egg, larva); **Genty et al. 1978**: 328, 329 (photos of faecal shield and pupa).

Tribe: Spilophorini Chapuis, 1875

10. *Calyptocephala gerstaeckeri* Boheman 1862 – **Córdova-Ballona and Sánchez-Soto 2008**: 674-680.

11. *Calyptocephala paralutea* Buzzi and Miyazaki, 1992 – **Buzzi and Miyazaki 1992**: 157-166 (larva of V instar, pupa).

Tribe: Omocerini Hincks, 1952

12. *Canistra rubiginosa* (Guérin, 1844) – **Flinte et al. 2008**: 387 (pl. 18 M, N) (photos of larvae).
13. *Cassidinoma denticulata* (Boheman, 1850) – **Fiebrig 1910** (as *Desmonota denticulata*): 198-200, pl. 9 (figs 23a, 23b) (larva).
14. *Discomorpha languinosa* (Boheman, 1850) – **Candéze 1861** (as *Dolichotoma languinosa*): 63-65, pl. V, (figs 4, 4a-4f) (larva).
15. *Omocerus klugi* (Spaeth, 1913b) – **Fiebrig 1910** (as *Tauroma antiqua*): 196-198, pl. 9 (figs 22a-22e) (egg, larva).
16. *Polychalca platynota* (Germar, 1824) – **Flinte et al. 2008**: 387 (pl. 18 O, P) (photos of larvae).

Tribe: Goniocheniini Spaeth, 1942

17. *Chlamydocassis cribripennis* (Boheman, 1850) – **Świętojańska et al. 2005**: 295-302 (larva of V instar).
18. *Chlamydocassis laticollis* (Boheman, 1850) – **Fiebrig 1910** (as *Polychalca laticollis*): 174-176, pl. 5 (fig. 10c), pl. 6 (figs 10a, 10b) (egg, larva, pupa).
19. *Chlamydocassis metallica* (Klug, 1829) – **Fiebrig 1910** (as *Polychalca metallica*): 176-179, pl. 7 (figs 11a-11h, 11Aa, 11Ab) (egg, larva, pupa).
20. *Polychalma multicava* (Latreille, 1811) – **Cuignet et al. 2008**: 354 (fig. 1 b-d) (photo of second, four and fifth instar larvae).

Tribe: Basiprionotini Hincks, 1952

21. *Basiprionota angusta* (Spaeth, 1914b) – **Lee and Cheng 2007**: 164-165 (ootheca, larva of V instar, pupa).
22. *Basiprionota bimaculata* (Thunberg, 1789) – **Gressitt 1952**: 535-536 (fig. 1), 541 (key to the larva), 543 (key to the pupa); **Gressitt and Kimoto 1963**: 946 (fig. 265a – pupa, after Gressitt 1952 [536 fig. 1]), 986-987 (key to the larva, after Gressitt 1952 [541]), 988 (key to the pupa, after Gressitt 1952 [543]).
23. *Basiprionota bisignata* (Boheman, 1862) – **Yu Pei-Yu 1981**: 49 (figs 3, 4 – larva).

24. *Basiprionota cerata* (Spaeth, 1925) – **Zaitsev and Medvedev 1982**: 125 (fig. 1.4), 126 (figs 2.3, 2.8), 127 (figs 3.2, 3.7), 130-131 (larva).
25. *Basiprionota decemmaculata* (Boheman, 1850) – **Maulik and Dover 1924** (as *Prioptera decemmaculata*): 1087-1090 (larva, pupa).
26. *Basiprionota schultzei* (Weise, 1908b) – **Schultze 1908** (as *Prioptera schultzei*): 263-264, pl. I (figs 6-8) (ootheca, larva, pupa).
27. *Basiprionota sexmaculata* (Boheman, 1850) – **Gressitt 1952** (as *Basiprionota maculipennis*): 541 (key to the larva); **Gressitt and Kimoto 1963** (as *Basiprionota maculipennis*): 986-987 (key to the larva, after Gressitt 1952 [541]).
28. *Basiprionota sinuata* (Olivier, 1790) – **Schultze 1908** (as *Prioptera sinuata*): 261-263, pl. I (figs 1-5) (egg, larva, pupa).
29. *Basiprionota westermanni* (Mannerheim, 1844) – **Zaitsev 1992b**: 169 (figs 1.1, 1.2), 172 (key to the pupa), 176-177 (pupa).
30. *Craspedonta leayana* (Latreille, 1807) – **Garthwaite 1939**: 241-242, pl. I (figs 1-7), pl. II (figs 8, 9, 11-15) (imm. stages); **Gressitt 1952**: 536, 540 (key to the ootheca), 541 (key to the larva), 543 (key to the pupa); **Gressitt and Kmoto 1963**: 985 (key to the ootheca, after Gressitt 1952), 986 (key to the larva, after Gressitt 1952), 988 (key to the pupa, after Gressitt 1952); **Ahmed and Sen-Sarma 1990** (as *Calopepla leayana*): 71-82 (imm stages); **Cox 1996**: 175, figs 318-319 (pupa); **Świętojańska and Ghate 2003**: 689-700 (larva of I and V instar, photo of pupa).
31. *Craspedonta mouhoti* (Baly, 1863) – **Zaitsev and Medvedev 1982**: 125 (figs 1.2, 1.3), 126 (figs 2.2, 2.5, 2.7, 2.10, 2.11), 127 (figs 3.3, 3.6), 128-130 (larva); **Zaitsev 1992b**: 169 (figs 1.5, 1.6), 172 (key to the pupa), 177 (pupa).
32. *Epistictina reicheana* (Guérin, 1844) – **Weise 1901** (as *Epistictina matronula*): 49-52 (larva, pupa); **Takizawa 1983** (as *Epistictinia* [sic!] *reicheana*): 78-79 (larva, pupa); **Ghate and Ranade 2002**: 729-731 (egg, larva of V instar, pupa).
33. *Epistictina viridimaculata* (Boheman, 1850) – **Yu Pei-Yu 1981**: 48 (figs 1C, 2 – larva); **Zaitsev and Medvedev 1982**: 125 (fig. 1.1), 126 (figs 2.1, 2.4, 2.6, 2.9), 127 (figs 3.1, 3.4, 3.5), 126-128 (larva); **Chen et al. 1986**: 57 (pl. 2-37 figs a, b – figures of larva after Yu Pei-Yu 1981 [48, figs 1C, 2]), 58 (pl. 2-38 fig. b, pl. 2-39 fig. e), 60 (pl. 2-41 fig. d), 67 (pl. 2-47 figs a, b) (larva, pupa); **Zaitsev 1992b**: 169 (figs 1.3, 1.4), 172 (key to the pupa).
34. *Metriopepla inornata* Fairmaire, 1882 – **Grobbelaar and Chaboo 2008**: 135 (photos of ootheca, larva, pupa).

Tribe: Eugenysini HINCKS, 1952

35. *Eugenysa columbiana* (BOHEMAN, 1850) – **Chaboo 2002**: 50-67 (larva of IV and V instar, pupa).

Tribe: Mesomphaliini (= Stolaini) CHAPUIS, 1875

36. *Acromis spinifex* (LINNAEUS, 1763) – **Fiebrig 1910** (as *Selenis spinifex*): 166-168, pl. 4 (fig. 1c), pl. 6 (figs 1a, 1b, 2c, 2d) (egg, larva, pupa, figs 2c, 2d show different species, some *Anacassis* or other belonging to Mesomphaliini); **Buzzi 1980** (as *Acromis nebulosa*): 63-67 (egg, larva of V instar, pupa); **Chaboo 2001**: 25 (figs 25-29), 91, 92 (egg, mature larva).
37. *Anacassis cribrum* (KLUG, 1829) – **Buzzi 1975b**: 59-89 (imm. stages); **Buzzi 1996**: 248 (key to the larva and pupa).
38. *Anacassis dubia* (BOHEMAN, 1854) – **Buzzi 1996**: 223-227, 248 (key to the larva and pupa), 271 (fig. 7), 272 (figs 13-15), 276 (fig. 26), 277 (fig. 32), 278 (fig. 38), 279 (figs 44, 50), 280 (figs 56-58), 286 (fig. 74) (egg, larva of IV and V instar, pupa).
39. *Anacassis fuscata* (KLUG, 1829) – **Buzzi 1975a**: 767-774 (imm. stages); **Morelli and Ponce de Leon 1990**: 29-35 (egg, larva, pupa); **Buzzi 1996**: 227-232, 248 (key to the larva and pupa), 271 (figs 8, 9), 273 (figs 16-19), 276 (figs 27, 28), 277 (figs 33, 34), 278 (figs 39, 40), 279 (figs 45, 46, 51, 52), 281 (figs 59-61), 282 (figs 62-64), 286 (figs 75, 76) (egg, larva of V instar, pupa).
40. *Anacassis languida* (BOHEMAN, 1854) – **Buzzi and Garcia 1983**: 193-198 (egg, larva of V instar, pupa); **Buzzi 1996**: 232-234, 248 (key to the larva and pupa), 271 (fig. 10), 274 (figs 20, 21), 276 (fig. 29), 277 (fig. 35), 278 (fig. 41), 279 (figs 47, 53), 283 (figs 65-67), 287 (fig. 77) (egg, larva of V instar, pupa).
41. *Anacassis phaeopoda* BUZZI, 1976c – **Buzzi 1996**: 234-239, 248 (key to the larva and pupa), 271 (fig. 11), 274 (figs 22, 23), 276 (fig. 30), 277 (fig. 36), 278 (fig. 42), 279 (figs 48, 54), 284 (figs 68-70), 287 (fig. 78) (egg, larva of V instar, pupa); **Flinte et al. 2008**: 386 (pl. 18 E) (photo of eggs).
42. *Anacassis punctulata* (KLUG, 1829) – **Buzzi 1996**: 239-242, 248 (key to the larva and pupa), 271 (fig. 12), 275 (figs 24, 25), 276 (fig. 31), 277 (fig. 37), 278 (fig. 43), 279 (figs 49, 55), 285 (figs 71-73), 287 (fig. 79) (egg, larva of V instar, pupa).
43. *Anacassis sulcipennis* (BOHEMAN, 1854) – **Aravena 1960**: 41-46 (imm. stages).

44. *Botanochara angulata* (Germar, 1824) – **Frers 1922** (as *Poecilaspis angulata*): 245-249 (egg, larva, pupa).
45. *Botanochara impressa* (Panzer, 1798) – **Buzzi 1977**: 221-228 (egg, larva of V instar, pupa); **Costa et al. 1988**: 248-249, pl. 136 (figs 1-16) (larva of V instar, pupa).
46. *Botanochara rubroguttata* (Boheman, 1850) – **Fiebrig 1910** (as *Poecilaspis rubroguttata*): 200-201, pl. 9 (figs 24a-24c, 25) (egg, larva, pupa).
47. *Botanochara sedecimpustulata* (Fabricius, 1781) – **Weise 1921** (as *Poecilaspis 16-pustulata*): 193-194 (larva).
48. *Chelymorpha cassidea* (Fabricius, 1775) – **Chittenden 1924**: 43-51 (egg, larva, pupa); **Lawson 1991**: 574 (figs 34.802a-g – larva).
49. *Chelymorpha constellata* (Klug, 1829) – **Marques 1932**: 14-18, pl. 2 (imm. stages).
50. *Chelymorpha cribraria* (Fabricius, 1775) – **Marques 1932** (as *Chelymorpha cribraria, Ch. puncticollis, Ch. rufipennis*): 14-18 (egg, larva, pupa).
51. *Chelymorpha indigesta* Boheman, 1854 – **Frers 1922** (as *Chelimorpha indigesta*)**:** 249-252 (egg, larva, pupa).
52. *Chelymorpha varians* (Blanchard, 1851) – **Frers 1922** (as *Chelimorpha variabilis*): 252-255 (egg, larva, pupa); **Zolessi 1968** (as *Chelymorpha variabilis*): 27-29, 36 (pl. I fig. 1), 37, (pl. II fig. 2), 40 (pl. V fig. 6), 42 (pl. VII figs 18-22) (imm. stages); **Artigas 1973**: 163-168 (imm. stages).
53. *Cyrtonota lateralis* (Linnaeus, 1758) – **Świętojańska 2008**: 621-639 (egg, larva of I and V instar, pupa).
54. *Cyrtonota sexpustulata* (Fabricius, 1781) – **Marques 1932** (as *Neomphalia sexpustulata*): 14-18, 47 (pl. 1 figs 1-7a) (imm. stages).
55. *Cyrtonota thalassina* (Boheman, 1850) – **Buzzi et al. 2000** (as *Cyrtonota conglomerata*): 21-26 (imm. stages).
56. *Elytrogona quatuordecimmaculata* (Latreille, 1802) – **Latreille 1802** (as *Cassida quatuordecim maculata*): 295-297 (larva).
57. *Mesomphalia gibbosa* (Fabricius, 1781) – **Flinte et al. 2008**: 386 (pl. 18 F) (photo of eggs).
58. *Nebraspis corticina* (Boheman, 1850) – **Fiebrig 1910** (as *Poecilaspis corticina*): 169-171, pl. 6 (fig. 4) (egg, larva, pupa).
59. *Omaspides pallidipennis* (Boheman, 1854) – **Costa Lima 1914** (as *Omoplata pallidipennis*): 112-116, pl. 10 (fig. 2) (pupa).
60. *Paraselenis axillaris* (Sahlberg, 1823) – **Donceel 1885** (as *Omoplata axillaris*): 159-160, pl. III (figs1-9) (larva).
61. *Paraselenis decipiens* (Boheman, 1854) – **Maulik 1948b** (definitely some larva of the tribe Omocerini was incorrectly described as *Echoma decipiens*): 821-825 (larva).

62. *Stolas chalybaea* (Germar, 1824) – **Fiebrig 1910** (as *Canistra chalybaea* var. *cupreata*): 168-169, pl. 6 (fig. 3) (egg, larva, pupa).
63. *Stolas festiva* (Klug, 1829) – **Frers 1925** (as *Pseudomesomphalia festiva*): 87-90 (egg, larva, pupa).
64. *Stolas implexa* (Boheman, 1850) – **Flinte et al. 2008**: 386 (pl. 18 L) (photo of larva).
65. *Stolas lacordairei* (Boheman, 1850) – **Buzzi and Miyazaki 1999**: 581-597 (imm. stages).
66. *Stolas lineaticollis* (Boheman, 1850) – **Donceel 1885** (as *Mesomphalia lineatocollis* [sic!]): 160-162, pl. III (figs 13-19) (larva).
67. *Zatrephina lineata* (Fabricius, 1787) – **Buzzi 1976b** (as *Zatrephina meticulosa*): 381-385 (larva of V instar).

Tribe: Dorynotini Monros et Viana, 1949

68. *Dorynota monoceros* (Germar, 1824) – **Fiebrig 1910** (as *Batonota monoceros*): 173-174, pl. 6 (figs 9a-9e) (egg, larva, pupa).
69. *Dorynota pugionata* (Germar, 1824) – **Buzzi 1976a**: 41-46 (egg, larva of V instar, pupa).
70. *Paranota ensifera* (Boheman, 1854) – **Fiebrig 1910** (as *Batonota ensifer*): 171-172, pl. 6 (figs 7a-7d) (egg, larva, pupa).
71. *Paranota spinosa* (Boheman, 1854) – **Fiebrig 1910** (as *Batonota spinosa*): 172-173, pl. 6 (figs 8a-8c) (egg, larva, pupa).

Tribe: Physonotini Spaeth, 1942

72. *Asteriza flavicornis* (Olivier, 1790) – **Świętojańska and Windsor 2008**: 641-665 (larva of V instar, pupa)**.**
73. *Cistudinella notata* (Boheman, 1854) – **Flinte et al. 2008**: 386 (pl. 18 D, G) (photo of eggs and gregarious larvae).
74. *Cistudinella obducta* (Boheman, 1854) – **Fiebrig 1910**: 187-192, pl. 5 (figs 19aI, 19bI), pl. 8 (figs 19a-19m, 19A) (egg, larva, pupa); **Świętojańska and Medeiros 2007**: 443-462 (larva of I and V instar).
75. *Eurypepla calochroma* (Blake, 1965) – **Woodruff 1976a**: 1 (larva of V instar, pupa).
76. *Eurypepla jamaicensis* (Linnaeus, 1758) – **Böving and Craighead 1930**: 318, 319 (pl. 116 figs A-F) (larva).
77. *Physonota alutacea* Boheman, 1854 – **Sanderson 1948**: 469 (key to the larva and pupa), 471 (pl. I figs 5, 8), 474, 476 (larva of V instar, pupa); **Świętojańska and Windsor 2008**: 641-665 (larva of I and V instar, pupa).

78. *Physonota arizonae* Schaeffer, 1925 – **Sanderson 1948** (as *Physonota arizonense*): 469 (key to the larva), 472 (larva of III instar).
79. *Physonota helianthi* Boheman, 1854 – **Sanderson 1948**: 469 (key to the larva and pupa), 470, 471 (pl. I figs 3, 6) (larva, pupa).
80. *Physonota unipunctata* (Say, 1824) – **Sanderson 1948**: 469 (key to the larva and pupa), 471 (pl. I figs 4, 7), 473 (larva, pupa).

Tribe: Cassidini Gyllenhal, 1813

81. *Aethiopocassis rhodesiana* (Spaeth, 1924) – **Świętojańska 2004a**: 421-426 (larva of V instar).
82. *Agroiconota bivittata* (Say, 1827) – **Walsh and Riley 1869** (as *Cassida bivittata*): 234 (figs 174.2, 174.3), 236-237 (fig. 176) (larva, pupa).
83. *Agroiconota judaica* (Fabricius, 1781) – **Marques 1932** (as *Metriona judaica*): 14-18, 53 (pl. 3), 55 (pl. 3A figs. 7, 7a, 7b) (imm. stages).
84. *Aporocassida graphica* (Germar, 1824) – **Frers 1922** (as *Saulaspis graphica*): 259-262 (egg, larva, pupa).
85. *Basipta stolida* Boheman, 1854 – **Muir and Sharp 1904**: 7-8, 12-13, pl. II (figs 14-16), pl. V (figs 24a-c) (ootheca, larva, pupa).
86. *Casida algirica* Lukas, 1849 – **Bibolini 1973**: 11-108 (imm. stages); **Steinhausen 2002**: 22-25 (fig. 197) (key to the pupa).
87. *Cassida alpina* Bremi-Wolf, 1855 – **Steinhausen 1994** (as *Cassida rubiginosa alpina*): 307-312 (key to the larva); **Bordy 2000**: 75-78 (key to the larva), 78-81 (key to the pupa), 197-198 (larva, pupa).
88. *Cassida amaranthica* Medvedev et Eroshkina, 1988a – **Zaitsev 1988**: 144-145 (key to the larva), 154 (fig. 3.2), 156, 158 (fig. 5.9) (larva); **Zaitsev 1992b**: 172-174 (key to the pupa), 180 (fig. 6.2, error – in description on p 184 there is an information that fig. 6.2 shows dorsal view of *C. amaranthica* but fig. 6.2 on p 180 is captioned as *Cassida conchyliata*), 184 (pupa).
89. *Cassida amurensis* (Kraatz, 1879a) – **Medvedev and Zaitsev 1978**: 155-159 (fig. 58.11), 160 (fig. 60.4), 162 (fig. 62.3), 164-168 (key to the larva).
90. *Cassida azurea* Fabricius, 1801 – **Suffrian 1844** (as *Cassida lucida*): 215-222 (larva, pupa); **Fuss 1853**: 156-158 (pupa); **Rupertsberger 1876** (as *Cassida azurea* and as *Cassida lucida*): 398 (pupa), 398-399 (larva, pupa); **Steinhausen 1950**: 49 (key to the larva); **Ogloblin and Medvedev 1971**: 113 (in key the same thesis runs to the both *Cassida azurea* and *Cassida flaveola*); **Bibolini 1975** (as *Cassida ornata*): 1-91 (ootheca, larva, pupa); **Medvedev and Zaitsev 1978**: 155-159, 164-165 (key to the larva); **Brovdii 1983**: 61-63, 75, 78 (key to the larva); **Bordy 2000**:

75 (key to the larva), 78 (key to the pupa), 100-101 (larva, pupa), pl. VIII (ootheca), pl. XIII (fig. b – pupa); **Steinhausen 2002**: 22-23 (figs 180, 183) (key to the pupa).

91. *Cassida bergeali* Bordy, 1995b – **Bordy 2000**: 75-78 (key to the larva), 78-80 (key to the pupa), 146 (larva, pupa).
92. *Cassida berolinensis* Suffrian, 1844 – **Medvedev and Matys 1975**: 138-140 (larva); **Medvedev and Zaitsev 1978**: 155-159 (fig. 58.9), 163 (fig. 63.5), 164-166 (key to the larva); **Medvedev 1982**: 194-196, 197 (fig. 65.9 after Medvedev and Zaitsev 1978 [156 fig. 58.9]), 198 (key to the larva), 202 (fig. 67.4); **Brovdii 1983**: 22 (fig. 18.5 after Medvedev and Zaitsev 1978 [156 fig. 58.9]), 24 (fig. 20.5 after Medvedev and Zaitsev 1978 [163 fig. 63.5]), 61-63, 75, 78 (key to the larva), 80 (key to the pupa), 108-110 (figs 73.1-73.8 after Medvedev and Matys 1975 [139 figs 9-15]), (larva, pupa); **Steinhausen 1994**: 307 (key to the larva).
93. *Cassida brevis* Weise, 1884 – **Husseini 1979**: 168 pp; **Steinhausen 2002**: 22-25 (key to the pupa).
94. *Cassida canaliculata* Laicharting, 1781 – **Bach 1851** (as *Cassida austriaca*): 158-159 (larva, pupa); **Rupertsberger 1876** (as *Cassida austriaca*): 378, 379 (larva, pupa); **Matys 1970**: 23-25 (larva, pupa); **Brovdii 1983**: 61-63, 75, 80 (key to the pupa), 82-83 (figs 48.1, 48.2, after Matys 1970 [24 fig. 1]) (larva, pupa); **Steinhausen 1994**: 307-311 (fig. 383) (key to the larva); **Bordy 2000**: 75-76 (key to the larva), 78-79 (key to the pupa), 135-136 (larva, pupa), pl. XVII (figs a, b – larva, pupa); **Steinhausen 2002**: 22-24 (fig. 181) (key to the pupa).
95. *Cassida circumdata* Herbst, 1799 – **Kershaw and Muir 1907** (as *Coptocycla circumdata*): 249-250 (ootheca); **Schultze 1908** (*Metriona trivittata*): 267-268, pl. V (figs 4-8) (ootheca, larva of II and V instar, pupa); **Yeung 1934** (as *Metriona circumdata*): 148-155, pl. 11 (figs 1-8), pl. 12 (fig. 3) (imm. stages); **Gressitt 1952**: 537, 540 (key to the ootheca), 541-542 (key to the larva), 543-544 (key to the pupa); **Gressitt and Kmoto 1963**: 985-986 (key to the ootheca, after Gressitt 1952), 986-988 (key to the larva, after Gressitt 1952), 988-989 (key to the pupa, after Gressitt 1952); **John George and Venkataraman 1986**: 248-253 (imm. stages); **Zaitsev 1988**: 144-146 (key to the larva), 158 (fig. 5.4 – larva); **Zaitsev 1992b**: 180 (fig. 6.3 – pupa); **Kimoto and Takizawa 1994** (description probably concerns other species than *C. circumdata*): 404 (pl. 125 fig. 2 – larva, pupa), 486-487, 506-505 (key to the larva); **Kimoto and Takizawa 1997** (description probably concerns other species than *C. circumdata*): 458 (pl. 113 fig. 2 – ootheca, larva, pupa, after Kimoto and Takizawa 1994), 530, 546 (key to the larva); **Liu and Hsiao 2005**: 303-308 (imm. stages); **Lee and Cheng 2007**: 170-171 (ootheca, larva of V instar, pupa).

96. *Cassida compuncta* (Boheman, 1855) – **Hawkeswood et al. 1997**: 333-339 (larva of V instar, pupa).
97. *Cassida concha* Solsky, 1872 – **Medvedev and Zaitsev 1978**: 155-159, 161 (fig. 61.9), 164-167 (key to the larva).
98. *Cassida conchyliata* (Spaeth, 1914c) – **Zaitsev 1988**: 144-145 (key to the larva), 154 (figs 3.1, 3.9), 155-156, 158 (fig. 5.8) (larva); **Zaitsev 1992b**: 172-174 (key to the pupa), 180 (fig. 6.2), 182 (fig. 7.7) (figures of pupa).
99. *Cassida corallina* Boheman, 1862 – **Bordy 2000**: 75-77 (key to the larva), 173 (larva).
100. *Cassida crucifera* (Kraatz, 1879b) – **Lee and Cheng 2007**: 178-179 (ootheca, larva of V instar, pupa).
101. *Cassida deflorata* Suffrian, 1844 – **Steinhausen 1994**: 307-312 (key to the larva); **Bordy 2000**: 36 (figs 36, 37), 75-78 (key to the larva), 78-81 (key to the pupa), 200-201 (larva, pupa); **Steinhausen 2002**: 22-25 (figs 182, 202) (key to the pupa).
102. *Cassida denticollis* Suffrian, 1844 – **Cornelius 1847**: 359-361 (larva, pupa); **Cornelius 1851**: 88-94 (larva, pupa); **Rupertsberger 1876**: 379, fig. 23 (larva, pupa); **Henriksen 1927**: 367-369, 371 (larva); **Steinhausen 1950**: 20, 27, 49-50 (key to the larva), pl. I (figs 1-7), pl. V (fig. 26), pl. VII (fig. 40), pl. VIII (fig. 43) (larva, pupa); **Palij 1959**: 807-808 (key to the larva), 813 (larva); **Emden 1962**: 33-36 (key to the larva); **Ogloblin and Medvedev 1971**: 113-115 (figs 51.12-51.15) (key to the larva); **Bibolini 1975**: 1-91 (ootheca, larva, pupa); **Medvedev and Zaitsev 1978**: 155-159, 162 (fig. 62.5), 164-169 (key to the larva); **Medvedev 1982**: 194-196, 197 (fig. 65.7), 198-201 (key to the larva, the same characters as to *Cassida sareptana*), 202 (fig. 67.8, after Medvedev and Zaitsev 1978 [162 fig. 62.5]); **Brovdii 1983**: 20 (fig. 16.7, after Medvedev and Zaitsev 1978 [162 fig. 62.5]), 22 (fig. 18.6, after Ogloblin and Medvedev 1971 [114 fig. 12]), 61-63, 75, 78-80 (key to the larva), 80-81 (key to the pupa), 148-149 (figs 114.1, 114.2, after Steinhausen 1950 [pl. I figs 1, 2]) (larva, pupa); **Steinhausen 1994**: 307-311 (key to the larva); **Bordy 2000**: 75-77 (key to the larva), 78-80 (key to the pupa), 167 (larva, pupa), pl. XX (fig. c – larva); **Steinhausen 2002**: 22-25 (fig. 200) (key to the pupa); **Świętojańska 2005c**: 583-610 (larva of I instar).
103. *Cassida enervis* Boheman, 1862 – **Sankaran and Krishnaswamy 1974**: 55-57 (figs 1-4) (imm. stages); **Singh et al. 1985** (probably *Cassida subtilis*): 107-110 (imm. stages).
104. *Cassida exilis* Boheman, 1854 – **Takizawa 1980** (as *Cassida* sp. 2): 36-37 (fig. 13) (larva of V instar, pupa).
105. *Cassida ferruginea* Goeze, 1777 – **Rupertsberger 1876**: 400 (larva); **Medvedev and Zaitsev 1978**: 155-159 (fig. 58.7), 164-167 (key to the

larva); **Brovdii 1983**: 22 (fig. 18.3, after MEDVEDEV and ZAITSEV 1978 [156 fig. 58.7]), 61-63, 75, 78-79 (key to the larva); **Steinhausen 1994**: 307-309 (key to the larva); **Bordy 2000**: 75-76 (key to the larva), 78-80 (key to the pupa), 148-149 (larva, pupa)**.**

106. *Cassida flaveola* THUNBERG, 1794 – **Gardiner 1837** (as *Cassida obsoleta*): 276-277 (larva, pupa); **Rupertsberger 1876**: 400, 401 (larva after GARDINER 1837); **Henriksen 1927**: 367-370 (larva); **Steinhausen 1950**: 14, 23, 49 (key to the larva), pl. II (fig. 8), pl. III (fig. 14), pl. VI (fig. 28) (larva, pupa); **Emden 1962**: 33 (key to the larva), 35 (fig. 10 – larva); **Ogloblin and Medvedev 1971**: 113 (in key the same characters run to *Cassida azurea* and *C. flaveola*); **Medvedev and Zaitsev 1978**: 155-159, 161 (fig. 61.4), 163 (fig. 63.3), 164-165 (key to the larva); **Brovdii 1983**: 17 (fig. 12.10), 24 (fig. 20.3, after MEDVEDEV and ZAITSEV 1978 [163 fig. 63.3]), 61-63, 75, 78 (key to the larva), 80-81 (key to the pupa), 105-106 (fig. 70.1, after MEDVEDEV and ZAITSEV 1978 [161 fig. 61.4], figs 70.2, 70.3, after STEINHAUSEN 1950 [pl. II fig. 8, pl. VI fig. 28]), photo 9 (ootheca, larva, pupa); **Steinhausen 1994**: 307 (fig. 359), 309 (fig. 365), 311 (fig. 377) (key to the larva); **Cox 1996**: 183, fig. 356 (pupa); **Bordy 2000**: 75 (key to the larva), 78 (key to the pupa), 107-108 (larva, pupa), pl. XI (fig. a – larva), pl. XIV (fig. a – pupa); **Steinhausen 2002**: 22-24 (fig. 186) (key to the pupa).
107. *Cassida fuscorufa* MOTSCHULSKY, 1866 – **Kimoto and Takizawa 1994**: 405 (pl. 126 fig. 2 – larva, pupa), 487, 506-505 (key to the larva); **Kimoto and Takizawa 1997**: 458 (pl. 113 fig. 4 – larva, pupa, after KIMOTO and TAKIZAWA 1994), 530, 546 (key to the larva); **Lee 1994**: 52-53 (key to the larva), 58 (fig. 2) (larva of V instar).
108. *Cassida hexastigma* SUFFRIAN, 1844 – **Xambeu 1893**: 245-248 (larva, pupa); **Bordy 2000**: 75-76 (key to the larva), 78-79 (key to the pupa), 178 (larva, pupa).
109. *Cassida humeralis* KRAATZ, 1874a – **Bordy 2000**: 75-77 (key to the larva), 78-80 (key to the pupa), 142 (larva, pupa).
110. *Cassida informis* BOHEMAN, 1862 – **Świętojańska and Borowiec 2007a**: 297-314 (larva of V instar).
111. *Cassida inquinata* BRULLÉ, 1832 – **Ogloblin and Medvedev 1971**: 113-115 (key to the larva); **Bordy 2000**: 75-77 (key to the larva), 78-80 (key to the pupa), 165 (larva, pupa), pl. XI (fig. c – larva), pl. XX (fig. a – pupa).
112. *Cassida japana* BALY, 1874 – **Gressitt 1952**: 539, 540 (key to the ootheca), 541, 542 (key to the larva), 543, 544, (key to the pupa), 580 (pl. 33 figs 1-9 – imm. stages); **Gressitt and Kimoto 1963**: 978 (figs 282a-282g – imm. stages, after GRESSITT 1952 [pl. 33]), 985-986 (key to

the ootheca, after GRESSITT 1952 [539, 540]), 986-988 (key to the larva, after GRESSITT 1952 [541, 542]), 988-989 (key to the pupa, after GRESSITT 1952 [543, 544]); **Lee and Cheng 2007**: 172-173 (ootheca, larva of V instar, pupa).

113. *Cassida leucanthemi* BORDY, 1995a – **Bordy 1995a**: 377-383 (larva of V instar, pupa); **Bordy 2000**: 75-76 (key to the larva), 78-80 (key to the pupa), 192 (larva, pupa), pl. XXIV (figs c, d – larva of V instar, pupa).
114. *Cassida lineola* CREUTZER, 1799 – **Letzner 1855**: 80-88 (larva, pupa); **Rupertsberger 1876**: 400 (larva, pupa); **Steinhausen 1950**: 49-50 (key to the larva); **Palij and Klepikova 1957**: 82 (key to the pupa), 83-84 (pupa); **Palij 1959**: 807-808 (key to the larva), 814-815 (larva); **Ogloblin and Medvedev 1971**: 110 (fig. 50.3), 113-115 (fig. 51.9, key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 160 (fig. 60.7), 164-165 (key to the larva); **Medvedev 1982**: 194-196 (fig. 64.2), 198 (key to the larva); **Brovdii 1983**: 22 (fig. 18.8, after OGLOBLIN and MEDVEDEV 1971 [114 fig. 9]), 61-63, 75, 78 (key to the larva), 80-81 (key to the pupa), 112-115 (figs 78.1-78.4, after PALIJ 1959 [815 figs 16, 17], figs 78.5-78.8, after PALIJ and KLEPIKOVA 1957 [84 figs 2, 3]) (larva, pupa); **Steinhausen 1994**: 307-311 (fig. 381) (key to the larva); **Steinhausen 2002**: 22-24 (fig. 192) (key to the pupa).
115. *Cassida mandli* SPAETH, 1921 – **Medvedev and Zaitsev 1978**: 160 (fig. 60.8), 164-165 (key to the larva).
116. *Cassida margaritacea* SCHALLER, 1783 – **Rupertsberger 1872**: 25-26 (larva, pupa); **Rupertsberger 1876**: 399, 400, figs 5, 6, 27 (larva, pupa); **Perris 1876**: 203-204 (larva); **Henriksen 1927**: 367-369, 371 (larva); **Steinhausen 1950**: 15, 24, 49-50 (key to the larva), pl. II (fig. 12), pl. III (fig. 16), pl. VI (fig. 30), pl. VIII (fig. 45) (larva, pupa); **Ogloblin and Medvedev 1971**: 113-114 (key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 164-166 (key to the larva); **Brovdii 1983**: 20 (fig. 16.4, after STEINHAUSEN 1950 [pl. III fig. 16]), 61-63, 75, 78-79 (key to the larva), 92-93 (fig. 59, after STEINHAUSEN 1950 [pl. VI fig. 30]) (larva, pupa); **Steinhausen 1994**: 307-308, 309 (fig. 366), 311 (fig. 384) (key to the larva); **Bordy 2000**: 75 (key to the larva), 78 (key to the pupa), 93-94 (larva, pupa); **Steinhausen 2002**: 22-23 (fig. 184) (key to the pupa).
117. *Cassida mongolica* BOHEMAN, 1854 – **Dubeshko and Medvedev 1975:** 240-242 (figs 36-40) (larva of V instar); **Medvedev and Zaitsev 1978:** 155-159, 160 (fig. 60.9), 163 (fig. 63.8), 164-169 (key to the larva); **Medvedev 1982**: 194-196, 198-201 (key to the larva), 203 (fig. 68.1, after MEDVEDEV and ZAITSEV 1978 [163 fig. 63.8]).

118. *Cassida murraea* Linnaeus, 1767 – **Kirby 1797** (as *Cassida maculata*): 10 (larva, pupa); **Lyonet 1832**: 119-120, pl. 12 (figs 7-10) (larva, pupa); **Gravenhorst and Scholtz 1842**: 435, pl. 24 (figs 1-4) (larva pupa); **Doufour 1847** (as *Cassida maculata*): 14-19, pl. 17 (larva, pupa); **Rupertsberger 1876**: 379, figs 17, 20, 31 (larva, pupa); **Henriksen 1927**: 367-370 (larva); **Weise 1900**: 272 (larva); **Kleine 1917**: 24-43 (larva); **Steinhausen 1950**: 17, 25, 49 (key to the larva), pl. IV (fig. 20), pl. VI (fig. 34), pl. VIII (fig. 42) (larva, pupa); **Palij and Klepikova 1957**: 82 (key to the pupa), 86-87 (pupa); **Palij 1959**: 807-809 (key to the larva), 817 (larva); **Emden 1962**: 33-36 (key to the larva); **Ogloblin and Medvedev 1971**: 113-116 (key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 160 (fig. 60.14), 162 (fig. 62.1), 164-168 (key to the larva); **Medvedev 1982**: 194-196, 198-199 (key to the larva), 203 (fig. 68.7 wrongly captioned as *Ischyronota desertorum*); **Brovdii 1983**: 18 (fig. 13.4), 20 (fig. 16.6, after Medvedev and Zaitsev 1978 [162 fig. 62.1]), 24 (fig. 20.2, after Medvedev and Zaitsev 1978 [160 fig. 60.14]), 61-63, 75, 78-79 (key to the larva), 80-81 (key to the pupa), 95 (figs 63.1-63.5, after Palij 1959 [817 figs 22, 23], figs 63.6, 63.7, after Palij and Klepikova 1957 [87 figs 8, 9]), 96-97, photo 5 (ootheca, larva, pupa); **Steinhausen 1994**: 307-311 (figs 372, 379) (key to the larva); **Kimoto and Takizawa 1994**: 405 (pl. 126 fig. 4 – larva, pupa), 487, 506-505 (key to the larva); **Bordy 2000**: 75-76 (key to the larva), 78-80 (key to the pupa), 132-133 (larva, pupa), pl. IX (fig. b – ootheca), pl. XI (fig. d – larva), pl. XVI (fig. c – larva); **Steinhausen 2002**: 22-24 (key to the pupa).

119. *Cassida nebulosa* Linnaeus, 1758 – **Frisch 1722**: 30-31 (larva); **De Geer 1775** (as *Cassida tigrina*): 169-174, pl. 5 (larva, pupa); **Rupertsberger 1876**: 400, figs 3, 4, 30 (larva, pupa); **Gravenhorst and Scholtz 1842** (as *Cassida tigrina*): 437 (larva, pupa); **Guérin[-Méneville] 1846**: 71-72 (pupa); **Suffrian 1844**: 280, 281 (pupa); **Cornelius 1846**: 397-399 (larva, pupa); **Taschenberg 1865**: 66-8, pl. VI (figs 9, 10) (larva, pupa); **Henriksen 1927**: 367-370 (larva); **Böving and Craighead 1930**: 318, 319 (pl. 116 fig. G) (larva); **Manolache et al. 1936**: 477-500 (ootheca, larva, pupa); **Steinhausen 1950**: 15, 23-24, 49-50 (key to the larva), pl. III (fig. 15), pl. VI (fig. 29), pl. VIII (fig. 44) (larva, pupa); **Gressitt 1952**: 540 (key to the ootheca), 541-542 (key to the larva), 543 (key to the pupa); **Palij and Klepikova 1957**: 82 (key to the pupa), 87-88 (pupa); **Palij 1959**: 807-808 (key to the larva), 813-814 (larva); **Emden 1962**: 33-36 (figs 3, 6) (key to the larva); **Gressitt and Kmoto 1963**: 985-986 (key to the ootheca, after Gressitt 1952), 986-987 (key to the larva, after Gressitt 1952), 988 (key to the pupa, after Gressitt 1952); **Ogloblin and Medvedev 1971**: 113-114 (figs 51.5, 51.7, 51.10, key to

the larva); **Medvedev and Zaitsev 1978**: 155-159 (fig. 58.4), 160 (fig. 60.12), 163 (fig. 63.6), 164-166 (key to the larva); **Medvedev 1982**: 194-196, 197 (fig. 65.3, after Medvedev and Zaitsev 1978 [156 fig. 58.4]), 198-199 (key to the larva), 203 (fig. 68.6, after Medvedev and Zaitsev 1978 [163 fig. 63.6]); **Brovdii 1983**: 17 (figs 12.3, 12.4), 20 (fig. 16.2, after Steinhausen 1950 [pl. III fig. 15]), 61-63, 75, 78-79 (key to the larva), 80 (key to the pupa), 99-101 (figs 67.1, 67.2, 67.4, after Palij 1959 [814 figs 14, 15], fig. 67.3, after Medvedev and Zaitsev 1978 [156 fig. 58.4], figs 67.5, 67.6, after Palij and Klepikova 1957 [88 figs 10, 11]), photo 7 (ootheca, larva, pupa); **Kimoto and Takizawa 1994**: 404 (pl. 125 fig. 3 – ootheca, larva, pupa), 487-488, 506-505 (key to the larva); **Steinhausen 1994**: 307-308, 311 (figs 378, 382) (key to the larva); **Lee 1994**: 52 (key to the larva), 53, 59 (fig. 3) (larva of V instar); **Cox 1996**: 181, fig. 361 (pupa); **Bordy 2000**: 75 (key to the larva), 78-79 (key to the pupa), 103-104 (larva, pupa), pl. X (ootheca, larva of I and V instar, pupa); **Steinhausen 2002**: 22-24 (fig. 189) (key to the pupa); **Borowiec and Świętojańska 2003**: 189-200 (larva of I instar).

120. *Cassida nobilis* Linnaeus, 1758 – **Rupertsberger 1872**: 23-24 (egg, larva, pupa); **Rupertsberger 1876**: 399, figs 7-10, 29 (larva, pupa); **Henriksen 1927**: 367-369, 371 (larva); **Steinhausen 1950**: 15-16, 24, 49-50 (key to the larva), pl. III (fig. 17), pl. VI (fig. 31), pl. VIII (fig. 44) (larva, pupa); **Palij and Klepikova 1957**: 82-83 (key to the pupa), 93-94 (pupa); **Palij 1959**: 807-808 (key to the larva), 815-816 (larva); **Emden 1962**: 33-36 (key to the larva); **Ogloblin and Medvedev 1971**: 110 (fig. 50.5), 113-115 (key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 164-167 (key to the larva); **Medvedev 1982**: 194-196, 198-199 (key to the larva); **Brovdii 1983**: 18 (fig. 13.6), 20 (fig. 16.8, after Steinhausen 1950 [pl. III fig. 17]), 61-63, 75, 78-79 (key to the larva), 80-81 (key to the pupa), 159-161 (figs 125.1-25.4, after Palij 1959 [815 figs 18, 19], figs 125.5, 125.6, after Palij and Klepikova 1957 [94 figs 20, 21]) (ootheca, larva, pupa); **Steinhausen 1994**: 307-309 (fig. 368) (key to the larva); **Bordy 2000**: 75-77 (key to the larva), 78 (key to the pupa), 122-123 (larva, pupa); **Steinhausen 2002**: 22-24 (figs 185, 187) (key to the pupa); **Świętojańska 2005a**: 49-68 (larva of I instar).

121. *Cassida obtusata* Boheman, 1854 – **Kershaw and Muir 1907**: 251-252 (ootheca); **Schultze 1908** (as *Cassida picifrons*): 266, pl. III (figs 5-7) (egg, larva, pupa); **Gressitt 1952**: 537-539, 540 (key to the ootheca), 541-542 (key to the larva), 543-544 (key to the pupa), 582 (pl. 34 figs 1-7, 9 – imm. stages); **Gressitt and Kimoto 1963**: 972 (figs 278a-278g – imm. stages, after Gressitt 1952 [582 pl. 34 figs 1-7, 9]), 985-986 (key to the ootheca, after Gressitt 1952), 986-988 (key to the larva, after Gressitt 1952), 988-989 (key to the pupa, after Gressitt 1952);

Takizawa 1980: 34-35 (fig. 11) (larva of V instar, pupa); **Zaitsev 1988:** 144-145 (key to the larva), 158 (fig. 5.7 – larva); **Zaitsev 1992b**: 172-174 (key to the pupa), 180 (fig. 6.4 – pupa); **Kimoto and Takizawa 1997:** 458 (pl. 113 fig. 3 – larva, pupa, after TAKIZAWA 1980), 530-531, 546 (key to the larva); **Lee and Cheng 2007**: 181 (ootheca, larva of V instar, pupa).

122. *Cassida palaestina* REICHE, 1858 – **Husseini 1979**: 168 pp.*****; **Al-Ali and Abbas 1981**: 179-184 (imm. stages).
123. *Cassida pallidicollis* BOHEMAN, 1856 – **Medvedev and Zaitsev 1978:** 155-159 (figs 58.2, 58.3, 58.10), 161 (fig. 61.5), 163 (fig. 63.4), 164-166 (key to the larva); **Medvedev 1982**: 194-196, 197 (fig. 65.10, after MEDVEDEV and ZAITSEV 1978 [156 fig. 58.10]), 198-199 (key to the larva), 203 (fig. 68.5, after MEDVEDEV and ZAITSEV 1978 [163 fig. 63.4]).
124. *Cassida pannonica* SUFFRIAN, 1844 – **Medvedev and Zaitsev 1978**: 155-159, 164-170 (key to the larva); **Brovdii 1983**: 18 (fig. 13.1), 61-63, 75, 78-80 (key to the larva), 127 (figs 94.1-94.4), photo 13 (ootheca, larva); **Steinhausen 1994**: 307-311 (key to the larva); **Bordy 2000**: 75-78 (key to the larva), 78-80 (key to the pupa), 157 (larva, pupa); **Steinhausen 2002**: 22-25 (fig. 199) (key to the pupa).
125. *Cassida panzeri* WEISE, 1907 – **Medvedev and Zaitsev 1978**: 155-159 (fig. 58.8), 161 (fig. 61.7), 164-167 (key to the larva); **Brovdii 1983:** 20 (fig. 16.9, after MEDVEDEV and ZAITSEV 1978 [161 fig. 61.7]), 22 (fig. 18.2 after MEDVEDEV and ZAITSEV 1978 [156 fig. 58.8]), 61-63, 75, 78-79 (key to the larva), 80-81 (key to the pupa), 116-117 (figs 81.1-81.3, after MATYS 1970 [25 fig. 2]) (larva, pupa); **Matys 1970** (as *Cassida panzeru* [sic!]): 25-26 (larva, pupa); **Steinhausen 1994**: 307-308 (key to the larva); **Bordy 2000**: 75-76 (key to the larva), 78-80 (key to the pupa), 151-152 (larva, pupa), pl. XVIII (fig. d – larva).
126. *Cassida papuana* (SPAETH, 1903) – **Cox 1996**: 182, fig. 364 (pupa).
127. *Cassida parvula* BOHEMAN, 1854 – **Matys 1970**: 25 (fig. 3), 26-27 (larva, pupa); **Ogloblin and Medvedev 1971**: 113-115 (key to the larva); **Medvedev and Zaitsev 1978**: 155-159 (fig. 58.12), 161 (fig. 61.10), 163 (fig. 63.7), 164-167 (key to the larva); **Medvedev 1982**: 194-196, 198-199 (key to the larva), 202 (fig. 67.6), 203 (fig. 68.3, after MEDVEDEV and ZAITSEV 1978 [163 fig. 63.7]); **Brovdii 1983**: 18 (fig. 13.3), 22 (fig. 18.4, after MEDVEDEV and ZAITSEV 1978 [156 fig. 58.12]), 24 (fig. 20.6, after MEDVEDEV and ZAITSEV 1978 [163 fig. 63.7]), 61-63, 75, 78-79 (key to the larva), 80-81 (key to the pupa), 157-158 (figs 122.1-122.4, figs 122.3, 122.4 after MATYS 1970 [25 fig. 3]), photo 20 (ootheca, larva, pupa).
128. *Cassida physodes* (BOHEMAN, 1855) – **Zaitsev 1988** (as *Cassida exprompta*): 144-146 (key to the larva), 152-153 (fig. 2.2), 158 (fig. 5.6)

(larva); **Zaitsev 1992b** (as *Cassida exprompta*): 178 (fig. 5.3), 184-185, (pupa).

129. *Cassida piperata* Hope, 1842 – **Medvedev and Zaitsev 1978**: 155-159, 163 (fig. 63.2), 164-166 (key to the larva); **Kimoto and Takizawa 1994**: 404 (pl. 125 fig. 4 – ootheca, larva, pupa), 488, 506-505 (key to the larva); **Kimoto and Takizawa 1997**: 459 (pl. 114 fig. 1 – ootheca, larva, pupa, after Kimoto and Takizawa 1994), 531, 546 (key to the larva); **Lee 1994**: 52 (key to the larva), 53-54, 60 (fig. 4) (larva of V instar); **Lee and Cheng 2007**: 174-175 (ootheca, larva of V instar, pupa).
130. *Cassida prasina* Illiger, 1798 **– Cornelius 1851** (as *Cassida languida*, misidentification): 88-94 (larva, pupa); **Rupertsberger 1876** (as *Cassida chloris*): 398 (larva, pupa); **Palij and Klepikova 1957**: 82-83 (key to the pupa), 92-93 (pupa); **Palij 1959**: 807 (key to the larva), 809-810 (larva); **Ogloblin and Medvedev 1971**: 110 (fig. 50.1), 113 (in key the same characters run to both *C. prasina* and *C. sanguinolenta*); **Bibolini 1975**: 1-91 (ootheca, larva, pupa); **Medvedev and Zaitsev 1978**: 155-159 (fig. 58.1), 160 (fig. 60.5, but in Medvedev 1982: 197 fig. 65.7 the same figure is captioned as *Cassida denticollis*), 164-169 (in key the same characters run to both *C. prasina* and *C. sanguinolenta*); **Brovdii 1983**: 18 (fig. 13.5), 19 (fig. 14.4, after Medvedev and Zaitsev 1978), 61-63, 75, 78-80 (in key the same characters run to both *C. prasina* and *C. sanguinolenta*), 153-155 (figs119.1, 119.3, after Palij 1959 [809 figs 2, 3], fig. 119.2, after Medvedev and Zaitsev 1978 [156 fig. 58.1], figs 119.4, 119.5, after Palij and Klepikova 1957 [93 figs 18, 19]) (ootheca, larva, pupa); **Bordy 2000**: 75-77 (key to the larva), 78-79 (key to the pupa), 195 (larva, pupa); **Świętojańska 2005c**: 583-610 (larva of I instar).
131. *Cassida pusilla* Waltl, 1839 – **Bordy 2000**: 75-76 (key to the larva), 78 (key to the pupa), 113 (larva, pupa), pl. XV (fig. a – larva).
132. *Cassida rati* Maulik, 1923 – **Zaitsev 1988**: 144 (key to the larva), 152 (fig. 2.3), 153-154, 158 (fig. 5.2) (larva); **Zaitsev 1992b**: 172-174 (key to the pupa), 178 (fig. 5.4), 182 (fig. 7.8), 185 (pupa); **Kimoto and Takizawa 1997**: 460 (pl. 115 fig. 3 – larva, after Zaitsev 1988), 531, 546-547 (key to the larva).
133. *Cassida rubiginosa* Müller, 1776 – **Réaumur 1737** (as *Cassida viridis*): 234-238 (larva, pupa); **Rösel 1749** (as *Cassida vibex*): 13-16, pl. VI (figs 1-3) (larva, pupa); **Stroem 1788** (as *Cassida viridis*): 379-382, 400a Tab. II (figs 1-5, 7) (larva, pupa); **Kirby 1797** (as *Cassida viridis*): 9 (larva, pupa); **Latreille 1817** (as *Cassida viridis*): 351-352 (larva, pupa); **Lyonet 1832** (as *Cassida viridis*): 117-119, pl. 12 (figs 1-4) (larva, pupa); **Gravenhorst and Scholtz 1842** (as *Cassida viridis*): 436-437 (larva, pupa); **Cornelius 1846**: 396-397 (larva, pupa); **Elditt 1851** (in Rupertsberger

1880 as *C. vibex*): 352, pl. 2 (figs A, B) (only figures of larva and pupa); **Chapuis and Candéze 1853**: pl. IX (figs 4, 4a, 4b) (figure of larva); **Rupertsberger 1876**: 397, figs 18, 19, 21, 25 (larva, pupa); **Henriksen 1927**: 367-370 (larva); **Paterson 1931** (as *Cassida viridis*): 944-945 (figs 30F, 30G), pl. I (figs 5, 10) (larva, pupa); **Steinhausen 1950**: 18-19, 26, 49-50 (key to the larva), pl. IV (fig. 23), pl. VII (fig. 37), pl. VIII (fig. 43) (larva, pupa); **Gressitt 1952**: 541-542 (key to the larva), 543-544 (key to the pupa); **Palij and Klepikova 1957**: 82-83 (key to the pupa), 91-92 (pupa); **Palij 1959**: 807-808 (key to the larva), 810-811 (larva); **Emden 1962**: 33-36 (fig. 11A) (key to the larva); **Gressitt and Kimoto 1963**: 986-988 (key to the larva, after Gressitt 1952), 988-989 (key to the pupa, after Gressitt 1952); **Ogloblin and Medvedev 1971**: 113-115 (key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 162 (fig. 62.6), 164-170 (key to the larva); **Medvedev 1982**: 194-196, 198-203 (fig. 67.9, after Medvedev and Zaitsev 1978 [162 fig. 62.6]) (key to the larva); **Brovdii 1983**: 17 (figs 12.8, 12.9), 20 (fig. 16.3 after Medvedev and Zaitsev 1978 [162 fig. 62.6]), 61-63, 75, 78-80 (key to the larva), 80-81 (key to the pupa), 130-132 (figs 98.1-98.4, after Palij 1959 [811 figs 6, 7], figs 98.5, 98.6, after Palij and Klepikova 1957 [91 figs 16, 17]), photos 16, 17 (ootheca, larva, pupa); **Lee 1994** (as *Cassida erudita*): 52 (key to the larva), 57 (fig. 1) (larva of V instar); **Kimoto and Takizawa 1994**: 406 (pl. 127 fig. 1 – ootheca, larva, pupa), 488, 506-505 (key to the larva); **Steinhausen 1994**: 307-312 (fig. 374) (key to the larva); **Cox 1996**: 182, fig. 367 (pupa); **Bordy 2000**: 39 (fig. 39), 75-78 (key to the larva), 78-81 (key to the pupa), 185-187 (larva, pupa), pl. XXII (larva of V instar, pupa); **Steinhausen 2002**: 22-25 (fig. 195) (key to the pupa); **Świętojańska 2004b**: 427-438 (larva of I instar).

134. *Cassida ruralis* (Boheman, 1862) – **Lee and Cheng 2007**: 166-167 (ootheca, larva of V instar, pupa).
135. *Cassida sanguinolenta* Müller, 1776 – **Rupertsberger 1876** (as *Cassida languida*): 397, fig. 24 (larva, pupa); **Steinhausen 1950**: 20, 27, 49-50 (key to the larva), pl. II (fig. 12), pl. V (fig. 27), pl. VII (fig. 41), pl. VIII (fig. 45) (larva, pupa); **Emden 1962**: 33 (key to the larva), 35 (figs 8, 9 – larva); **Ogloblin and Medvedev 1971** (as *Cassida sanguinolentha* [sic!]): 113 (key to the larva); **Medvedev and Zaitsev 1978** (as *Cassida sanguinolentha* [sic!]): 155-159 164-169 (key to the larva); **Brovdii 1983**: 61-63, 75, 78-80 (key to the larva), 80-81 (key to the pupa), 151-152 (figs 117.1-117.4, after Palij 1959 [813, figs 12, 13] but in his paper these figures are captioned as *Cassida denticollis*),figs 117.5, 117.6, after Steinhausen 1950 [pl. V fig. 27, pl. VII fig. 41]) (larva, pupa); **Steinhausen 1994**: 307-311 (fig. 373) (key to the larva); **Bordy 2000**: 75-77 (key to the larva), 78-79 (key to the pupa), 176 (larva, pupa), pl.

XI (fig. b – larva of V instar); **Steinhausen 2002**: 22-25 (fig. 198) (key to the pupa); **Świętojańska 2005c**: 583-610 (larva of I instar).

136. *Cassida sanguinosa* Suffrian, 1844 – **Cornelius 1846**: 391-396 (larva, pupa); **Rupertsberger 1876**: 379 (larva, pupa); **Steinhausen 1950**: 18, 25-26, 49-50 (key to the larva), pl. IV (fig. 22), pl. VII (fig. 36), pl. VIII (fig. 43) (larva, pupa); **Palij and Klepikova 1957**: 82-83 (key to the pupa), 92 (pupa); **Palij 1959**: 807-808 (key to the larva), 812-813 (larva); **Emden 1962**: 33-36 (fig. 4) (key to the larva); **Ogloblin and Medvedev 1971**: 113-115 (fig. 51.11) (key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 162 (fig. 62.7), 164-170 (key to the larva); **Brovdii 1983**: 20 (fig. 16.5, after Medvedev and Zaitsev 1978 [162 fig. 62.7]), 22 (fig. 18.7, after Ogloblin and Medvedev 1971 [114 fig. 11]), 61-63, 75, 78-80 (key to the larva), 80-81 (key to the pupa), 144-145 (figs 109.1-109.5, after Palij 1959 [812 figs 10, 11]) (larva, pupa); **Steinhausen 1994**: 307-312 (fig. 375) (key to the larva); **Bordy 1995a:** 377-383 (larva of V instar, pupa); **Bordy 2000**: 75-77 (key to the larva), 78-80 (key to the pupa), 189-190 (larva, pupa), pl. IX (fig. d – ootheca), pl. XXIV (figs a, b – larva of V instar, pupa); **Steinhausen 2002**: 22-25 (fig. 196) (key to the pupa); **Świętojańska 2005c**: 583-610 (larva of I instar).

137. *Cassida sareptana* Kraatz, 1874b – **Medvedev and Matys 1975**: 140-141 (larva); **Medvedev 1982**: 194-196, 198-201 (key to the larva); **Brovdii 1983**: 61-63, 75, 78-79 (key to the larva), 137-138 (figs 101.1-101.7, after Medvedev and Matys 1975 [140 figs 16-22]) (larva).

138. *Cassida sauteri* (Spaeth, 1913c) – **Takizawa 1978**: 80-83 (larva of V instar, pupa); **Kimoto and Takizawa 1997**: 459 (pl. 114 fig. 2 – ootheca, larva, pupa, after Takizawa 1978), 531, 546 (key to the larva); **Lee and Cheng 2007**: 176-177 (ootheca, larva of V instar, pupa).

139. *Cassida seladonia* Gyllenhal, 1827 – **Bordy 2000**: 75-76 (key to the larva), 78-80 (key to the pupa), 162 (larva, pupa).

140. *Cassida solida* Spaeth, 1940 – **Zaitsev 1988**: 144-146 (key to the larva), 154 (fig. 3.10), 156-157, 158 (fig. 5.1) (larva); **Zaitsev 1992b**: 172-174 (key to the pupa), 178 (fig. 5.2), 182 (fig. 7.5) (figures of pupa).

141. *Cassida stigmatica* Suffrian, 1844 – **Cornelius 1847** (as *Cassida chloris*, misidentification): 361-363 (larva, pupa); **Cornelius 1851** (as *Cassida chloris*, misidentification): 88-94 (larva, pupa); **Weise 1908a**: 205-207 (larva, pupa); **Steinhausen 1950**: 17-18, 25, 49-50 (key to the larva), pl. II (fig. 13), pl. IV (fig. 21), pl. VII (fig. 35), pl. VIII (fig. 45) (larva, pupa); **Palij and Klepikova 1957**: 82 (key to the pupa), 84-85 (pupa); **Palij 1959**: 807 (key to the larva), 810 (larva); **Emden 1962**: 33-36 (key to the larva); **Ogloblin and Medvedev 1971**: 110 (fig. 50.2), 113 (key

to the larva), 114 (fig. 51.8); **Medvedev and Zaitsev 1978**: 155-159, 160 (fig. 60.6), 164-165 (key to the larva); **Medvedev 1982**: 194-196, 197 (fig. 65.2, after MEDVEDEV and ZAITSEV 1978 [160 fig. 60.6]), 198 (key to the larva); **Brovdii 1983**: 22 (fig. 18.9, after OGLOBLIN and MEDVEDEV 1971 [114 fig. 8]), 61-63, 75, 78 (key to the larva), 80 (key to the pupa), 141-143 (figs 106.1-106.5, after PALIJ 1959 [810 figs 4, 5], figs 106.6, 106.7, after PALIJ and KLEPIKOVA 1957 [85 figs 4, 5]) (larva, pupa); **Steinhausen 1994**: 307-311 (figs 358, 380) (key to the larva); **Bordy 2000**: 75-76 (key to the larva), 78-79 (key to the pupa), 170 (larva, pupa), pl. XXI (figs a, b – larva of V instar, pupa); **Steinhausen 2002:** 22-24 (figs 190, 191) (key to the pupa); **Świętojańska 2004b**: 427-438 (larva of I instar).

142. *Cassida subreticulata* SUFFRIAN, 1844 – **Wradatsch 1919** (as *Cassida splendidula*): 1-11 (larva, pupa); **Steinhausen 1950**: 49-50 (key to the larva); **Medvedev 1982**: 194-196, 198-199 (key to the larva), 202 (fig. 67.5); **Brovdii 1983**: 61-63, 75, 80-81 (key to the pupa); **Leonardi and Sassi 1997**: 213-215 (larva, pupa); **Bordy 2000**: 75 (key to the larva), 78-79 (key to the pupa), 95-96 (larva, pupa), pl. IX (fig. a – ootheca).
143. *Cassida subtilis* WEISE, 1897 – **Takizawa 1980** (as *Cassida* sp. 1): 35-36 (fig. 12) (larva of V instar, pupa).
144. *Cassida triangulum* (WEISE, 1897) – **Zaitsev 1988**: 144-146 (key to the larva), 157, 158 (fig. 5.3) (larva); **Zaitsev 1992b** (as *Cassida triangulum indochinensis*): 176 (fig. 4.3), 183 (pupa).
145. *Cassida turcmenica* (WEISE, 1892) – **Medvedev and Matys 1975**: 141-143 (larva); **Medvedev 1982** (as *Tylocentra turcmenica*): 194-195 (key to the larva), 196 (fig. 64.2), 202 (fig. 67.1).
146. *Cassida undecimnotata* GEBLER, 1841 – **Medvedev and Matys 1975:** 137-138 (larva); **Medvedev and Zaitsev 1978**: 155-159, 160 (fig. 60.3), 162 (fig. 62.4), 164-169 (key to the larva); **Medvedev 1982**: 194-196, 197 (fig. 65.6, after MEDVEDEV and ZAITSEV 1978 [160 fig. 60.3]), 198-201 (key to the larva), 202 (fig. 67.7, after MEDVEDEV and ZATSEV 1978 [162 fig. 62.4]).
147. *Cassida unimaculata* BOHEMAN, 1854 – **Muir and Sharp 1904**: 8, 14-15, pl. V (figs 26a, 26b) (egg, larva, pupa).
148. *Cassida uniorbis* (CHEN et ZIA, 1961) – **Świętojańska 2005b**: 413-429 (larva of V instar, pupa).
149. *Cassida varians* HERBST, 1799 – **Sankaran and Krishnaswamy 1974** (as *Cassida syrtica*): 58-60 (figs 5-8) (imm. stages); **Świętojańska and Borowiec 2007a**: 297-314 (larva of V instar).
150. *Cassida versicolor* (BOHEMAN, 1855) – **Gressitt and Kimoto 1963**: 975 (figs 280b, 280c – pupa), 988-989 (key to the pupa); **Zaitsev 1988**: 144-

145 (key to the larva), 152 (fig. 2.4), 155 (fig. 4.9), 157-158 (fig. 5.5) (larva); **Zaitsev 1992b**: 172-174 (key to the pupa), 180 (fig. 6.1), 182 (fig. 7.6), 183 (pupa); **Kimoto and Takizawa 1994**: 406 (pl. 127 fig. 2 – ootheca, larva, pupa), 488, 506-505 (key to the larva); **Kimoto and Takizawa 1997**: 459 (pl. 114 fig. 3 – ootheca, larva, pupa, after KIMOTO and TAKIZAWA 1994), 532, 546 (key to the larva); **Lee 1994**: 52 (key to the larva), 54, 61 (fig. 5) (larva of III instar).

151. *Cassida vespertilio* BOHEMAN, 1862 – **Muir and Sharp 1904** (as *Cassida muirana*): 8, pl. II (figs 18, 19) (ootheca), pl. V (figs 25a, 25b) (larva, pupa).
152. *Cassida vespertina* BOHEMAN, 1862 – **Lee 1994**: 52 (key to the larva), 54-55, 62 (fig. 6) (larva of III instar); **Kimoto and Takizawa 1994**: 405 (pl. 126 fig. 3 – ootheca, larva, pupa), 489, 506-505 (key to the larva); **Kimoto and Takizawa 1997**: 459 (pl. 114 fig. 4 – ootheca, larva, pupa, after KIMOTO and TAKIZAWA 1994), 532, 546-547 (key to the larva); **Lee and Cheng 2007**: 168-169 (ootheca, larva of V instar, pupa).
153. *Cassida vibex* LINNAEUS, 1767 – **Goedart 1662**: 119-120, pl. 43 (larva, pupa); **Kirby 1797** (as *Cassida liriophora*): 8-9 (larva, pupa); **Cornelius 1846**: 399-400 (larva, pupa); **Rupertsberger 1876**: 379, 380, fig. 28 (pupa); **Paterson 1931**: 944 (figs 30B, 30C), 945 (larva, pupa); **Steinhausen 1950**: 19, 26, 49-50 (key to the larva), pl. V (fig. 25), pl. VII (fig. 39), pl. VIII (fig. 43) (larva, pupa); **Palij and Klepikova 1957**: 82 (key to the pupa), 89-90 (pupa); **Palij 1959**: 807-808 (key to the larva), 811-812 (larva); **Emden 1962**: 33-36 (fig. 11B) (key to the larva); **Ogloblin and Medvedev 1971**: 110 (fig. 50.4), 113-115 (key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 163 (fig. 63.9), 164-169 (key to the larva); **Medvedev 1982**: 194-196, 198-201 (key to the larva), 203 (fig. 68.2, after MEDVEDEV and ZAITSEV 1978 [163 fig. 63.9]); **Brovdii 1983**: 18 (fig. 13.2), 24 (fig. 20.4, after MEDVEDEV and ZAITSEV 1978 [163 fig. 63.9]), 61-63, 75, 78-80 (key to the larva), 80-81 (key to the pupa), 121-123 (figs 89.1-89.5, after PALIJ 1959 [811 fig. 8, 812 fig. 9], figs 89.6, 89.7, after PALIJ and KLEPIKOVA 1957 [89 figs 12, 13]) (larva, pupa); **Kimoto and Takizawa 1994**: 405 (pl. 126 fig. 5 – ootheca, larva, pupa), 489, 506-505 (key to the larva); **Lee 1994**: 52 (key to the larva), 55, 63 (fig. 7) (larva of III instar); **Steinhausen 1994**: 307-312 (key to the larva); **Bordy 2000**: 75-78 (key to the larva), 78-80 (key to the pupa), 155 (larva, pupa); **Steinhausen 2002**: 22-25 (fig. 201) (key to the pupa).
154. *Cassida viridis* LINNAEUS, 1758 – **Goedart 1662**: 120, pl. 44 (larva, pupa); **Blankaart 1688**: 89, pl. 11 (figs D, E) (larva, pupa); **De Geer 1775**: 175 (larva); **Herbst 1799**: 211-214 (larva, pupa); **Westwood 1839**: 377-378 (figs 46.9-46.11) (mature larva, pupa); **Gravenhorst and Scholtz 1842**

(as *Cassida equestris*): 435-436, pl. 73 (figs 5, 6) (larva, pupa); **Cornelius 1847** (as *Cassida equestris*): 363-365 (larva, pupa); **Rupertsberger 1872** (as *Cassida equestris*): 22-23 (egg); **Rupertsberger 1876**: 401, figs 1, 2, 11-16, 22, 26 (larva, pupa); **Henriksen 1927**: 367-370 (larva); **Paterson 1931** (as *Cassida equestris*): 943-944 (figs 30A, 30D, 30E) (larva of V instar, pupa); **Engel 1935**: 41-96 (larva, pupa); **Manolache et al. 1938:** 435-457 (ootheca, larva, pupa); **Steinhausen 1950**: 19, 26, 49 (key to the larva), pl. V (fig. 24), pl. VII (fig. 38), pl. VIII (fig. 43) (larva, pupa); **Gressitt 1952**: 540 (key to the ootheca), 541-542 (key to the larva), 543-544 (key to the pupa); **Palij and Klepikova 1957**: 82 (key to the pupa), 85-86 (pupa); **Palij 1959**: 807-809 (key to the larva), 816-817 (larva); **Emden 1962**: 33-36 (figs 2, 5) (key to the larva); **Gressitt and Kmoto 1963**: 985-986 (key to the ootheca, after Gressitt 1952), 986-987 (key to the larva, after Gressitt 1952), 988-989 (key to the pupa, after Gressitt 1952); **Ogloblin and Medvedev 1971**: 113-116 (key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 162 (fig. 62.2), 164-168 (key to the larva); **Brovdii 1983**: 17 (figs 12.5-12.7), 19 (figs 14.1, 14.2, 15), 20 (fig. 16.1, after Medvedev and Zaitsev 1978 [162 fig. 62.2]), 21 (figs 17a, 17b), 24 (fig. 20.1), 25 (figs 21, 22a, 22b, after Palij and Klepikova 1957 [86 figs 6, 7]), 61-63, 75, 78-79 (key to the larva), 80-81 (key to the pupa), 84-86, photo 2, 3 (ootheca, larva, pupa); **Kimoto and Takizawa 1994** (as *Cassida erudita*): 405 (pl. 126 fig. 1 – ootheca, larva, pupa), 487, 506-505 (key to the larva); **Steinhausen 1994**: 307-310 (fig. 371) (key to the larva); **Bordy 2000**: 39 (fig. 38 – pupa), 75-76 (key to the larva), 78-79 (key to the pupa), 126 (larva, pupa), pl. IX (fig. c – ootheca), pl. XVI (fig. a – pupa); **Steinhausen 2002**: 22-24 (fig. 194) (key to the pupa).

155. *Cassida virguncula* Weise, 1889 – **Chen et al. 1986**: 57 (pl. 2-37 figs c, d), 58 (pl. 2-39 fig. f), 68 (pl. 2-48 fig. a) (figures of larva and pupa).
156. *Cassida vittata* Villers, 1789 – **Steinhausen 1950**: 16, 24, 49-50 (key to the larva), pl. II (figs 10, 11), pl. III (fig. 18), pl. VI (fig. 32), pl. VIII (fig. 43) (larva, pupa); **Emden 1962**: 33-36 (key to the larva); **Ogloblin and Medvedev 1971**: 113-115 (key to the larva); **Medvedev and Zaitsev 1978**: 155-159, 161 (fig. 61.8), 164-167 (key to the larva); **Brovdii 1983**: 61-63, 75, 78-79 (key to the larva), 80-81 (key to the pupa), 164-166 (figs 128.1, 128.2, after Steinhausen 1950 [pl. III fig. 18, pl. VI fig. 32]) (larva, pupa); **Steinhausen 1994**: 307-309 (fig. 367) (key to the larva); **Cox 1996**: 181, fig. 374 (pupa); **Bordy 2000**: 75-77 (key to the larva), 78 (key to the pupa), 117-118 (larva, pupa), pl. XV (fig. c – pupa); **Steinhausen 2002**: 22-24 (fig. 188) (key to the pupa); **Świętojańska 2005a**: 49-68 (larva of I instar).

157. *Cassida weisei* (Jacobson, 1894) – **Zaitsev 1992a**: 67-70 (egg, larva of I and V instar, pupa).
158. *Charidotella bifossulata* (Boheman, 1855) – **Dugés 1887** (as *Coptocycla dubitabilis*): 143-145, pl. II (figs 1-10) (larva, pupa).
159. *Charidotella flaviae* Maia and Buzzi, 2005 – **Maia and Buzzi 2008**: 43-49 (egg, larva, pupa).
160. *Charidotella opulenta* (Boheman, 1855) – **Dugés 1887** (as *Coptocycla opulenta*): 145-146, pl. II (figs 11-13) (larva, pupa).
161. *Charidotella rubicunda* (Guérin, 1844) – **Flinte et al. 2008**: 386 (pl. 18 J) (photo of larva).
162. *Charidotella seriatopunctata* (Spaeth, 1900) – **Fiebrig 1910** (as *Cassida seriatopunctata*): 202, pl. 9 (fig. 26) (egg, larva).
163. *Charidotella sexpunctata* (Fabricius, 1781) – **Walsh and Riley 1869** (as *Cassida aurichalcea* and *Cassida pallida*): 236 (fig. 175), 237 (figs 177, 178c) (larva, pupa); **Orton and Chittenden 1917** (as *Coptocycla bicolor*): 65, figs 76b, 76c) (figures of larva and pupa); **Weise 1921** (as *Metriona trisignata*, ab. *ternata*): 199-200 (larva); **Woodruff 1976b** (as *Metriona bicolor*): 1-2 (egg, larva, pupa); **Leblanc 1986** (as *Charidotella bicolor*): 1-9 (egg, larva, pupa); **Cox 1996** (as *Metriona bicolor* after Woodruff 1976b, and as *Metriona sexpunctata*): 186, figs 397, 398 (pupa).
164. *Charidotella vinula* (Boheman, 1855) – **Frers 1922** (as *Metriona argentina*, nomen nudum): 255-259 (egg, larva, pupa).
165. *Charidotis auroguttata* Boheman, 1855 – **Fiebrig 1910**: 183-184, pl. 7 (fig. 16a) (larva).
166. *Charidotis clypeolata* Boheman, 1855 – **Fiebrig 1910**: 179-180, (larva, pupa).
167. *Charidotis furunculus* (Boheman, 1855) – **Flinte et al. 2008**: 386 (pl. 18 C) (photo of egg).
168. *Charidotis gemellata* Boheman, 1855 – **Fernandes and Buzzi 2007**: 234-238 (egg, larva of V instar, pupa).
169. *Charidotis gibbipennis* Spaeth, 1910b – **Fiebrig 1910**: 181-182, pl. 7 (figs 14a-14g, 14Aa-14Ae) (larva, pupa).
170. *Charidotis mansueta* (Boheman, 1855) – **Fiebrig 1910**: 182-183 (larva).
171. *Charidotis punctatostriata* Boheman, 1856 – **Fiebrig 1910**: 185-187, pl. 8 (figs 18, 18f-18i) (egg, larva, pupa).
172. *Chiridopsis bipunctata* (Linnaeus, 1767) – **Takizawa 1980**: 30-31 (fig. 8), 38 (fig. 15c) (larva of V instar, pupa); **Ghate et al. 2004**: 185-211 (larva of I and V instar, pupa).
173. *Chiridopsis bistrimaculata* (Boheman, 1855) – **Ghate et al. 2004**: 185-211 (larva of I and V instar, pupa).

174. *Chiridopsis bowringii* (Boheman, 1855) – **Zaitsev 1988:** 144 (key to the larva), 147 (fig. 1.6), 150-151, 154 (fig. 3.4), 155 (fig. 4.10) (larva); **Zaitsev 1992b**: 172-175 (key to the pupa).
175. *Chiridopsis coorta* Spaeth, 1926a – **Zaitsev 1988:** 144-145 (key to the larva), 147 (fig. 1.4), 149, 154 (fig. 3.7), 155 (fig. 4.11) (larva).
176. *Chiridopsis punctata* (Weber, 1801) – **Zaitsev 1988:** 144-145 (key to the larva), 151, 152 (fig. 2.1), 154 (fig. 3.5), 155 (fig. 4.6) (larva); **Zaitsev 1992b** (as *Chiridopsis punctata punctata*): 172-175 (key to the pupa), 176 (fig. 4.4), 179-180 (pupa).
177. *Chiridopsis rubromaculata* Borowiec, Ranade, Rane et Ghate, 2001 – **Borowiec et al. 2001**: 361-371 (larva of V instar, pupa).
178. *Chiridopsis scalaris* (Weber, 1801) – **Zaitsev 1988:** 144-145 (key to the larva), 147 (fig. 1.5), 150, 154 (fig. 3.6), 155 (fig. 4.5) (larva); **Zaitsev 1992b**: 172-175 (key to the pupa), 176 (fig. 4.3), 181 (pupa).
179. *Chiridopsis selecta* (Weise, 1905) – **Takizawa 1980** (as *Chiridopsis promiscula* [sic!]): 31-32 (fig. 9) (larva of V instar, pupa).
180. *Chiridopsis undecimnotata* (Boheman, 1855) – **Ghate et al. 2004**: 185-211 (larva of I and V instar, pupa).
181. *Chiridopsis ventralis* (Boheman, 1855) – **Ghate et al. 2004**: 185-211 (larva of I and V instar, pupa).
182. *Coptocycla arcuata* (Swederus, 1787) – **Flinte et al. 2008**: 386 (pl. 18 A, H) (photo of eggs and larvae).
183. *Coptocycla contemta* (Boheman, 1855) – **Fiebrig 1910** (as *Psalidonota contemta*): 195-196, pl. 8 (figs 21a, 21b) (egg, larva, pupa).
184. *Cteisella egens* Spaeth, 1910b – **Fiebrig 1910**: 180-181, pl. 7 (fig. 13) (egg, larva).
185. *Deloyala guttata* (Olivier, 1790) – **Walsh and Riley 1869** (as *Cassida guttata*): 237-238 (figs 179a, 179b) (larva, pupa); **Barrows 1979**: 11 (photo of V instar larva).
186. *Drepanocassis profana* (Boheman, 1855) – **Buzzi and Winder 1986:** 31-41 (egg, larva of V instar, pupa).
187. *Eremionycha bahiana* **(**Boheman, 1855) – **Teixeira and Casari 2003** (as *Microctenochira difficilis*, misidentification, see discussion on page 79): 23-30 (egg, larva, pupa).
188. *Glyphocassis trilineata* (Hope, 1831) – **Zaitsev 1988**: 144-145 (key to the larva), 147 (fig. 1.2), 148-149, 154 (fig. 3.8), 155 (fig. 4.7) (larva); **Zaitsev 1992b**: 172-174 (key to the pupa), 178 (fig. 5.1), 181 (pupa).
189. *Glyphocassis spilota* (Gorham, 1885) – **Cho and Lee 2006**: 42-44 (egg, larva of I and V instar, pupa).
190. *Gratiana pallidula* (Boheman, 1854) – **Rolston et al. 1965** (as *Nuzonia pallidula*): 362-366 (egg, larva, pupa).

191. *Gratiana spadicea* (KLUG, 1829) – **Frers 1925**: 82-86 (egg, larva, pupa); **Mata and Aravena 1926**: 31-34 (egg, larva, pupa); **Kvasina and Ponce de Leon 1985**: 9-15 (larva); **Hill and Hulley 1995**: 347-348 (ootheca, larva, pupa).
192. *Helocassis clavata* (FABRICIUS, 1798) – **Woodruff 1975** (as *Plagiometriona clavata*): 1-2 (larva); **Lawson 1991** (as *Plagiometriona clavata*): 574 (figs 34.804a-g – larva).
193. *Hypocassida meridionalis* (SUFFRIAN, 1844) – **Bordy 2005**: 117-121 (larva of V instar, pupa).
194. *Hypocassida subferruginea* (SCHRANK, 1776) – **Cornelius 1847** (as *Cassida ferruginea*): 365-366 (larva); **Cornelius 1849** (as *Cassida ferruginea*): 22-23 (larva); **Henriksen 1927**: 367-369, 371 (larva); **Steinhausen 1950**: 16-17, 25, 49 (key to the larva), pl. II (fig. 9), pl. IV (fig. 19), pl. VI (fig. 33), pl. VIII (fig. 43) (larva, pupa); **Gressitt 1952**: 541 (key to the larva); **Palij and Klepikova 1957**: 82 (key to the pupa), 90-91 (pupa); **Palij 1959**: 807-809 (key to the larva), 817-818 (larva); **Emden 1962**: 33 (key to the larva), 35 (fig. 7 – larva); **Gressitt and Kmoto 1963**: 986-987 (key to the larva, after GRESSITT 1952); **Ogloblin and Medvedev 1971**: 112, 114 (fig. 51.2) (larva); **Medvedev and Zaitsev 1978**: 155-163 (figs 60.1, 61.1) (larva); **Medvedev 1982**: 194-196 (key to the larva), 197 (fig. 65.4, after MEDVEDEV and ZAITSEV 1978 [160 fig. 60.1]), 202 (fig. 67.2, after MEDVEDEV and ZAITSEV 1978 [161 fig. 61.1]); **Brovdii 1983**: 17 (figs 12.1, 12.2), 19 (fig. 14.5 after MEDVEDEV and ZAITSEV 1978 [160 fig. 60.2] but in their paper these figures are captioned as *Pilemostoma*), 61-63, 69-71 (figs 43.1-43.5, after PALIJ 1959 [818 figs 24, 25], figs 43.6, 43.7, after PALIJ and KLEPIKOVA 1957 [90 figs 14, 15]) (ootheca, larva, pupa); **Steinhausen 1994** (as *Cassida subferruginea*): 307-309 (figs 360, 369, 376) (key to the larva); **Bordy 2000** (as *Cassida* (*Hypocassida*) *subferruginea*): 75 (key to the larva), 78-79 (key to the pupa), 89 (larva, pupa); **Steinhausen 2002** (as *Cassida subferruginea*): 22-24 (fig. 193) (key to the pupa).
195. *Ischyronota conicicollis* (WEISE, 1890) – **Medvedev 1982**: 194-198 (key to the larva), 196 (fig. 64.1), 202 (fig. 67.12); **Świętojańska and Borowiec 2007b**: 43-56 (larva of V instar).
196. *Ischyronota desertorum* (GEBLER, 1834) – **Matys 1970**: 28-29 (larva, pupa); **Ogloblin and Medvedev 1971**: 112 (larva); **Medvedev 1982**: 194-196 (key to the larva), 202 (fig. 67.10), 203 (fig. 68.4, wrongly captioned as *Cassida murraea*); **Brovdii 1983**: 61-65 (figs 37.1-37.3, after MATYS 1970 [28 fig. 4]) (larva, pupa); **Świętojańska and Borowiec 2007b**: 43-56 (larva of V instar).
197. *Ischyronota elevata* (REITTER, 1890) – **Medvedev and Radzivilovskaja 1971**: 199-204 (larva).

198. *Ischyronota schusteri* Spaeth, 1914d – **Medvedev 1982**: 194-198 (key to the larva), 202 (fig. 67.11).
199. *Jonthonota nigripes* (Olivier, 1790) – **Walsh and Riley 1869** (as *Cassida nigripes*): 238 (fig. 180) (larva, pupa); **Lawson 1991**: 574 (figs 34.803a-h – larva).
200. *Macromonycha apicalis* (Gebler, 1845) – **Matys 1970**: 29-31 (larva, pupa).
201. *Metriona elatior* (Klug, 1829) – **Morelli et al. 1993**: 150-154 (figs 4-7) (ootheca, larva, pupa).
202. *Oocassida cruenta* (Fabricius, 1792) – **Maulik 1919**: 279-280 (mature larva); **Takizawa 1980**: 32-34 (fig. 10) (ootheca, larva of V instar, pupa).
203. *Oocassida pudibunda* (Boheman, 1856) – **Cox 1996**: 187, fig. 401 (pupa).
204. *Oxylepus deflexicollis* (Boheman, 1862) – **Bordy 2000**: 71-72 (fig. 57) (larva of V instar, pupa).
205. *Pilemostoma fastuosa* (Schaller, 1783) – **Maulik 1949**: 633-638 (larva); **Emden 1962**: 33 (key to the larva), 34 (fig. 1 – larva); **Ogloblin and Medvedev 1971**: 112-113, 114 (figs 51.1, 51.3, 51.4, 51.6) (larva); **Medvedev and Zaitsev 1978**: 155-159 (fig. 58.6), 160 (figs 60.2, 60.10), 161 (fig. 61.2), 164 (larva); **Medvedev 1982**: 194-196 (key to the larva), 197 (figs 65.5, 65.8, after Medvedev and Zaitsev 1978 [156 fig. 58.6, 160 fig. 60.2]), 202 (fig. 67.3, after Medvedev and Zaitsev 1978 [161 fig. 61.2]), 203 (fig. 68.8, after Medvedev and Zaitsev 1978 [160 fig. 60.10]); **Brovdii 1983**: 19 (fig. 14.3, after Medvedev and Zaitsev 1978 [160 fig. 60.1] but in Medvedev and Zaitsev 1978 this figure concerns *Hypocassida*), 20 (fig. 16.10, after Medvedev and Zaitsev 1978 [161 fig. 61.2]), 22 (fig. 18.1, after Medvedev and Zaitsev 1978 [156 fig. 58.6]), 61-63, 67 (larva); **Steinhausen 1994** (as *Cassida fastuosa*): 307-310 (fig. 370) (key to the larva); **Bordy 2000** (as *Cassida* (*Pilemostoma*) *fastuosa*): 75-76 (key to the larva), 78-79 (key to the pupa), 129 (larva, pupa).
206. *Plagiometriona ambigena* (Boheman, 1855) – **Flinte et al. 2008**: 386 (pl. 18 K) (photo of larva).
207. *Plagiometriona dodonea* (Boheman, 1855) – **Flinte et al. 2008**: 386 (pl. 18 B) (photo of eggs).
208. *Plagiometriona flavescens* (Boheman, 1855) – **Fiebrig 1910**: 184-185, pl. 8 (figs 17a-17c) (egg, larva, pupa); **Flinte et al. 2008**: 386 (pl. 18 I) (photo of larva).
209. *Plagiometriona tenella* (Klug, 1829) – **Frers 1923** (as *Metriona tenella*): 256-259 (egg, larva, pupa).

210. *Rhytidocassis scutellaris* (KLUG, 1835) – **Zaitsev 1989** (as *Cassida scutellaris*): 297 (fig. 2.4), 299 (fig. 3.5), 301-302 (larva).
211. *Silana farinosa* (BOHEMAN, 1856) – **Takizawa 1980**: 37-39 (fig. 14a) (pupa); **Mohamedsaid and Sajap 1996**: 36-38 (figs 5, 6) (larva of I and V instar, pupa).
212. *Syngambria bisinuata* (BOHEMAN, 1855) – **Fiebrig 1910** (as *Coptocycla bisinuata*): 193-195, pl. 8 (figs 20a-20e) (egg, larva, pupa).
213. *Thlaspida biramosa* (BOHEMAN, 1855) – **Zaitsev 1988** (as *Thlaspida biramosa chinensis*): 144 (key to the larva), 154 (fig. 3.12), 155 (fig. 4.1) (figures of larva); **Zaitsev 1992b**: 172- 173 (key to the pupa), 176 (fig. 4.2), 181-182 (figs 7.2, 7.9), 184 (fig. 8.1) (pupa); **Kimoto and Takizawa 1994** (as *Thlaspida cribrosa*): 406 (pl. 127 fig. 4 – ootheca, larva, pupa), 490, 504-505 (key to the larva); **Lee and Park 1996** (as *Thlaspida cribrosa*): 388-390 (key to the egg, larva and pupa, fig. 1) (egg, larva, pupa); **Kimoto and Takizawa 1997** (as *Thlaspida cribrosa*): 460 (pl. 115 fig. 1 – ootheca, larva, pupa, after KIMOTO and TAKIZAWA 1994), 533; **Lee and Cheng 2007**: 188-189 (ootheca, larva of V instar, pupa).
214. *Thlaspida cribrosa* (BOHEMAN, 1855) – **Zaitsev 1988**: 144 (key to the larva), 146-147 (fig. 1.1), 154 (figs 3.3, 3.11), 155 (fig. 4.2) (larva); **Zaitsev 1992b**: 172-173 (key to the pupa), 182 (figs 7.3, 7.10) (pupa).
215. *Thlaspida lewisii* (BALY, 1874) – **Medvedev and Zaitsev 1978**: 155-164 (figs 58.5, 60.11, 61.3), (larva); **Lee and Park 1996**: 388 (key to the egg, larva and pupa), 390-392 (fig. 2) (egg, larva, pupa); **Kimoto and Takizawa 1994** (as *Thlaspida lewisi* [sic!]): 406 (pl. 127 fig. 5 – larva, pupa), 490, 504-505 (key to the larva).
216. *Vietocassis viridis* MEDVEDEV et EROSHKINA, 1988a – **Zaitsev 1988**: 144 (key to the larva), 147 (fig. 1.3), 148, 155 (figs 4.3, 4.8) (larva); **Zaitsev 1992b**: 176 (fig. 4.1), 182-183 (pupa).

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217. *Aspidimorpha adhaerens* (WEBER, 1801) – **Simon Thomas 1964**: 169 (fig. 2 – pupa).
218. *Aspidimorpha areata* (KLUG, 1835) – **Zaitsev 1989** (as *Aspidomorpha areata*): 297 (fig. 2.5), 299 (figs 3.4, 3.7), 300-301 (larva); **Heron 2007**: 77-81 (imm. stages).
219. *Aspidimorpha chandrika* MAULIK, 1918 – **Maulik 1919** (as *Aspidomorpha chandrika*): 277, 279, larva; **Gressitt 1952** (as *Aspidomorpha chandrika*): 541-542, key to the larva; **Gressitt and Kimoto 1963** (as *Aspidomorpha chandrika*): 986-987 (key to the larva, after GRESSITT 1952).

220. *Aspidimorpha confinis* (KLUG, 1835) – **Muir and Sharp 1904** (*Aspidomorpha confinis*): 6-7, 11, pl. II (figs 10, 11), pl. IV (fig. 22a) (ootheca, larva, pupa); **Zaitsev 1989** (as *Aspidomorpha apicalis*): 297 (fig. 2.3), 299 (figs 3.2, 3.8), 298-300 (larva).
221. *Aspidimorpha deusta* (FABRICIUS, 1775) – **Medvedev and Zaitsev 1993** (as *Sindia schawalleri*): 42-45 (figs 5-12) (larva of I and V instar, pupa); **McBride et al. 2000**: 167-170 (larva).
222. *Aspidimorpha difformis* (MOTSCHULSKY, 1860) – **Medvedev and Zaitsev 1978** (as *Aspidomorpha difformis*): 155-159, 160 (fig. 60.13), 162 (fig. 62.8), 170-171 (key to the larva); **Kimoto and Takizawa 1994** (as *Aspidomorpha indica*): 403 (pl. 124 fig. 6 – ootheca, larva, pupa), 485, 506-505 (key to the larva).
223. *Aspidimorpha dorsata* (FABRICIUS, 1787) – **Maulik 1919** (as *Aspidomorpha dorsata*): 275-277 (larva, pupa); **Gressitt 1952** (as *Aspidomorpha dorsata*): 541-542 (key to the larva), 543 (key to the pupa); **Gressitt and Kimoto 1963** (as *Aspidomorpha dorsata*): 986-987 (key to the larva, after GRESSITT 1952), 988-989 (key to the pupa, after GRESSITT 1952); **Zaitsev and Medvedev 1983** (as *Aspidomorpha dorsata*): 133 (fig. 1.2), 134 (fig. 2.5), 135 (fig. 3.6), 137-138 (key to the larva), 141-142 (larva); **Zaitsev 1992b** (as *Aspidomorpha dorsata*): 170 (fig. 2.3), 172-173 (key to the pupa), 179, 182 (fig. 7.4), 184 (fig. 8.6).
224. *Aspidimorpha furcata* (THUNBERG, 1789) – **Kershaw and Muir 1907** (as *Aspidomorpha micans*): 250 (ootheca); **Gressitt 1952** (as *Aspidomorpha furcata*): 528-535, 540 (key to the ootheca), 541-542 (key to the larva), 543-544 (key to the pupa), 576 (pl. 31 figs 1-7), 578 (pl. 32 figs 1-3), 586 (pl. 36 fig. 7) (imm. stages); **Gressitt and Kimoto 1963** (as *Aspidomorpha furcata*): 951 (fig. 268 figures of imm. stages, after GRESSITT 1952 [pl. 31, 32, 36]), 985 (key to the ootheca, after GRESSITT 1952), 986-987 (key to the larva, after GRESSITT 1952), 988-989 (key to the pupa, after GRESSITT 1952); **Visalakshi et al. 1980** (as *Aspidomorpha furcata*): 167-169 (imm. stages); **Takizawa 1980**: 26-27 (fig. 5), 38 (fig. 14d) (ootheca, larva of V instar, pupa); **Zaitsev and Medvedev 1983** (as *Aspidomorpha furcata*): 134 (fig. 2.6), 135 (figs 3.4, 3.8), 137-139 (key to the larva), 142-143 (larva); **Zaitsev 1992b** (as *Aspidomorpha furcata*): 172-174 (key to the pupa), 175 (fig. 3.4 – pupa); **Kimoto and Takizawa 1997** (as *Aspidomorpha furcata*): 457 (pl. 112 fig. 5 – ootheca, larva, pupa), 528, 546 (key to the larva); **Lin and Hsiao 2005** (as *Aspidomorpha indica*): 115 (figures of ootheca, lrva and pupa).
225. *Aspidimorpha fuscopunctata* BOHEMAN, 1854 – **Takizawa 1980** (as *Aspidomorpha dorsata*): 25-26 (fig. 4) (larva of V instar); **Zaitsev and Medvedev 1983** (as *Aspidomorpha fuscopunctata*): 134 (fig. 2.7), 135

(figs 3.3, 3.7), 137-139 (key to the larva), 142 (larva); **Zaitsev 1992b** (as *Aspidomorpha fuscopunctata*)**:** 175 (fig. 3.3 – pupa).

226. *Aspidimorpha icterica* Boheman, 1854 – **Paterson 1941** (as *Aspidomorpha tecta*): 2-4 (imm. stages).
227. *Aspidimorpha inuncta* Boheman, 1854 – **Takizawa 1980** (as *Aspidomorpha spaethi*): 23-25 (fig. 3), 38 (fig. 14c) (ootheca, larva of V instar, pupa).
228. *Aspidimorpha isparetta* Boheman, 1854 – **Zaitsev 1989** (as *Aspidomorpha schoenherri*): 297 (fig. 2.2), 299 (figs 3.3, 3.6), 300 (larva, probably misidentification).
229. *Aspidimorpha maculatissima* (Boheman, 1856) – **Hawkeswood 1982** (as *Aspidomorpha maculatissima*): 92-101 (imm. stages).
230. *Aspidimorpha miliaris* (Fabricius, 1775) – **Schultze 1908** (as *Aspidomorpha miliaris*): 264-265, pl. II, pl. III (figs 1-4), pl. IV (ootheca, larva of V instar, pupa); **Maulik 1919** (as *Aspidomorpha miliaris*): 270-273 (ootheca, larva, pupa); **Gressitt 1952** (as *Aspidomorpha miliaris*): 540 (key to the ootheca), 541-542 (key to the larva), 543 (key to the pupa), 586 (pl. 36 fig. 2 – pupa); **Gressitt and Kimoto 1963** (as *Aspidomorpha miliaris*): 952 (fig. 269a – pupa, after Gressitt 1952 [pl. 36]), 985 (key to the ootheca, after Gressitt 1952), 986-987 (key to the larva, after Gressitt 1952), 988 (key to the pupa, after Gressitt 1952); **Takizawa 1980**: 28-30 (fig. 7), 38 (fig. 14e) (ootheca, larva of V instar, pupa); **Zaitsev and Medvedev 1983** (as *Aspidomorpha miliaris*): 134 (fig. 2.4), 135 (fig. 3.5), 137 (key to the larva), 139 (fig. 4.2), 140-141 (larva); **Manjunatha et al. 1986** (as *Aspidomorpha miliaris*): 704-708 (imm. stages); **Zaitsev 1992b** (as *Aspidomorpha miliaris*): 170 (fig. 2.4), 172-173 (key to the pupa), 184 (fig. 8.2 – pupa); **Cox 1996** (as *Aspidomorpha miliaris*):178, figs 336-337 (pupa); **Kimoto and Takizawa 1997** (as *Aspidomorpha miliaris*): 458 (pl. 113 fig. 1 – ootheca, larva, pupa, after Takizawa 1980), 528-529, 546 (key to the larva); **Lee and Cheng 2007** (as *Aspidomorpha miliaris*): 162-163 (ootheca, larva of V instar, pupa).
231. *Aspidimorpha puncticosta* Boheman, 1854 – **Muir and Sharp 1904**: 2-6, 9-10, pl. I (figs 1-6, 9), pl. III (figs 20a-20e) (ootheca, larva, pupa).
232. *Aspidimorpha sanctaecrucis* (Fabricius, 1792) – **Maulik 1919** (as *Aspidomorpha sanctae-crucis*): 273-274 (ootheca, larva, pupa); **Gressitt 1952** (as *Aspidomorpha sanctae-crucis*): 536, 540 (key to the ootheca), 541-542 (key to the larva), 543 (key to the pupa), 586 (pl. 36 fig. 3 – pupa); **Gressitt and Kimoto 1963** (as *Aspidomorpha sanctaecrucis*): 953 (fig. 270 – pupa, after Gressit 1952 [pl. 36]), 985 (key to the ootheca, after Gressitt 1952), 986-987 (key to the larva, after Gressitt 1952), 988-989

(key to the pupa, after Gressitt 1952); **Gubbajah and Devaiak 1978** (as *Aspidomorpha sanctae-crucis*): 156 (ootheca); **Takizawa 1980** (as *Aspidomorpha sanctaecrucis*): 27-28 (fig. 6), 38 (fig. 14b) (ootheca, larva of V instar, pupa); **Zaitsev and Medvedev 1983** (as *Aspidomorpha sanctae-crucis*): 134 (fig. 2.9), 135 (fig. 3.10), 137-139 (key to the larva), 144 (larva); **Zaitsev 1992b** (as *Aspidomorpha sanctae-crucis*): 172-173 (key to the pupa), 175 (fig. 3.1), 184 (fig. 8.4) (figures of pupa).

233. *Aspidimorpha stevensi* Baly, 1863 – **Zaitsev and Medvedev 1983** (as *Aspidomorpha vietnamica*): 134 (fig. 2.8), 135 (fig. 3.9), 138 (fig. 4.1), 137-140 (key to the larva), 143-144, (larva); **Zaitsev 1992b** (as *Aspidomorpha vietnamica*): 175 (fig. 3.2), 179, 184 (fig. 8.5) (pupa).
234. *Aspidimorpha submutata* Weise, 1899 – **Heron 2008**: 225-245, 389 (pl. 21, 22), 390 (pl. 23, 24), 391 (pl. 25, 26), 392 (pl. 27) (imm. stages).
235. *Aspidimorpha tecta* Boheman, 1854 – **Muir and Sharp 1904**: 6, 10-11, pl. IV (fig. 21a) **(**ootheca, larva, pupa).
236. *Aspidimorpha transparipennis* (Motschulsky, 1860) – **Medvedev and Zaitsev 1978**: 155-159, 162 (fig. 62.9), 163 (fig. 63.1), 170-171 (key to the larva); **Kimoto and Takizawa 1994**: 404 (pl. 125 fig. 1 – ootheca, larva, pupa), 486, 506-505 (key to the larva); **Lee and Cho 2006**: 113 (fig. 8 – photo of larva).
237. *Conchyloctenia hybrida* (Boheman, 1854) – **Paterson 1941**: 4-6 (imm. stages).
238. *Conchyloctenia nigrovittata* (Boheman, 1854) – **Rane et al. 2001**: 53-57 (imm. stages).
239. *Conchyloctenia punctata* (Fabricius, 1787) – **Paterson 1941**: 6-8 (imm. stages); **Heron 1999**: 565-579 (imm. stages).
240. *Conchyloctenia tripuncticollis* (Boheman, 1862) – **Muir and Sharp 1904** (as *Aspidomorpha tigrina*): 7, 11-12, pl. II (figs 12, 13), pl. IV (figs 23a-23d) (ootheca, larva, pupa).
241. *Laccoptera cicatricosa* Boheman, 1855 – **Heron 2004**: 455-468 (imm. stages).
242. *Laccoptera corrugata* (Sahlberg, 1823) – **Zaitsev 1989**: 296-298 (figs 2.1, 2.6), 299 (fig. 3.1) (larva).
243. *Laccoptera excavata* Boheman, 1855 – **Muir and Sharp 1904**: 8-9, 15, pl. V (figs 27a, 27b) (ootheca, larva, pupa).
244. *Laccoptera foveolata* (Boheman, 1856) – **Ranade et al. 2004**: 783-796 (ootheca, larva of I and V instar, pupa).
245. *Laccoptera hospita* Boheman, 1855 – **Zaitsev and Medvedev 1983** (as *Sindiola hospita*): 131-136 (figs 1.1, 2.2, 3.1), 137 (key to the larva) (larva); **Zaitsev 1992b** (as *Sindiola hospita*): 170 (fig. 2.2), 172-173 (key to the pupa), 177, 182 (fig. 7.1) (pupa).

246. *Laccoptera nepalensis* Boheman, 1855 – **Kershaw and Muir 1907** (as *Laccoptera chinensis*): 250-251 (ootheca); **Maulik 1919** (as *Laccoptera quadrimaculata*): 278-279 (larva); **Hoffman 1933** (as *Laccoptera chinensis*): 259, 260, pl. 16 (figs 1-6) (egg, larva, pupa); **Gressitt 1952** (as *Laccoptera quadrimaculata*): 537, 540 (key to the ootheca), 541 (key to the larva), 543 (key to the pupa), 584 (pl. 35 figs 1-8, 10 – imm. stages); **Gressitt and Kimoto 1963** (as *Laccoptera quadrimaculata*): 956 (figs 272a-272h – imm. stages, after Gressit 1952 [pl. 35]), 985-986 (key to the ootheca, after Gressitt 1952), 986-987 (key to the larva, after Gressitt 1952), 988 (key to the pupa, after Gressitt 1952); **Takizawa 1980** (as *Laccoptera quadrimaculata*): 22-23 (fig. 2) (larva of V instar, pupa); **Zaitsev and Medvedev 1983** (as *Laccoptera quadrimaculata*): 134 (fig. 2.3), 137 (key to the larva); **Zaitsev 1992b** (as *Laccoptera quadrimaculata*): 170 (fig. 2.1), 177-179, 184 (fig. 8.3) (pupa); **Kimoto and Takizawa 1994** (as *Laccoptera quadrimaculata*): 406 (pl. 127 fig. 3 – ootheca, larva, pupa), 489, 504-505 (key to the larva); **Kimoto and Takizawa 1997** (as *Laccoptera quadrimaculata*): 460 (pl. 115 fig. 2 – ootheca, larva, pupa, after Kimoto and Takizawa 1994), 532-533; **Lee and Cheng 2007**: 182-183 (ootheca, larva of V instar, pupa).
247. *Laccoptera quatuordecimnotata* Boheman, 1855 – **Takizawa 1980**: 21-22 (fig. 1), 38 (fig. 15b) (ootheca, larva of V instar, pupa).
248. *Laccoptera sulcata* (Olivier, 1808) – **Maulik 1948a** (as *Sindia clathrata*): 368-371 (egg, larva); **Hingston 1928** (as *Sindia clathrata*): 60-64 (ootheca, larva, pupa); **Rane and Ghate 2005**: 217-222 (imm. stages).
249. *Laccoptera tredecimpunctata* (Fabricius, 1801) – **Schultze 1908** (*Laccoptera philippinensis*): 268-269, pl. V (figs 1-3) (ootheca, larva, pupa); **Medvedev 2002**: 36-37 (figs 9-10) (larva).
250. *Laccoptera vigintisexnotata* Boheman, 1855 – **Zaitsev and Medvedev 1983** (as *Sindiola vigintisexnotata*): 134 (fig. 2.1), 135 (fig. 3.2), 136-137, 137 (key to the larva) (larva).

CHARACTERS OF IMMATURE STAGES OF CASSIDINAE TRIBES

Tribe: Notosacanthini Hincks, 1952

Immatures of *Notosacantha siamensis, N. sauteri, N. vicaria* and *N. castanea* were described or figured (Medvedev and Eroshkina 1988b; Kimoto and Takizawa 1997; Rane et al. 2000; Lee and Cheng 2007).

First instar larva
Unknown.

Mature larva

Body of larva strongly dorso-ventrally flattened, elongated, almost parallel-sided or slightly widened posteriorly (Fig. 80). Prothorax plate-like, distinctly longer than meso- and metathorax. Meso- and metathorax similar in shape and measurements. Segments of thorax without lateral scoli, abdominal segments I-VIII with a pair of scoli directed laterally, abdominal segment IX with very short scoli directed posteriorly. Lateral scoli simple, without lateral branches, cone-like with broad base. Each scolus armed apically with pointed seta. The ninth abdominal segment smaller than remainder, in shape more or less rectangle or trapezoid. Supra-anal processes absent.

Dorsally nine pairs of tubular spiracles: one on thorax and eight on abdomen (at base of lateral scoli of segments I-VIII). Spiracles of eight abdominal segment the most prominent.

No information on chaetotaxy of body, legs and head.

Head prognathous, distinctly sclerotized, visible from above, partially retracted into prothorax (two triangular lobes of epicranial part are inserted into prothorax). Median endocarina well developed, epicranial stem absent. Frontal arms distinct. No information on chaetotaxy of head.

Five stemmata on each side of head (*N. siamensis* – Medvedev and Eroshkina 1988b; *N. vicaria* – Rane et al. 2000).

Antennae 3-segmented (*N. siamensis* – Medvedev and Eroshkina 1988b; *N. vicaria* – Rane et al. 2000).

No information on fronto-clypeal suture and setae of clypeus.

Labrum wider than long, anterior margin not emarginate. Setae on labrum present but not precisely described (*N. siamensis* – Medvedev and Eroshkina 1988b).

Mandibles heavily sclerotized, triangular in shape (*N. siamensis* – Medvedev and Eroshkina 1988b).

Maxillae and labium connate, no information on labial palpi.

Legs short, 3-segmented, consist of coxa, femur and tibiotarsus which

armed apically with claw. Claw curved, single and simple with single pointed seta at base. Tibiotarsus slightly shorter than coxa (*N. siamensis* – MEDVEDEV and EROSHKINA 1988b). No information on pulvilli (present or not) at base of claw and setae on legs.

Pupa

Body strongly dorso-ventrally flattened, elongate-oval (Fig. 81).

Segments of thorax and abdominal segment I without lateral scoli. In *N. vicaria* and *N. sauteri* abdominal segments II-VI with a pair of simple lateral scoli, segments VII and VIII with a pair of doubled lateral scoli. In *N. siamensis* and *N. castanea* abdominal segments II-V with a pair of simple lateral scoli, segments VI-VIII with a pair of doubled lateral scoli. Segment IX with a pair of flat, wedge-shaped processes directed posteriorly.

Five pairs of spiracles, one pair on each abdominal segment I-V (*N. vicaria* – RANE et al. 2000). Spiracles of segment V the most prominent, elongated, distinctly longer than lateral scoli.

Head visible from above.

REMARKS

The larvae and pupae are leaf-mining, and they don't make any shield at the end or on dorsal side of body. General morphology of larva is similar to the morphology of hispines which live inside leaves: body strongly dorso-ventrally flattened, head prognathous strongly dorso-ventrally flattened with two epicranial lobes inserted into pronotum, median endocarina well developed, epicranial stem absent**,** frontal arms distinct, antennae 3-segmented, lateral scoli of body simple without lateral branches, spiracles of abdominal segment VIII elongated. Elongated spiracles of abdominal segment VIII of larva and segment V of pupa seem to be an adaptation to living inside leaf tissue.

Only five pairs of stemmata were observed in Notosacanthini whereas in larvae of other species of cassidoid Cassidinae six pairs were observed.

Tribe: Delocranini SPAETH, 1929

Until now larva and egg of only *Delocrania cossyphoides* were described (BONDAR 1940; GENTY et al. 1978).

First instar larva

Unknown.

Mature larva (?)

Body dorso-ventrally flattened, elongated, almost parallel-sided (Fig. 82).

Body with twelve pairs of lateral scoli and one pair of very short scoli. Thorax with 4 pairs of lateral scoli: prothorax with two pairs, meso- and metathorax each with one pair. Each abdominal segment I-VIII with a pair of lateral scoli. Segment IX with a pair of short scoli directed posteriorly (or supra-anal processes?) which in build are similar to remainder lateral scoli. Lateral scoli covered with long setae or with lateral branches which apically armed with seta. Setae of lateral scoli distinctly widened at the top.

Dorsally nine pairs of spiracles: one prominent tubular on thorax (distinctly elongated) and eight, distinctly shorter than the first one, on abdominal tergites I-VIII.

No information on chaetotaxy of body, legs and head.

No information on mouth parts, antennae and number of stemmata.

Head hypognathous.

No information on legs.

Pupa

Unknown.

Remarks

According to Bondar (1940) The larvae (as well as adults) show concealed behaviour, prefer ventral side of leaves or folded leaves of palms (Arecaceae) – their host plants and they live naked or little hidden by the excrements. According to D. Windsor and L. Sekerka (personal comm.) they inhabit narrow crevices between leaves that are binded together or inside rolled up leaves.

Tribe: Hemisphaerotini Monros et Viana, 1951

Larvae of four species were described: *Hemisphaerota cyanea*, *Hemisphaerota palmarum*, *Spaethiella crassicornis* and *Spaethiella tristis* (Beshear 1969; Bondar 1940; Candéze 1861; Chaboo and Nguyen 2004; Fiebrig 1910; Olliff 1884; Woodruff 1965; Genty et al. 1978).

First instar larva

Unknown.

Mature larva

Body moderately dorso-ventrally flattened, oval, the widest across metathorax (along border between meso- and metathorax). Width of prothorax shorter than of meso- and metathorax, width of abdominal segments slightly shortened posteriorly (Figs 83, 136, 137). Thorax without lateral scoli, each abdominal segments I-VIII with a pair of short scoli, abdominal segment IX

with a pair of supra-anal processes. Lateral scoli in shape of tubercle with setae at the top. Two-branched supra-anal processes, bear shield composed of previous larval skins and faeces.

Dorsally nine pairs of spiracles: one pair on thorax and eight on abdomen (one pair on each segment I-VIII). Spiracles of thorax prominent, tubular, distinctly longer than remainder spiracles and than lateral scoli of meso-, metathorax and of abdominal segments.

No information on chaetotaxy of body, legs and head. According to Chaboo and Nguyen (2004) setae on body present but in their paper there is no more precise information on chaetotaxy.

Head oval, well sclerotized, hypognathous, retracted into prothorax, not visible from above. Chaetotaxy of head not described.

Six stemmata on each side of head.

Antennae 2-segmented, set in membranous ring.

Fronto-clypeal suture present. Clypeus distinct, wider than long. Setae of clypeus not described and figured.

Labrum wider than long, with anterior margin broadly emarginate. Setae on labrum present but not precisely described (Chaboo and Nguyen 2004).

Mandibles heavily sclerotized, with unidentate apex, and two setae at base dorsally.

Maxillae and labium connate. Stipes and palpiger distinct. Maxillary palp 2-segmented. Mala, prementum and postmentum distinct. Labial palp 1-segmented.

Legs stout, 3-segmented, consist of coxa, femur and tibiotarsus which armed apically with claw. Claw heavily sclerotized, curved, single and simple. Chaetotaxy of leg by Chaboo and Nguyen (2004) was umprecisely described as "sparse setation".

Pupa

Body dorso-ventrally flattened, short-oval almost rounded.

Prothorax broad with anterior margin broadly rounded and with distinct posterior angles. Thorax without scoli. Lateral margin of abdominal segments I-V slightly projected laterally. Last abdominal segment (according to Chaboo and Nguyen 2004 segment VIII but it is questionable because in known larvae of Hemisphaerotini supra-anal processes are on abdominal segment IX and in pupae of species belonging to remainder Cassidinae tribes supra-anal processes are on abdominal segment IX) with two supra-anal processes.

According to Chaboo and Nguyen (2004) 8 pairs of spiracles, one pair on each abdominal segment I-VIII.

Head not visible from above.

Remarks

Shield of larva composed of faeces and exuvia. Previous larval skins practically invisible covered by excrements. Faecal matter is attach to base of larval skins in form of very long, numerous filaments which build structure similar to small bird nest. The faecal structure resembles an inverted bird's nest which completely encloses the larva (Figs 135-137).

Tribe: Spilophorini Chapuis, 1875

Immatures of *Calyptocephala paralutea* and *C. gerstaeckeri* were described (Buzzi and Miyazaki 1992; Córdova-Ballona and Sánchez-Soto 2008).

First instar larva

Unknown.

Mature larva

Body dorso-ventrally flattened, elongated, almost parallel-sided, slightly narrowed posteriorly (Fig. 84). Prothorax plate-like, distinctly longer than meso- and metathorax. Meso- and metathorax similar in shape and measurements. Fourteen pairs of lateral scoli: each thoracic segment with two pairs of lateral scoli and abdominal segment I-VIII with a pair of scoli. Lateral scoli conical, simple, without lateral branches. Abdominal segment VIII with extremely short lateral scoli. Supra-anal processes directed posteriorly, bear previous larval skin without faeces. Each supra-anal process consist of two parts: prominent horn-like base and short and thin top.

Dorsally nine pairs of spiracles: one pair on thorax and eight on abdomen.

Body covered with short sparse setae, abdominal sternites I-IV with numerous setae placed medially.

Head oval, hypognathous, visible from above. Fronto-clypeal suture present. No information on median endocarina or epicranial stem. Setae of head not described.

Six stemmata on each side of head.

Antennae – no information.

Fronto-clypeal suture present. Clypeus distinct, subrectangular. In original description no information on setae is available but according to drawings clypeus is with two pairs of setae and a pair of campaniform sensilla.

Labrum wider than long, with anterior margin slightly emarginate. In description no information on setae. According to drawing labrum with 6 setae and 4 campaniform sensilla dorsally; anterior margin with 10 setae medially and three setae on each lateral side.

Mandibles heavily sclerotized, triangular in shape, with four teeth (one distinctly smaller than remainder). According to drawing mandibles with two setae dorsally.

Maxillae and labium connate. Stipes and palpiger distinct. Maxillary palp 2-segmented. According to BUZZI and MIYAZAKI (1992) lacinia and galea globe-like and not fused. Prementum and postmentum distinct. Labial palp 1-segmented.

Legs stout, 3-segmented, consist of coxa, femur and tibiotarsus with claw at the top. At base of claw pulvilli. Claw heavily sclerotized, curved, single and simple, armed basally with a pointed seta. Setae not precisely described, according to drawing legs covered with sparse setae which are as long as setae of head.

Pupa

Body dorso-ventrally flattened (Fig. 85).

Nine pairs of lateral scoli: two pairs on prothorax and 7 pairs on abdominal segments I-VII. Head with a pair of prominent processes. Processes of head and scoli of prothorax conical. Scoli of abdominal segments I-V leaf-like; segments VI and VII with conical scoli. Abdominal scoli gradually shortened towards posterior part of body. Each process simple, without lateral branches. Last abdominal segment with supra-anal processes which bear shield composed of previous larval skins.

Six pairs of spiracles, one pair on each abdominal segment I-VI.

Head invisible from above, except for lateral scoli of head.

REMARKS

The larvae have specific supra-anal processes which are consist of two parts: prominent, stout base and short, thin top. Shield attached to the supra-anal processes of larva is composed of only previous larval skins without faeces.

Tribe: Omocerini HINCKS, 1952

The larvae of three species were described: *Cassidinoma denticulata*, *Discomorpha languinosa* and *Omocerus klugi* (CANDÉZE 1861; FIEBRIG 1910). The larvae of two species were figured: *Canistra rubiginosa* and *Polychalca platynota* (FLINTE et al. 2008). By courtesy of Donald WINDSOR a photo of the mature larva of *Discomorpha nevermanni* (SPAETH, 1928) is presented in this paper (Fig. 134).

First instar larva

Unknown.

Mature larva

Body dorso-ventrally flattened, elongated, the widest across metathorax (Figs 86-88, 134). Width of prothorax distinctly shorter than of meso- and metathorax. Width of abdominal segments shorter than meso- and metathorax and slightly shortened posteriorly, segments VII and VIII the shortest. Body with 17 pairs of lateral scoli and a pair of supra-anal processes. Prothorax with four pairs of lateral scoli, mesothorax with three, and metathorax with two pairs, abdominal segments I-VIII with a pair of scoli. Lateral scoli more or less elongated without lateral branches. Supra-anal processes simple, long and free (*Omocerus klugi*) or short and stout (*Cassidinoma denticulata*).

Dorsally nine pairs of spiracles: one pair on thorax and eight on abdomen (one pair on each segment I-VIII).

Chaetotaxy of body unknown.

Head oval, well sclerotized, hypognathous, retracted into prothorax, its top slightly visible from above. No information on median endocarina. Chaetotaxy of head unknown.

Six stemmata on each side of head.

Antennae 2-segmented (Candéze 1861).

No information on fronto-clypeal suture and clypeus.

Anterior margin of labrum emarginate. No information on setae.

According to Candéze (1861) mandibles, maxillae and labium as in larvae of European *Cassida*.

Leg 3-segmented. Chaetotaxy of legs unknown.

Pupa

Unknown.

Remarks

Supra-anal processes of larva are simple, long and free (*Omocerus klugi*) or short and stout with strongly elaborated basal part and each process has one short lateral process (*Discomorpha languinosa, Cassidinoma denticulata, Discomorpha nevermanni* (Spaeth, 1928)) (Figs 86-88, 134). In larvae of *Discomorpha peruviana* (Boheman, 1850), *D. nevermanni* shield composed of exuvia and faeces were observed (information by courtesy of Donald Windsor).

Tribe: Goniocheniini Spaeth, 1942

The larvae of three species were described: *Chlamydocassis cribripennis*, *Chlamydocassis laticollis* and *Chlamydocassis metallica* (Fiebrig 1910; Świętojańska et al. 2005). The larva of *Polychalma multicava* was figured (Cuignet et al. 2008).

First instar larva
Unknown.

Mature larva (mainly based on description of *Chlamydocassis cribripennis*).

Body dorso-ventrally flattened, elongate-oval, the widest across metathorax (Figs 92, 142). Width of prothorax shorter than of meso- and metathorax, width of abdominal segments distinctly shortened posteriorly. Body with 13 pairs of lateral scoli and a pair of short supra-anal processes. Prothorax with three pairs of lateral scoli, meso-, metathorax and abdominal segments I-VIII with a pair of scoli. Scoli of thorax and of last abdominal segment covered with setae and with a few short lateral branches, remaining abdominal scoli only with setae. Apex of scoli and lateral branches armed with one long pointed seta. First two lateral scoli placed very close to each other and directed anteriorly. Supra-anal processes short and stout, bended dorsally, bear shield composed of previous larval skins and faeces.

Nine pairs of spiracles on dorsal side of body: one pair on thorax and eight on abdomen (one pair on each segment I-VIII).

Numerous setae distributed regularly on dorsal and ventral side of body. Setae on the whole surface of dorsal side of body more or less in similar length, pointed without tubercles at base. Setae on sternites approximately as long as setae on tergites except setae of abdominal sternites medially, which are distinctly longer than the remainder. The longest setae placed on abdominal sternite I-III medially (*Chlamydocassis cribripennis*).

Head oval, well sclerotized, hypognathous, retracted into prothorax, its top slightly visible from above. Median suture (endocarina) complete, connected with fronto-clypeal suture. Whole surface of head with numerous setae, distributed regularly. Setae on frontal and lateral sides slightly longer than on remainder parts of head.

Six stemmata on each side of head.

Antennae 2-segmented, set in membranous ring.

Fronto-clypeal suture present. Clypeus distinct, wider than long with a pair of setae and a pair of campaniform sensilla.

Labrum wider than long with anterior margin distinctly emarginate. Labrum of *Chlamydocassis cribripennis* with four setae and four campaniform sensilla dorsally; pair of setae at anterior margin dorsally; emargination of anterior margin with 8 thin, short setae; each lateral side of anterior margin with four long, stout setae.

Mandibles heavily sclerotized, palmate with 4 teeth and with distinct tubercle at molar part. Dorsally mandibles with two setae and two campaniform sensilla.

Maxillae and labium connate. Stipes and palpiger distinct. Dorsally on palpiger place distinct protuberance covered with numerous spines – lacinia. Maxillary palp 2-segmented. Mala, prementum and postmentum distinct. Labial palp 1-segmented. Hypopharynx covered with numerous spines. Ligula inconspicuous.

Legs thin and elongated, 3-segmented, consist of coxa, femur and tibiotarsus with claw at the top. Claw heavily sclerotized, curved, single and simple. At base of claw pulvilli. Pulvilli and claw surrounded by extremely numerous setae. All segments of legs covered by numerous setae, distributed regularly like on body and head. One extremely long seta on femur in the middle of length ventrally.

Pupa
Unknown.

Remarks
The shield that mature larva of *Chlamydocassis cribripennis* carries on supra-anal processes covers nearly 80% of its body (Figs 139, 142). When the larva is resting all the body is covered by shield. The shield is composed of faeces and remnants of previous larval skins. Larger part of shield is made with faeces thus at first glance shield seems to be made only of faeces, without previous larval skins. In mature larvae of *Polychalma multicava* (Latreille, 1811) were observed shields composed only of exuvia (information by courtesy of Donald Windsor and Lukas Sekerka).

Tribe: Basiprionotini Hincks, 1952

The larvae of 14 species were described until now. First instar larva was described only for *Craspedonta leayana* (Świętojańska and Ghate 2003).

First instar larva (based on description of *Craspedonta leayana*)
Body dorso-ventrally flattened, elongate-oval, moderately narrowed posteriorly the widest across meso- and metathorax (Fig. 1). Body with 14 pairs of typical lateral scoli, two pairs of short scoli (prothorax and mesothorax with three pairs, metathorax with two pairs, and each abdominal segment I-VIII with one pair) and a pair of supra-anal processes. Short scoli are in form of three-bulb structure and placed in position of 5th and 7th pair of scoli in other species. Typical lateral scoli are elongated, without lateral branches but covered with more or less elongated cauliflower-shape sensilla. Each thoracic (except for 5th and7th) and the last two abdominal scoli armed apically with elongated, in apical half plumose seta, each of the remaining abdominal scoli and bulbs of 5th and 7th scoli armed with cauliflower-shape sensilla. First two

lateral scoli fused at base and directed anteriorly. Scoli of prothorax and of abdominal segments VII and VIII are the longest. Scoli of abdominal segment I-VI gradualy shortened posteriorly. Supra-anal processes bended dorsally, apically flask-shaped, without apical setae.

Nine pairs of spiracles on dorsal side of body: one pair on thorax and eight on abdomen (one pair on each segment I-VIII). Spiracles elevated and their diameter slightly decreasing posterad.

Dorsal and ventral side of the body distinctly granulate. Very minute setae at border of each tergite and sternite and minute setae placed close to each spiracle. Dorsal surface without long, pointed setae but with cauliflower-shaped sensilla, each placed on distinct tubercle. Sternites of pro-, meso-, metathorax, and first three abdominal segments with long (especially long are setae of abdominal segments), pointed setae. Sternites of abdominal segments IV-VIII with tubercles armed with elongate, in apical half plumose sensilla, which are distinctly longer than sensilla on the dorsal side of body.

Pronotum on each side with 10-12 cauliflower-shaped sensilla. Meso- and metanotum with a pair of very minute setae close to anterior border of the tergites, with two pairs of cauliflower-shaped sensilla placed on tubercles antero-medially, and with row of five cauliflower-shaped sensilla placed on tubercles on each side posteriorly. Each antero-lateral side of meso- and metanotum with single tubercle armed with cauliflower-shaped sensillum. Abdominal tergites with a pair of minute setae at anterior border, and with one minute seta between each anterior border and spiracle. First abdominal tergite on each side with row of three tubercles anteriorly, and with a pair of tubercles postero-medially, each tubercle armed with cauliflower-shaped sensilla. Abdominal tergites II-VIII, on each side, with two pairs of tubercles with cauliflower-shaped sensilla: first placed antero-laterally and the second postero-medially. Each side of tergite with one tubercle with cauliflower-shaped sensillum placed close to spiracle.

Prosternum with two pairs of very minute setae in anterior third. Meso- and metasternum and abdominal sternites with one pair of minute setae at anterior border medially. Pro-, meso- and metasternum with two pairs of setae medially. First three abdominal sternites with 8-10 (sometimes 6) setae medially, two setae or elongate cauliflower-shape sensilla on each postero-lateral side, and one sensillum on each antero-lateral side. On each side of abdominal sternites IV-VI one sensillum placed antero-laterally and two pairs of elongate cauliflower-shape sensilla: one placed antero-medially, the second postero-laterally. Abdominal sternite VII on each side with one elongate cauliflower-shape sensillum antero-medially, one sensillum antero-laterally and a pair of sensilla postero-laterally. Sternite of abdominal segment VIII with sensilla arranged like sternite VII, but without one antero-lateral sensillum. Each elongate cauliflower-shape sensillum placed on tubercle.

Head oval, well sclerotized, hypognathous, retracted into prothorax, its top slightly visible from above. Median suture (endocarina) complete, connected with fronto-clypeal suture. Head with four small vertical setae (V 1-4) and five frontal rows of setae: row Fa (with three setae), Fb (with four setae), Fc (with three setae), Fd (with one seta) and Fe (with two setae). Temporal side of head with three setae (T 1-3).

Six stemmata on each side of head.

Antennae 2-segmented, set in membranous ring. First segment distinctly wider than long with four campaniform sensilla on sides. Second segment stout as long as width with distinct sensory appendix and six small peg-like sensilla at the apex.

Fronto-clypeal suture present. Clypeus distinct, wider than long with a pair of setae and a pair of campaniform sensilla.

Labrum wider than long. Anterior margin emarginate. Labrum of *Craspedonta leayana* with four setae and four campaniform sensilla dorsally; pair of setae dorsally close to anterior margin; emargination of anterior margin with 6 short stout setae; each lateral side of anterior margin with four long, stout setae. Ventral surface of labrum (epipharyngeal area) with two pairs of small setae and 16 small sensilla medially. Central and lateral parts of ventral surface armed with numerous small spines.

Mandibles heavily sclerotized, palmate with 6 triangular, apical teeth in row, and with two setae and two campaniform sensilla on dorsal side.

Maxillae and labium connate. Each stipes with two long pointed setae. Palpiger distinct with two setae and three campaniform sensilla ventrally, and numerous spines dorsally. Mala bear: six pointed setae, one blunt seta, one peg-like sensillum and one campaniform sensillum. Maxillary palp 2-segmented. First segment with two setae and one campaniform sensillum. Second segment with a group of sensilla at apex, and with campaniform sensillum, digitiform sensillum and pointed seta below the apex. Labial palp 1-segmented with a group of sensilla at the apex and one campaniform sensillum below the apex. Hypopharynx covered with numerous spines, and with four campaniform sensilla at base. Prementum with two long and two short setae, and two campaniform sensilla. Postmentum with six setae.

Legs stout, 3-segmented, consist of coxa, femur and tibiotarsus with claw at the top. Claw heavily sclerotized, curved, single and simple armed basally with a pointed seta. Claw surrounded by a complex of 18-21 setae, which are straight and blunt, needle-like to almost hockey-stick-shaped. Tibiotarsus with two campaniform sensilla and one small seta above claw, and with two long setae in dorso-medial part. Femur with 10 long setae; with a group of five campaniform sensilla and one minute seta, and one campaniform sensillum at the distance basally on internal side; and with two campaniform sensilla

basally on external side. Coxa internally with setae arranged in three groups: first with long and two short setae, the second with three short setae, and basal group with long and short seta. Coxa extaernally with three setae.

Mature larva

Body dorso-ventrally flattened, elongate-oval, the widest across metathorax (Fig. 104). Width of prothorax slightly shorter than of meso- and metathorax, width of abdominal segments slightly shortened posteriorly. Body with 16 or 14 pairs of lateral scoli and a pair of supra-anal processes. Lateral scoli of 5th and 7th pair distinctly shorter than remaining (species with 16 lateral scoli) or reduced (species with 14 lateral scoli – for example in *Craspedonta leayana* reduced to a few tubercles; each tubercle armed apically with pointed seta). Prothorax with three pairs of lateral scoli. Mesothorax with three and metathorax with two pairs of lateral scoli (species with 16 pairs of lateral scoli) or mesothorax with two pairs and metathorax with a pair of scoli (species with 14 pairs of lateral scoli). Abdominal segments I-VIII with a pair of scoli. Lateral scoli elongated without lateral branches but covered with small tubercles each apically with pointed setae. Top of each scolus armed apically with pointed 1-2 setae. Scoli more or less subequal in length except for scoli of abdominal segments VII and VIII which are always the longest. First two lateral scoli fused at base and directed anteriorly. Supra-anal processes short and stout, bended dorsally, bear shield composed of previous larval skins and faeces.

Dorsally nine pairs of spiracles: one pair on thorax and eight on abdomen (one pair on each segment I-VIII).

Dorsal and ventral side of body with numerous setae distributed regularly (*Craspedonta leayana*). Setae pointed, placed on small tubercles. Setae of tergites shorter than setae of sternites but placed on higher tubercles. The longest and the most numerous are setae on first three abdominal sternites.

Head oval, well sclerotized, hypognathous, retracted into prothorax, its top slightly visible from above. Median suture (endocarina) complete, connected with fronto-clypeal suture. Surface of head with numerous setae especially on side of head near stemmata.

Six stemmata on each side of head.

Antennae 2-segmented, set in membranous ring. First segment distinctly wider than length, second stout as long as width with distinct sensory appendix and few small peg-like sensilla at the apex.

Fronto-clypeal suture present. Clypeus distinct, wider than long with a pair of setae and a pair of campaniform sensilla.

Labrum wider than long. Anterior margin distinctly emarginate like of *Craspedonta mouhoti* and *Craspedonta leayana*, slightly emarginate like of

Basiprionota cerata (according to ZAITSEV and MEDVEDEV 1982) or without emargination like of *Epistictina viridimaculata* (according to ZAITSEV and MEDVEDEV 1982). Labrum of *Basiprionota cerata*, *Craspedonta leayana*, *C. mouhoti* and *Epistictina viridimaculata* with four setae and four campaniform sensilla dorsally and a pair of setae dorsally close to anterior margin. Emargination of anterior margin of *Basiprionota cerata*, *Craspedonta leayana* and *C. mouhoti* with 6 short setae ventrally. Each lateral side of anterior margin with two (*Craspedonta mouhoti*) or three (*Basiprionota cerata*) or four (*Craspedonta leayana*, *Epistictina viridimaculata*) long setae.

Mandibles heavily sclerotized, palmate, 3-dentate (*Epistictina viridimaculata*) or 6-dentate (*Craspedonta mouhoti*, *Craspedonta leayana*). Dorsally mandibles with two setae and two campaniform sensilla (*Craspedonta leayana*).

Maxillae and labium connate. Stipes and palpiger distinct. Maxillary palp 2-segmented. Mala, prementum and postmentum distinct. Labial palp 1-segmented. Hypopharynx covered with numerous spines. Ligula inconspicuous.

Legs stout, 3-segmented, consist of coxa, femur and tibiotarsus with claw at the top. Claw heavily sclerotized, curved, single and simple. Base of claw of *Craspedonta mouhoti*, *Craspedonta leayana* and *Epistictina viridimaculata* with extremely numerous setae. All segments of legs covered by numerous setae, distributed regularly like on body, the longest setae placed on femur ventrally (*Craspedonta leayana*).

Pupa

Body dorso-ventrally flattened, oval (Fig. 104).

Prothorax broad with anterior margin broadly rounded and with distinct posterior angles. Anterior margin with two pairs of lateral scoli. Meso- and metathorax without scoli. Abdominal segments I-V with flat lateral processes. Scoli without lateral processes, shortened posteriorly. Side of remaining abdominal segments rounded. According to GHATE and RANADE (2002) last abdominal segment of *Epistictina reicheana* without any processes; according to ZAITSEV (1992 b) *Basiprionota westermanni* and *Craspedonta mouhoti* have very short supra-anal processes.

Number of spiracles unknown.

Head with two more or less prominent tubercles, not visible from above except for tubercles.

REMARKS

Larvae carry shield composed of faeces and exuvia (Fig. 127). Faeces are in form of long and short filaments (*Basiprionota schultzei*, *B. sinuata*,

Craspedonta leayana). Before pupation larva lose their shields but pupa remains with the exuvium of the last instar larva.

Tribe: Eugenysini Hincks, 1952

Immatures of only *Eugenysa columbiana* were described (Chaboo 2002).

First instar larva
Unknown.

Mature larva

Body dorso-ventrally flattened, oval, the widest across metathorax (Fig. 89**)**. Width of prothorax shorter than meso- and metathorax, width of abdominal segments distinctly shortened posteriorly. Body with 14 pairs of lateral scoli and a pair of supra-anal processes. Prothorax with three pairs of lateral scoli, mesothorax with two pairs, metathorax and abdominal segments I-VIII with a pair of scoli. Lateral scoli elongated, simple, covered with setae. Scoli of pairs 12-14 the longest. Supra-anal processes bended dorsally, covered with setae, bear shield composed of previous larval skins and faeces.

According to Chaboo (2002) 8 pairs of spiracles: one pair on thorax and seven on abdominal segments I-VII.

In original description (Chaboo 2002) chaetotaxy of body is presented in very confused way thus the only thing which is obvious is that dorsal and ventral side of body are covered with setae.

Head oval, well sclerotized, hypognathous, retracted into prothorax, top slightly visible from above. According to Chaboo (2002) "epicranial suture with stem short, endocarina incomplete, not reaching frontoclypeus". The information should be confirmed. If endocarina and epicranial stem were found then should be also described frontal arms but in original paper there are no information on frontal arms as well as there are no detailed figure of head. Information on setae of head also was not given.

Six stemmata on each side of head.

Antennae 2-segmented, set in membranous ring.

Original description lack information on fronto-clypeal suture (if it present or absent) and on setae of clypeus.

Labrum wider than long, with anterior margin distinctly emarginate. No information on setae of labrum (oryginal description of labrum is very poor without appropriate figures).

Mandibles heavily sclerotized, palmate with 4 teeth. No information on setae.

Maxillae and labium connate. Stipes and palpiger distinct. Maxillary palp 2-segmented. Mala, prementum and postmentum distinct. Labial palp 1-segmented.

Legs stout, 3-segmented, consist of coxa, femur and tibiotarsus with claw at the top. Claw heavily sclerotized, curved, single and simple. According to CHABOO (2002) with "sparse long setation".

Pupa

Body dorso-ventrally flattened, oval.

Prothorax broad with anterior margin broadly rounded and with distinct posterior angles. Lateral processes reduced. Thorax without scoli. Abdominal segments I-V with margins laterally extended into short lobes. Lobes of segments I-III triangular in shape, lobes of next two abdominal segments – rounded. According to CHABOO (2002) last abdominal segment (IX) is without supra-anal processes.

Spiracles elevated; no information on their number.

Head not visible from above.

REMARKS

Shield of larva composed of faeces and exuvia. Previous larval skins distinctly visible between shapeless, small pieces of faeces. Adults show parental care and at list the female after laying an egg mass, stays close to the progeny throughout the egg, larva and pupa period and actively defending them against predator (*Eugenysa coscaroni* VIANA, 1968 – WINDSOR and CHOE 1994; *Eugenysa columbiana* – CHABOO 2002). Moreover the larvae and pupae demonstrate gregarious behaviour.

Tribe: Mesomphaliini (= Stolaini) CHAPUIS, 1875

Immatures of 32 species were described or at least figured up to now. First instar larva was described in detail only for *Cyrtonota lateralis* (ŚWIĘTOJAŃSKA 2008). By courtesy of Oz RITTNER a photo of the mature larva of *Anacassis exarata* (BOHEMAN, 1854) is added to the present paper (Fig. 141).

First instar larva (based on description of *Cyrtonota lateralis*)

Body flattened dorso-ventrally, oval, moderately narrowed posteriorly, widest across meso- and metathorax (Figs 2, 10). Body with 14 pairs of lateral scoli, two pairs of distinct protuberances (prothorax with three pairs of scoli, mesothorax with two pairs of scoli and one pair of protuberances, metathorax with one pair of scoli and one pair of protuberances, each abdominal segment

I-VIII with one pair of lateral scoli) and a single pair of supra-anal processes. Two pairs of protuberances are (each with three long and one short seta) in position of 5th and 7th pair of lateral scoli in other species. Scoli of pairs 1, 2 and 4 of thorax and of abdominal segments I-V the shortest. The rest of scoli more or less of the same length. All lateral scoli without lateral branches, but covered with numerous very long pointed setae. Tops of scoli with one long pointed seta (Fig. 22). Supra-anal processes look like lateral scoli but supra-anal processes are distinctly longer than scoli (2 or 3 times longer). Each supra-anal process is covered with numerous long pointed setae and apically armed with one long pointed seta (Fig. 23).

Nine pairs of spiracles: one on thorax and 8 on abdomen (Figs 66, 67). Spiracles of thorax and abdominal segments I-VII distinctly elevated and their diameter very slightly decreasing posterad. Spiracles of abdominal segment VIII extremely small.

Dorsal and ventral side of the body distinctly granulate. Tergites and sternites with long pointed setae; minute setae at anterior border of each segments (Figs 2, 14, 17, 28-31, 34). Setae of head and legs in similar size as setae of body (Fig. 39). The longest setae are on tergites of thorax, on abdominal sternites IV and VI, on lateral scoli and supra-anal processes.

Pronotum on each side with one minute seta and one campaniform sensillum antero-medially; and with 11 or 12 long setae. Anterior border of meso- and metanotum with a pair of minute setae placed medially and two minute setae on each side laterally. Meso- and metanotum anteriorly with row of 4 long setae medially and with protuberance on each lateral side (protuberances which are in position of 5th and 7th pair of lateral scoli in other species), each protuberance with 3 long setae and one short seta. Meso- and metanotum posteriorly: with two protuberances medially, each with 3 long setae; protuberance with 2 setae on each lateral side; and one seta on each side between protuberances with 3 and 2 setae. Abdominal tergites with a pair of minute setae close to anterior border medially and on each side with two pairs of long setae: first placed antero-laterally and the second postero-medially. Two minute setae and one long seta on each abdominal tergite laterally, close to spiracle. Setae of pronotum placed posteriorly and setae of meso- and metanotum are the longest setae of body.

Anterior border of pro-, meso- and metasternum with two minute setae medially and two minute setae on each side laterally. Pro-, meso- and metasternum in the middle with two pairs of long pointed setae. Anterior margin of all abdominal sternites with a pair of minute setae. First abdominal sternite with 6 setae in the middle of segment and two setae on each lateral side. Abdominal sternites II and III with 6 setae in the middle of segment, one seta on each antero-lateral side, and two setae on each postero-lateral side. Abdominal sternitae IV-VI on each side with one seta placed antero-laterally, and with

two pairs of setae: one placed antero-medially, the second postero-laterally. Abdominal sternite VII with 6 setae. Eight abdominal sternite with 4 setae. One long seta at base of each lateral scoli of segments I to V.

Six stemmata on each side of head (Fig. 42).

Head well sclerotized, hypognathous, retracted into pronotum. Median suture (endocarina) complete, connected with fronto-clypeal suture. Frontal side of head with four small, vertical, pointed setae (V 1-4), and five frontal rows of setae: row Fa (with three setae), Fb (with five setae), Fc (with three setae), Fd (with single seta), Fe (with two setae) and one campaniform sensillum between setae Fc1 and Fe1. Temporal side of head with three setae slightly shorter and thinner than setae of frons (T 1-3) and four campaniform sensilla.

Antennae 2-segmented, set in membranous ring (Fig. 48). Both segments stout. First segment slightly wider than second one, with four campaniform sensilla on sides. Second segment more or less as wide as long or slightly longer than width, with one small seta on side and sensory appendix and five small peg-like sensilla at the apex.

Fronto-clypeal suture present. Clypeus distinct, wider than long, with a pair of setae and a pair of campaniform sensilla.

Labrum wider than long, anterior margin emarginate. Dorsal side of labrum with four long setae and two pairs of campaniform sensilla medially, and two setae close to anterior margin (Fig. 54). Anterior margin with 8 small setae placed medially (not visible from dorsal view) and 4 setae on each side (visible from dorsal as well as ventral view). Mid part of ventral surface (epipharyngeal area) with a pair of small setae, six campaniform sensilla, and 16 small sensilla in 4 or 6 groups. Central and lateral parts of ventral side of labrum armed with numerous small spines.

Mandibles heavily sclerotized, palmate, with four distinct, triangular, apical teeth in one row and with two setae and two campaniform sensilla dorsally at base.

Maxillae and labium connate (Fig. 53). Each stipes with three long pointed setae. Palpiger with two setae and two campaniform sensilla placed ventrally. Distinct protuberance covered with numerous spines placed on palpiger dorsally. Mala and lacinia not distinctly bordered from palpiger. Mala bear: eight long pointed setae, one blunt seta, one very short blunt seta (or peg-like sensillum? Fig. 62), and one campaniform sensillum (Fig. 61). Maxillary palp 2-segmented: first segment with two setae and one campaniform sensillum, second segment with a group of sensilla at apex, and with campaniform sensillum and one seta below the apex. Labial palp 1-segmented with a group of sensilla at the apex and one campaniform sensillum below the apex (Fig. 63). Hypopharynx covered with numerous spines, and with

four campaniform sensilla at base. Prementum with two long and two short setae, and four campaniform sensilla. Postmentum with six setae.

Legs elongated, consist of three segments: coxa, femur and tibiotarsus which armed apically with claw (Fig. 70). Internal side of coxa with setae arranged in three groups: first group with two short, one very long and one shorter seta; second with two short and one long setae; third with one short and one long seta. Externally coxa with one long seta and two short setae. Femur with 11 long setae and one short seta placed dorsally close to the base; with a group of five campaniform sensilla and one short pointed seta basally on internal side; one campaniform sensillum at base ventrally; two campaniform sensilla basally on external side. Tibiotarsus apically with heavily sclerotized, short and curved, single and simple claw armed basally with a pointed seta (Fig. 72). Claw and pointed seta surrounded by a complex of blunt and clubate setae (Fig. 73). Tibiotarsus above claw with one shorter seta and two campaniform sensilla. Setae on tibiotarsus more numerous than on femur. Setae placed ventrally on tibiotarsus distinctly shorter than on dorsal side.

Mature larva

Body dorso-ventrally flattened, elongate-oval, the widest across metathorax (Figs 90, 141). Prothorax narrower than meso- and metathorax, width of abdominal segments slightly shortened posteriorly. Body usually with 14 pairs of lateral scoli (prothorax with three pairs, mesothorax with two, metathorax and each abdominal segment I-VIII with one pair) and a pair of supra-anal processes. According to Buzzi (1980) body of *Acromis spinifex* with 10 pairs of lateral scoli (two pairs on thorax and 8 on abdomen), according to Donceel (1885) body of *Paraselenis axillaris* with 8 lateral scoli (one pair on each abdominal segment I-VIII). Lateral scoli elongated covered with setae, each setae placed on tubercle or scoli with short lateral branch. Supra-anal processes moderately long and stout, bended dorsally, bear shield composed of previous larval skins and faeces.

Dorsally nine pairs of spiracles: one pair on thorax and eight on abdomen (one pair on each segment I-VIII).

Dorsal and ventral side of body with numerous setae distributed regularly. Setae of tergites placed on distinct tubercles, setae of sternites without tubercles or on low tubercles. The most numerous setae are in the middle of abdominal sternites.

Head oval, well sclerotized, hypognathous, retracted into prothorax, not visible from above. Median suture (endocarina) complete, connected with fronto-clypeal suture. Numerous setae distributed regularly on frontal and lateral sides of head.

Six stemmata on each side of head.

Antennae 2-segmented, set in membranous ring.

Fronto-clypeal suture present. Clypeus distinct, wider than long with a pair of setae and a pair of campaniform sensilla.

Labrum wider than long, dorsally with two pairs of setae, two pairs of campaniform sensilla and a pair of setae close to anterior margin. Anterior margin emarginate. Emargination with six short, thin setae ventrally. Each side of anterior margin with 4-5 setae.

Mandibles heavily sclerotized, palmate with 4 teeth. Dorsally mandibles with two setae and two campaniform sensilla.

Maxillae and labium connate. Stipes and palpiger distinct. Dorsally palpiger with small protuberance covered with spines (*Cyrtonota lateralis*). Maxillary palp 2-segmented. Mala distinct. Prementum and postmentum distinct. Labial palp 1-segmented. Hypopharynx covered with numerous spines. Ligula inconspicuous.

Legs stout, 3-segmented, consist of coxa, femur and tibiotarsus with claw at the top. Claw heavily sclerotized, curved, single and simple. Base of claw with numerous setae. All segments of leg covered by numerous setae. Setae as long and as numerous as setae on head and both sides of body. Setae of leg more or less of similar length; one extremely long seta in the middle length of femur ventrally.

Pupa

Body dorso-ventrally flattened, oval, dorsally convex, ventral side flat (Fig. 91).

Prothorax broad with anterior margin broadly rounded and with distinct posterior angles. Anterior margin of pronotum without any lateral processes or with two pairs of processes (*Chelymorpha indigesta* – Frers 1922). Meso- and metathorax without scoli. Abdominal segments I-IX with a pair of processes. Scoli without lateral branches. Scoli of segment I-V the most prominent covered with setae. Lateral processes of abdominal segments IV-IX short.

Abdominal tergites I-VII with a pair of spiracle (*Cyrtonota lateralis* – Świętojańska 2008).

Head not visible from above.

Exuvium of last instar larva remain attached to the pupa.

Remarks

Larvae carry shield composed only of exuvia [*Stolas cucullata* (Boheman, 1862; *S. lebasii* (Boheman, 1850) – information by courtesy of Donald Windsor)] or with exuvia and faeces [*Terpsis quadrivittata* (Champion, 1893), information by courtesy of Donald Windsor; *Stolas ephippium* (Lichtenstein, 1795), information by courtesy of Lukas Sekerka; *Anacassis exarata* (Bohe-

MAN, 1854), information by courtesy of Oz RITTNER – Fig. 141]. Within tribe Mesomphaliini, parental care were observed in species belonging to three genera: *Acromis* CHEVROLAT, 1837, *Omaspides* CHEVROLAT, 1837 and *Paraselenis* SPAETH, 1913b (Figs 157-166). Larvae of species belonging to *Stolas* BILLBERG, 1820 are gregarious (WINDSOR and CHOE 1994).

Tribe: Dorynotini MONROS et VIANA, 1949

Four species were described untill now: *Dorynota monoceros*, *Dorynota pugionata*, *Paranota ensifera* and *Paranota spinosa* (FIEBRIG 1910; BUZZI 1976a).

First instar larva
Unknown.

Mature larva
Body dorso-ventrally flattened, oval, the widest across metathorax. Width of prothorax shorter than of meso- and metathorax, width of abdominal segments distinctly shortened posteriorly. Body with 17 pairs of lateral scoli and a pair of short and stout supra-anal processes. Prothorax with four pairs of lateral scoli, mesothorax with three pairs, metathorax with two pairs, and each abdominal segment I-VIII with a pair of scoli. Lateral scoli elongated, simple, covered with short setae. Supra-anal processes bended dorsally, bear shield composed of previous larval skin and faeces.

Dorsally nine pairs of spiracles: one pair on thorax and eight on abdominal segments I-VIII.

Dorsal and ventral side of *Dorynota pugionata* body with numerous setae distributed regularly. Setae on dorsal side more or less of similar length on whole surface, setae on ventral side slightly longer than previous one.

Head oval, hypognathous, not visible from above. Median suture (endocarina) complete, connected with fronto-clypeal suture. Frons of head (*Dorynota pugionata*) with numerous setae, distributed regularly.

Six stemmata on each side of head.

Antennae 2-segmented, set in membranous ring.

Fronto-clypeal suture present. Clypeus distinct, subrectangular. No information on setae.

Labrum wider than long, with anterior margin strongly emarginate. In descriptions no information on setae of labrum but according to drawings of *Dorynota pugionata* (BUZZI 1976a) labrum with two pairs of setae and two pairs of campaniform sensilla. Each lateral side of anterior margin with 5 setae.

Mandibles heavily sclerotized, palmate with six teeth. According to drawing of *Dorynota pugionata* (Buzzi 1976a) with two setae and two campaniform sensilla.

Maxillae and labium connate. Stipes and palpiger distinct. Maxillary palp 2-segmented. Mala, prementum and postmentum distinct. Labial palp 1-segmented.

Legs stout, 3-segmented, consist of coxa, femur and tibiotarsus with claw at the top. Claw heavily sclerotized, curved, single with tooth at base. Legs covered with numerous setae, setae distinctly longer on ventral side of femur (*Dorynota pugionata*).

Pupa

Body dorso-ventrally flattened.

According to Buzzi (1976a) pupa of *Dorynota pugionata* possess 9 pairs of lateral scoli: one pair on each abdominal segment I-IX. Toracic segments without lateral scoli. Lateral scoli conical which gradually shortened towards posterior part of body. Each process without lateral branches. Last abdominal segments of pupa of *Dorynora pugionata* are covered by larval skin of last instar. No information on processes of last abdominal segment of pupa.

Six pairs of spiracles, one pair on each abdominal segment I-VI.

Head not visible from above.

Remarks

Shield attached to the supra-anal processes of larva is composed of previous larval skins and faeces. On base of larval skins faecal matter forms long, numerous filaments. In the last instar larva of *Dorynota pugionata* was observed that pices of faecal shield easily fall down.

Tribe: Physonotini Spaeth, 1942

Immatures of 8 species have been described until now: *Asteriza flavicornis, Cistudinella obducta, Eurypepla calochroma, E. jamaicensis, Physonota alutacea, Ph. arizonae, Ph. helianthi, Ph. unipunctata* (Fiebrig 1910; Böving and Craighed 1930; Woodruff 1976a; Sanderson 1948; Świętojańska and Medeiros 2007; Świętojańska and Windsor 2008). Egg and gregarious larvae of *Cistudinella notata* (Boheman, 1854) were figured (Flinte et al. 2008). First instar larva was described for *Cistudinella obducta* and *Physonota alutacea* (Świętojańska and Medeiros 2007; Świętojańska and Windsor 2008).

First instar larva (based on describtions of *C. obducta* and *Ph. alutacea*)

Body flattened dorso-ventrally, oval, moderately narrowed posteriorly, widest across meso- and metathorax (Figs 3, 4, 8, 9). Body with 16 pairs of

lateral scoli (prothorax and mesothorax with three pairs, metathorax with two pairs, and each abdominal segment I-VIII with one pair – *Cistudinella obducta*) or with 14 pairs (prothorax with three pairs, meso- and metathorax with two pairs, each abdominal segment I-VII with one pair – *Physonota alutacea*) and a single pair of long supra-anal processes. In *Cistudinella obducta* scoli quite long (as long as width of body or longer) except for scoli 4th, 5th,7th, 9th and 13th pairs; scoli of 4th pair visible from ventral side, dorsally hidden under spiracles of thorax; scoli of 5th and 7th pair visible from dorsal side; scoli 15th and 16th pairs the longest but of 16th slightly longer than of 15th. In *Physonota alutacea* lateral scoli very short (as long as or slightly longer than half width of body), more or less of the same length except for scoli of first pair which are the shortest. All lateral scoli without lateral branches, but covered with numerous long setae. Tops of scoli with one long seta (Fig. 16). Setae of scoli covered with spinulae. Supra-anal processes sinuate, bent dorsally. In *C. obducta* 2/3 apical length of supra-anal processes covered with numerous spinulae, apex flask-shaped without apical setae (Fig. 27). Supra-anal processes of *Ph. alutacea* stout, 4-5 times longer than lateral scoli, without spinules, covered with numerous setae, apex of supra-anal processes acute without apical setae (Fig. 26).

Nine pairs of spiracles (one on thorax and 8 on abdomen), each elevated, their diameter very slightly decreasing posterad (Figs 64, 65, 69). In *Ph. alutacea* spiracles of thorax not visible from dorsal view.

Dorsal and ventral side of the body distinctly granulate. Tergites and sternites with long setae, and with minute setae at anterior border of each segment. Setae of tergites covered with small spines at the top (Figs 32, 33). Setae of sternites pointed. Setae of head and legs in similar size as setae of body and most of them covered with small spines at the top (Figs 37, 38). The longest setae are on abdominal sternites (Figs 12, 13).

Pronotum on each side with one minute seta antero-laterally and with 12 (*Cistudinella obducta*) or more (26-31 – *Physonota alutacea*) long setae. On each side of pronotum also 2-4 campaniform sensilla placed close to medial line of body. Meso- and metanotum with a pair of very minute setae at anterior border of tergite and with two rows of 10 long setae (*C. obducta*) or with a group of two to four long setae on each antero-lateral side and with two rows of long setae: one placed anteriorly with around 14 setae and second placed posteriorly with about 25 setae (*Ph. alutacea*). All abdominal tergites with a pair of minute setae at anterior border medially. In *C. obducta* first abdominal tergite on each side with four long setae anteriorly, and with a pair of long setae postero-medially; remaining abdominal tergites on each side with two pairs of long setae: first placed antero-laterally and the second postero-medially; on each abdominal tergite two minute setae and one long seta laterally, close to spiracle. In *Ph. alutacea* each abdominal tergite with

two rows of long setae; rows of individual segments with the same number of setae which decreasing posteriorly: from 11 on abdominal tergite I to 6 on tergite VIII. Each abdominal tergite also with two minute setae, one or two long setae laterally, close to spiracle.

In *C. obducta* anterior border of prosternum with 6 minute setae; anterior margin of meso- and metasternum with four minute setae; two minute setae at anterior border of abdominal sternites. In *Ph. alutacea* a few minute setae at anterior border of all sternites. Pro-, meso- and metasternum in the middle with two pairs of pointed setae (*C. obducta*) or with numerous setae (*Ph. alutacea*). In *C. obducta* abdominal sternites I-VII with 6 setae medially and on each side two setae postero-laterally and one seta antero-laterally. Eight abdominal sternite with row of 6 setae. In *Ph. alutacea* abdominal sternites covered with numerous setae of different length. The longest setae of body are setae on abdominal sternites (Figs 12, 13).

Six stemmata on each side of head (Fig. 45).

Head hypognathous, oval, well sclerotized (Figs 45, 46). Median suture (endocarina) complete, connected with fronto-clypeal suture. Frontal side of head of *C. obducta* with four small, vertical, pointed setae (V 1-4), five rows of setae: row Fa (with three setae), Fb (with five setae), Fc (with three setae), Fd (with single seta), Fe (with two setae), two campaniform sensilla between setae Fc1 and Fe1 and two additional setae placed close to vertical setae; temporal side of head of *C. obducta* with three setae (T 1-3) slightly shorter and thinner than setae of frons and four campaniform sensilla. Head of *Ph. alutacea* with setae as in *C. obducta* and with numerous long and short additional setae. In both species short setae pointed, long setae covered with small spines (Figs 37, 38).

Antennae 2-segmented, set in membranous ring (Figs 47, 49). Both segments stout. First segment slightly wider than second one, with four campaniform sensilla on sides. Second segment more or less as wide as long or slightly longer than width, with one small seta on side and sensory appendix and five small peg-like sensilla at the apex.

Fronto-clypeal suture present. Clypeus distinct, wider than long, with a pair of setae and a pair of campaniform sensilla.

Labrum wider than long, anterior margin not or slightly emarginate. Dorsal side of labrum with four long setae and two pairs of campaniform sensilla placed centrally and two setae close to anterior margin. Mid part of ventral surface (epipharyngeal area) with a pair of small setae, six campaniform sensilla, and four groups of four small sensilla. Central and lateral parts of ventral side of labrum armed with numerous small spines. Anterior margin with 14 setae: 8 placed medially and three setae on each side (Figs 51, 52).

Mandibles heavily sclerotized, palmate, with three distinct, triangular, apical teeth in one row and four small teeth distinctly moved back (*C. ob-*

ducta) or with four apical teeth in one row and two small moved back (*Ph. alutacea*). Dorsal side of mandibles at base with two setae and two campaniform sensilla.

Maxillae and labium connate (Fig. 52). Each stipes with 3-4 long pointed setae. Mala and lacinia not distinctly bordered from palpiger. Visible dorsally and ventrally, broad, truncate at the apex mala bear: eigth long pointed setae, one blunt seta, one very short blunt seta (or peg-like sensillum?), and one campaniform sensillum. Lacinia in form of protuberance covered with numerous spines placed on palpiger dorsally (Figs 57, 58, 60). Ventrally palpiger with two setae and two campaniform sensilla (*C. obducta*) or with four long pointed setae (*Ph. alutacea*). Maxillary palp 2-segmented: first segment with 2-3 setae and one campaniform sensillum, second segment with a group of sensilla at apex, and below the apex with campaniform sensillum and one seta. Labial palp 1-segmented with a group of sensilla at the apex and one campaniform sensillum below the apex. Hypopharynx covered with numerous spines, and with four campaniform sensilla at base. Prementum with two long and two short setae, and four campaniform sensilla. Postmentum with two long and four shorter setae (*C. obducta*) or with two long and 8 shorter setae (*Ph. alutacea*).

Legs elongated, 3-segmented consist of: coxa, femur and tibiotarsus. Tibiotarsus with heavily sclerotized, short and curved, single and simple claw apically which armed basally with a pointed seta. In *Cistudinella obducta* were observed a pair of pulvilli at base of claw (Figs 76, 78). Claw surrounded by a complex of more or less numerous setae (Figs 74-78). Tibiotarsus with two campaniform sensilla and one small seta above claw, and with four long setae (*C. obducta*) in dorsal part or numerous setae (*Ph. alutacea*) distributed on whole length. Femur with 11 long setae and one short seta close to the base dorsally (*C. obducta*) or with numerous setae (*Ph. alutacea*) distributed on whole length. Femur also with a group of five campaniform sensilla and one short pointed seta basally on internal side; one campaniform sensillum at base ventrally; and two campaniform sensilla basally on external side. Coxa of *C. obducta* internally with setae arranged in three groups: first with two short, one very long and one shorter setae; second with three short setae; third with two short setae; externally coxa with three setae. Coxa of *Ph. alutacea* with two long setae and around 16 shorter setae.

Mature larva

Body dorso-ventrally flattened, oval, the widest across metathorax (Figs 93-95). Width of prothorax shorter than of meso- and metathorax, width of abdominal segments distinctly shortened posteriorly. Body with 11 (prothorax with two pairs, meso-, metathorax and each abdominal segment I-VII with one pair – *Physonota arizonae, Ph. helianthi*), 14 (prothorax with three pairs, meso-, metathorax with two pairs, and each abdominal segment I-VII with

one pair – *Eurypepla calochroma, E. jamaicensis, Physonota alutacea, Ph. unipunctata*,) 15 (prothorax with three pairs, meso-, metathorax with two pairs, and each abdominal segment I-VIII with one pair – *Asteriza flavicornis*) or 16 (pro- and mesothorax with three pairs, metathorax with two pairs, and each abdominal segment I-VIII with one pair – *Cistudinella obducta*) pairs of lateral scoli and a pair of supra-anal processes. Scoli of *Eurypepla calochroma, E. jamaicensis, Physonota alutacea, Ph. arizonae, Ph. helianthi, Ph. unipunctata* short and conical at the top slightly bended posteriorly. Scoli of *Asteriza flavicornis* also short but in opposite to previously listed species – straight. Scoli of *Cistudinella obducta* elongated and straight with numerous lateral branches and less numerous setae. Supra-anal processes long, with apical half less sclerotised than basal (*Cistudinella obducta*) or long and strongly sclerotised on whole length (*Physonota alutacea, Ph. arizonae, Ph. helianthi, Ph. unipunctata*) or short and strongly sclerotised (*Asteriza flavicornis, Eurypepla calochroma, E. jamaicensis*).

Dorsally nine pairs of spiracles: one pair on thorax and eight on abdominal segments I-VIII. Spiracles of thorax often not visible from dorsal view.

Dorsal and ventral side of body with numerous setae distributed regularly. Setae on dorsal side more or less of similar in length on whole surface, setae on ventral side slightly longer than previous one especially setae on abdomen medially. Tergites with numerous long (*Asteriza flavicornis, Cistudinella obducta*) or short (*Physonota alutacea*) setae. Setae of tergites placed on elongated (*Cistudinella obducta*) or stout (*Asteriza flavicornis*) or small (*Physonota alutacea*) tubercles. Sternites with numerous setae mostly without tubercles. Setae of sternites distinctly longer (*Cistudinella obducta, Physonota alutacea*) than setae of tergites or almost as long as (*Asteriza flavicornis*) setae of tergites. On ventral side of body the longest and the most numerous are setae in the middle of all abdominal sternites (*Physonota alutacea*) or in the middle of abdominal sternites I-III (*Asteriza flavicornis*) or in the middle of abdominal sternites II-V (*Cistudinella obducta*).

Head oval (Fig. 107), hypognathous, not visible or top slightly visible from above. Median suture (endocarina) complete, connected with fronto-clypeal suture. Head with extremely numerous setae, distributed regularly.

Six stemmata on each side of head (Fig. 106).

Antennae 2-segmented, set in membranous ring (Fig. 119).

Fronto-clypeal suture present. Clypeus distinct, subrectangular with a pair of setae and a pair of campaniform sensilla (*Asteriza flavicornis*) or with a pair of long setae, a pair of campaniform sensilla and a few short setae at base (*Physonota alutacea, Cistudinella obducta*).

Labrum wider than long (Fig. 114), emarginate (*Physonota alutacea, Asteriza flavicornis*) or almost without emargination (*Cistudinella obducta*).

Dorsal surface of labrum with four setae and four campaniform sensilla (*Cistudinella obducta*, *Asteriza flavicornis*) or with four long setae and numerous short setae medially (*Physonota alutacea*). Two setae in *Physonota alutacea* and *Asteriza flavicornis* at anterior margin of labrum dorsally. Anterior margin with 14 setae.

Mandibles palmate with three teeth and 3 to 4 small teeth moved back (*Cistudinella obducta*) or four teeth and tubercle at molar part (*Asteriza flavicornis*) or five teeth and one teeth moved back (*Physonota alutacea*). Dorsally mandibles with two setae and two campaniform sensilla (*Cistudinella obducta*, *Asteriza flavicornis*) or with two long setae two campaniform sensilla and a few short setae (*Physonota alutacea*).

Maxillae and labium connate**.** Stipes and palpiger distinct. Dorsally palpiger with distinct protuberance covered with numerous spines – lacinia (Fig. 124). Maxillary palp 2-segmented. Mala distinct. Prementum and postmentum distinct. Hypopharynx covered with numerous spines (Fig. 123). Ligula inconspicuous. Labial palp 1-segmented. Each stipes with 5-6 (*Cistudinella obducta, Asteriza flavicornis*) long pointed setae or with 5-6 long and numerous short setae (*Physonota alutacea*). Mala and lacinia not distinctly bordered from palpiger. Broad, truncate at the apex mala bear: eigth long pointed setae, one blunt seta, one very short blunt seta (or peg-like sensillum?), and one campaniform sensillum (Figs 120, 125). Lacinia in form of protuberance covered with numerous spines placed on palpiger dorsally (Fig. 124). Ventrally palpiger with two setae and two campaniform sensilla (*C. obducta*), or with 3-4 setae and 1-2 campaniform sensilla (*A. flavicornis*) or with 5-6 long, few short setae and one campaniform sensillum (*Ph. alutacea*). Maxillary palp 2-segmented: first segment with 2 setae and one campaniform sensillum (*C. obducta, A. flavicornis*) or with 7-8 setae and one campaniform sensillum (*Ph. alutacea*), second segment with a group of sensilla at apex, and below the apex with campaniform sensillum and one seta. Labial palp 1-segmented with a group of sensilla at the apex (Fig. 121) and one campaniform sensillum below the apex (*C. obducta, A. flavicornis*) or with a group of sensilla at the apex, one campaniform sensillum and 5-8 setae below the apex (*Ph. alutacea*). Hypopharynx covered with numerous spines, at base with four campaniform sensilla (*C. obducta*) or with 2-4 setae and 4-6 campaniform sensilla at base (*Ph. alutacea*) or with 2 setae and 4 campaniform sensilla (*A. flavicornis*). Prementum with two long and two short setae, and four campaniform sensilla (*C. obducta*) or with 2 long, 2-6 short setae and 4 campaniform sensilla (*Ph. alutacea*) or with 4 long, 2 short setae and 2 campaniform sensilla (*A. flavicornis*). Postmentum with numerous long and short setae.

Legs stout, 3-segmented, consist of coxa, femur and tibiotarsus with claw at the top. Claw heavily sclerotized, curved, single with single seta at base.

Legs covered with numerous setae. Setae more or less of the same length except for two long setae in the middle length of femur ventrally. Extremely numerous are setae on sides and at base of claw. Until now only in *Cistudinella obducta* a pair of pulvilli were observed at base of claw.

Pupa

Body dorso-ventrally flattened, short-oval, dorsal side strongly convex (Figs 96, 97).

Prothorax broad with anterior margin broadly rounded. Anterior margin of prothorax usually without lateral processes but in *Asteriza flavicornis* two short processes on each side were observed. Thorax without lateral scoli.

Physonota helianthi: abdominal segments I-III with margins laterally extended into short lobes in shape of short traingular tubercles, lateral side of next abdominal segments rounded.

Asteriza flavicornis, Physonota alutacea and *Ph. unipunctata*: abdominal segments I-V with distinct lateral scoli, which gradually shortened posteriorly. Each process without lateral branches.

Seven pairs of spiracles on abdominal tergites I-VII. Spiracles of segments I-V distinct, diameter of spiracles gradually shortened posteriorly, spiracles of segments VI and VII very small.

Head not visible from above.

Remarks

Larvae without shield (*Physonota alutacea, Asteriza flavicornis*) or with shield composed only of exuvia (*Cistudinella obducta* – Fig. 140) or exuvia and faeces (*Eurypedus nigrosignatus* (Boheman, 1854) – information by courtesy of Donald Windsor; Gómez et al. 1999).

Tribe: Cassidini Gyllenhal, 1813

Within this tribe immatures of 136 species have been hitherto described or figured. First instar larva was described in detail for 9 *Cassida* species: *C. denticollis, C. nebulosa, C. nobilis, C. prasina, C. rubiginosa, C. sanguinosa, C. snguinolenta, C. stigmatica, C. vittata* (Borowiec and Świętojańska 2003; Świętojańska 2004b, 2005a, 2005c). By courtesy of Donald Windsor photos of *Microctenochira championi* (Spaeth, 1926b) are added to the present paper.

First instar larva

Body flattened dorso-ventrally, oval, moderately narrowed posteriorly, widest across meso- and metanotum (Figs 5, 6, 11, 145). Body with 16 pairs of lateral scoli (pro- and mesothorax with three pairs, metathorax with two

pairs, and each abdominal segment I-VIII with one pair) and a single pair of long supra-anal processes, more or less as long as body length or shorter (as 2/3 to ½ of body length). Lateral scoli of thorax usually (except for scoli of pairs 5th and 7th) more or less equal in length and approximately as long as half width of meso- and metathorax. Within described species thoracic scoli of only *C. stigmatica* shorter, more or less as long as ¼ width of body (Figs 11, 18). Lateral scoli of abdominal segment I to VI shortened posteriorly. Lateral scoli 15th and 16th pair the longest (but scoli of 16th pair slightly longer than of 15th) and they are usually two to three times shorter than supra-anal processes. First and second lateral scoli fused at the base and directed anteriorly. First pair of lateral scoli with two to three lateral branches, the other scoli simple, without lateral branches but covered with a few, more or less elongate cauliflower sensilla. Lateral scoli armed apically with elongate truncate setae at the apex covered with scales or armed apically with more or less elongate cauliflower sensilla (Figs 18-21). Lateral scoli 15th and 16th usually armed apically with a simple seta but in *C. stigmatica* armed apically with cauliflower-shape sensilla. Supra-anal processes sinuate, bent dorsally, basal half to 2/3 covered with spinules, apically flash-shaped without any setae (Figs 24, 25).

Nine pairs of spiracles (one on thorax and 8 on abdomen), each elevated, their diameter very slightly decreasing posterad (Fig. 68).

Dorsal and ventral surface of body granulate. Very minute setae at border of each tergite and sternite and two minute setae placed close to each spiracle. Dorsal surface with cauliflower-shaped sensilla, the size of which very slightly decreases posteriorly. Sternites of pro-, meso-, metathorax, and first two to three abdominal segments with long (especially long are setae of abdominal segments) pointed setae (Fig. 35). Sternites of remaining abdominal segments with cauliflower-shaped sensilla, which are slightly larger than those of the dorsal surface of body (Figs 15, 36).

Pronotum on each side with with 10 cauliflower-shaped sensilla. Often on each antero-lateral side of pronotum one or two campaniform sensilla, or campaniform sensillum and minutae seta. Sometimes occurs an additional campaniform sensillum placed postero-laterally. Meso- and metanotum with two pairs of very minute setae at anterior border of tergite, a pair of cauliflower-shaped sensilla antero-medially, and row of five cauliflower-shaped sensilla on each side posteriorly. Each antero-lateral side of meso- and metanotum with a single cauliflower-shaped sensillum. All abdominal tergites with a pair of very minute setae at anterior border and with two minute setae close to each spiracle. First abdominal tergite on each side with 3-4 cauliflower-shaped sensilla anteriorly and two caulifrower-shaped sensilla postero-medially. Abdominal segments II-VIII on each side with two pairs of cauliflower-shaped sensilla: first placed antero-laterally and the second

postero-medially. Each tergite with one cauliflower-shaped sensillum placed laterally, close to spiracle.

Sternites of thorax with two pairs of minute setae at anterior border. Pro-, meso- and metasternum with two pairs of setae medially. Sternitae of abdomen with one pair of minute setae at anterior border. Usually first three abdominal sternites with long pointed setae medially, two cauliflower-shape sensilla postero-laterally and one cauliflower-shape sensillum antero-laterally. Until now only in *C. stigmatica* were observed that long pointed setae are only on first two abdominal sternites medially. First three abdominal sternites usually with 8 pointed setae medially (*C. sanguinolenta*). Sometimes first segment with 10 pointed setae (*Cassida rubiginosa, C. nebulosa*). The most variable is number of setae of third sternite. Third abdominal sternite can be with 6 pointed setae (*C. sanguinosa*); or with 4 pointed setae and 2 cauliflower-shape sensilla (*C. prasina*); or with 6 pointed setae and 2 cauliflower-shape sensilla (*C. denticollis*), or with 4 pointed setae and 4 cauliflower-shape sensilla (*C. nebulosa, C. nobilis, C. vittata*). Each side of abdominal sternite IV-VI with one cauliflower-shape sensillum antero-laterally, and two pairs of cauliflower-shape sensilla: first pair placed antero-medially, the second postero-laterally. Each side of abdominal sternite VII with one sensillum antero-medially, one sensillum antero-laterally, and a pair of sensilla postero-laterally. Ventral side of abdominal segment VIII with sensilla arranged like on sternite VII, but without one sensillum placed postero-laterally.

Stemmata six on each side of head. Five of the same size and one very small (Figs 43, 44).

Head hypognathous, oval, well sclerotized. Median suture (endocarina) complete, connected with fronto-clypeal suture. Frontal arms and epicranial suture absent. Frontal side of head with four small, vertical setae (V 1-4) and five frontal rows of setae or campaniform sensilla: row Fa (with three setae), Fb (with four or five setae), Fc (with three setae), Fd (with a single seta), Fe (with one or two setae). One campaniform sensillum in area close to seta Fc1. Temporal side of head with three setae (T 1-3) and a single campaniform sensillum. Head covered with truncate or plumose setae or with cauliflower-shape sensilla (Figs 40, 41).

Antennae 2-segmented, set in membraneous ring (Fig. 50). First segment slightly wider than length with four campaniform sensilla on sides. Second segment stout as long as width or slightly longer than width or distinctly longer than width with one seta on side and one sensory appendix and three small peg-like sensilla at the top.

Fronto-clypeal suture present. Clypeus distinct, wider than long, with a pair of setae and a pair of campaniform sensilla.

Labrum wider than long, with distinctly emarginate anterior margin. Mid part of ventral surface (epipharyngeal area) with a pair of small setae, two

pairs of campaniform sensilla, and two irregular groups of a few small sensilla. Central and lateral parts of ventral side of labrum armed with numerous small spines. Anterior margin with six (long or short, thin or stout) setae placed in emargination, and with 2-4 long and stout setae on each side. One seta on each side of anterior margin dorsally. Dorsal side of labrum with four setae and two pairs of campaniform sensilla medially (Fig. 55).

Mandibles heavily sclerotized, palmate, with six triangular, apical teeth: five in row and sixth slightly retracted. Dorsal side of mandibles at base with two setae and two campaniform sensilla.

Maxillae and labium connate (Fig. 56). Stipes distinct with two long pointed setae. Mala and lacinia not distinctly bordered from palpiger. Palpiger distinct, at basal part heavily sclerotised with two setae and three campaniform sensilla ventrally and a group of numerous spines dorso-laterally (lacinia? Fig. 59). Maxillary palp 2-segmented. First segment of maxillary palpi with two setae and one campaniform sensillum. Second segment with a group of sensilla at apex, and with one campaniform sensillum, one digitiform sensillum and one seta below the apex. Mala bear six pointed setae, one blunt seta, one peg-like sensillum one campaniform sensillum. Labial palp 1-segmented with a group of sensilla at the apex and one campaniform sensillum below the apex. Hypopharynx divided, covered with spines, and with six large campaniform sensilla at base. Prementum with two long and two short setae and four campaniform sensilla. Postmentm with two long and four shorter setae.

Legs stout 3-segmented, consist of coxa, femur and tibiotarsus which armed apically with claw. Tibiotarsus with heavily sclerotized, short, curved, single and simple claw apically which armed basally with a pointed seta. Claw surrounded by a complex of 6 setae which are at the top from slightly curved to almost hockey-stick-shaped (Figs 71, 79). Tibiotarsus with two campaniform sensilla and one small seta above claw, and with two long setae placed dorso-medially. Femur with 8 long setae on internal side; three long setae on external side; one short seta close to the base dorsally; a group of five campaniform sensilla and one short pointed seta, and one campaniform sensillum at a distance basally on internal side; and two campaniform sensilla basally on external side. Coxa on internal side with setae arranged in three groups: first group with one long and three short setae, second with three short setae, and third group with two short setae. Externally coxa with three short setae.

Mature larva

Body usually distinctly flattened dorso-ventrally (Figs 101, 103, 143, 144), in some species body slightly flattened dorso-ventrally (*Oxylepus deflexicollis* – Bordy 2000), rarely not flattened, with strongly convex thoracic tergites

(*Ischyronota conicicollis, I. desertorum* – Świętojańska and Borowiec 2007b) (Fig. 100). Body usually oval, widest across meso- and metanotum, narrowed posteriorly (Figs 98, 99, 144, 146, 148), with 16 pairs of lateral scoli (prothorax and mesothorax with three pairs, metathorax with two pairs, and each abdominal segment I-VIII with one pair) and a pair of supra-anal processes (Figs 99, 126, 146). In some species lateral scoli absent (*Ischyronota desertorum*) or present only on abdominal segments (in *Ischyronota conicicollis* were observed 8 pairs of scoli – Fig. 98). Lateral scoli very long (length of scoli as long as half width of body or longer; *Cassida informis, C. pusilla, C. uniorbis, C. varians* – Bordy 2000; Świętojańska 2005; Świętojańska and Borowiec 2007a) or moderately long (length of scoli shorter than half width of body; *Cassida flaveola, C. nebulosa, C. panzeri, C. parvula, C. stigmatica* – Bordy 2000; Matis 1970) with numerous lateral branches. Each lateral scolus and lateral branch armed apically with one seta or cauliflower-shape sensillum. In some species scoli reduced to short processes which are without lateral branches (*Oxylepus deflexicollis*, *Ischyronota conicicollis*). In some species one or two lateral branches of second pair of scoli as long and stout as lateral scoli thus some authors describe them as additional lateral scoli (*Charidotella bifossulata, Charidotella opulenta, Drepanocassis profana* – Dugés 1887; Buzzi and Winder 1986). Supra-anal processes usually long, bent dorsally, carry faecal shield composed of larval skin or with larval skin and faeces. In larvae of *Oocassida* were observed fused together supra-anal processes into one forked at the top process (*Oocassida cruenta* – Takizawa 1980).

Nine pairs of spiracles. Spiracles of thorax the most prominent. Size of spiracles of abdominal sternites very slightly decreasing posterad. Often spiracles on abdominal segment VIII hardly visible, not elevated, slightly depressed, best visible in prepared speciments – on slides.

Dorsal and ventral side of the body with numerous setae or setae and elongated cauliflower-shaped sensilla. There are often two pairs of minutae setae on each thoracic tergite and sternite close to anterior border, a pair of minute setae on each abdominal tergite and sternite close to anterior border medially, and at base of each leg 2 or 3 minutae setae. Tergite with elongate cauliflower-shaped sensilla placed on more or less prominent tubercles. Sternite, especially sternite of thorax and abdominal segments I to III, mostly with pointed setae. Remainder abdominal sternites (IV-VIII) with cauliflower-shape sensilla.

Setae of pronotum often arranged in two circles with one, two or a few sensilla in the middle of each circle. Meso-, metanotum and abdominal tergites with two rows of sensilla; sensilla tend to decrease their number and size posteriorly.

Pro-, meso- and metasternum in the middle with: two pairs of pointed setae; or two groups of pointed setae anteriorly and one pair of pointed setae

posteriorly; or four groups of pointed setae (two groups placed anteriorly and two posteriorly). Each lateral side of thoracic sternites with group of pointed setae or cauliflower-shape sensilla. Setae and sensilla on each abdominal sternite forming irregular row along width of segment. Setae in the middle of first three abdominal sternites most numerous and longest. Number and size of setae of sternites decreases posteriorly.

Head hypognathous, retracted into pronotum, hardly visible from above, oval and well sclerotized. Median suture (endocarina) complete, connected with fronto-clypeal suture. Clypeus distinct, wider than long, with a pair of setae and a pair of campaniform sensilla.

Six stemmata on each side of the head (Fig. 108). In some species were observed five stemmata and one pigmented spot in place were other species has stemma of sixth pair (*Ischyronota conicicollis*).

Frontal side of head with four small, vertical setae (V 1-4) and five frontal rows of setae: row Fa with three setae, Fb with fine setae, Fc with three setae, Fd with single seta, Fe with two setae. In area between rows Fb and Fe appear campaniform sensilla. Temporal side of head with three setae (T 1-3) and two or three campaniform sensilla. Frons of head with pointed setae or with more or less elongate cauliflower-shaped sensilla (Figs 108, 109). Temporal side usually with pointed setae. In some species some of these listed setae are absent in other some additional setae are present.

Antennae 2-segmented, set in membraneous ring. First segment stout wider than long often with two pairs of campaniform sensilla. Second segment distinctly longer than width or as long as width, usually with few (2-4) small peg-like sensilla and prominent sensory apendix at the apex, and one seta on side.

Labrum wider than long, with emarginate anterior margin (Figs 107, 111, 113, 114). Emargination of labrum more or less distinct. Mid part of ventral surface (epipharyngeal area) with a pair of small setae, four campaniform sensilla and two irregular groups of a few sensilla (sensilla placodea?). Central and lateral parts of ventral side of labrum armed with numerous small spines. Anterior margin with six setae medially (in emargination), and with 2-4 setae on each side. Dorsal side of labrum with four setae, and four campaniform sensilla medially and two setae close to anterior margin.

Mandibles heavily sclerotized, usually 6-dentate, teeth blunt at apex, teeth 2-5 with crenulate anterior margin. Sixth tooth distinctly moved back. Mandibles with 7 teeth were observed in *Cassida piperata* (Lee 1994); 5-dentate in *Cassida exilis* (Takizawa 1980); 4-dentate in *Charidotis gemellata* (Fernandes and Buzzi 2007). At base of dorsal side of the mandible two setae and 2-3 campaniform sensilla.

Maxillae and labium connate (Figs 111, 112). Stipes and palpiger distinct. Maxillary palp 2-segmented (Figs 112, 115, 116, 118). Sometimes 1-segmen-

ted (*Ischyronota desertorum*, Fig. 117). Mala, prementum and postmentum distinct. Labial palp 1-segmented. Hypopharynx covered with numerous spines. Ligula inconspicuous. Stipes usually with two long pointed setae. Palpiger with two setae and three campaniform sensilla ventrally and with numerous spines or with distinct protuberance covered with numerous spines (lacinia?) dorsally (Figs 117, 118). First segment of maxillary palpi with two setae and one campaniform sensillum. Second segment of palpi with a group of sensilla at apex, and below the apex with one campaniform sensillum, one digitiform sensillum and one seta (Figs 118, 122). Mala bears six pointed setae, one blunt at the apex seta, one campaniform sensillum and one peg-like sensillum. Labial palp with group of sensilla at apex and one campaniform sensillum below apex. Praementum with two long setae, two short setae and four campaniform sensilla. Postmentum with two long setae and two or four short setae. Three pairs of campaniform sensilla at base of hypopharynx.

Legs stout, 3-segmented (Fig. 110). Tibiotarsus apically with heavily sclerotized, curved, single and simple claw armed basally with a pointed seta. Claw usually surrounded by a complex of 6 setae which are quite long and straight (five placed close to the claw and one at a distance); two campaniform sensilla and one small seta above claw. Moreover tibiotarsus with at least 4 (or more) long setae (or elongate cauliflower-like sensilla). Femur usually with at least 10 (15 or more) long setae (or cauliflower-like sensilla) on external and internal side; one short seta dorsally at base; a group of five campaniform sensilla and one short pointed seta and one campaniform sensillum, at a distance, basally on internal side; and two campaniform sensilla basally on external side. Coxa on internal side with setae arranged in three groups: first with one very long and at least 3 (4 or a few) shorter setae, second group with three short setae, and basal group with two short setae. External side of coxa with at least 4 setae.

Pupa

Body dorso-ventrally flattened, short-oval (Fig. 105). Pupae of *Ischyronota* (*Ischyronota desertorum* – Matis 1970) oval, not flattened dorso-ventrally, strongly convex dorsally.

Prothorax broad with anterior margin broadly rounded. Anterior margin of prothorax often with numerous lateral processes usually two processes on each side longer than remainder (*Cassida obtusata, C. subtilis, C. uniorbis* – Takizawa 1980; Świętojańska 2005). There were also observed prothorax without any processes on anterior margin (*Ischyronota desertorum*). Meso- and metathorax without lateral scoli. The most often abdominal segments I-V with distinct leaf-like lateral scoli, which have lateral processes and gradually shortened posteriorly; abdominal segments VI-VIII with short process on each side; and abdominal segment IX with quite long supra-anal processes. Pupa

without any lateral scoli were observed in *Ischyronota desertorum*.

Seven pairs of spiracles on abdominal tergites I-VII. Spiracles of segments I-V distinct, diameter of spiracles gradually shortened posteriorly, spiracles of segments VI and VII very small.

Head not visible from above.

REMARKS

Larvae carry shield composed only of exuvia (*Cassida stigmatica, Chiridopsis undecimnotata*) or of exuvia and faeces (Figs 98, 100, 101, 103, 128-133, 138, 143-145, 147-150). Faeces can be strongly attached to skeleton build of larval exuvia and form thick trangular structure (*Cassida rubiginosa, C. sanguinosa, Aethiopocassis rhodesiana, Chiridopsis bipunctata, Ch. bistrimaculata, Ch. ventralis*) or can be in lumps which are loosely attached to exuvia and easily fall off (*Cassida nobilis, C. vittata*). In some species faeces form more or less long filaments attached to exuvia (*Cassida murraea, Thlaspida biramosa*).

Tribe: Aspidimorphini CHAPUIS, 1875

Immatures of 34 species belonging to this tribe have been described until now. First instar larva was described in detail for *Laccoptera foveolata* (RANADE et al. 2004).

First instar larva (based on describtion of *Laccoptera foveolata*)

Body flattened dorso-ventrally, oval, moderately narrowed posteriorly, widest across metanotum (Fig. 7). Body with 16 pairs of lateral scoli (pro- and mesothorax with three pairs, metathorax with two pairs, and each abdominal segment I-VIII with one pair) and a single pair of supra-anal processes. Lateral scoli of thorax more or less similar in length, except 5th and 7th which are slightly shorter than remainder lateral scoli of thorax. Scoli from 9th to 13th gradually shortened posteriorly, scoli from 14th to 16th gradually longer. Supra-anal processes long, approximately 1.5 times as long as body length. First and second lateral scoli fused at the base and directed anteriorly. First lateral scoli with four lateral branches, three visible from dorsal side and one from ventral side. Remaining lateral scoli simple, without lateral branches but covered with few cauliflower-shaped sensilla. Thoracic scoli armed apically with elongate clavate setae. Apical sensilla of 9-14 pairs of lateral scoli gradually shortened posteriorly and changed from elongate (with plumose apex) to short and cone-like. Scoli 15th and 16th armed apically with one seta. Supra-anal processes sinuate, bent dorsally, basal third covered with spinules. Apically supra-anal processes flask-shaped and without apical setae.

Nine pairs of spiracles (one pair on thorax and eight on abdomen), elevated, their diameter very slightly decreasing posterad.

Dorsal and ventral surface of body granulate. Very minute setae at border of each tergite and sternite and two minute setae close to each spiracle. Dorsal surface without long, pointed setae but with cauliflower-shaped sensilla, the size of which very slightly decreases posteriorly. Sternites of pro-, meso-, metathorax, and first two abdominal segments with long (especially long are setae of abdominal segments), pointed setae. Sternites of remaining abdominal sternites with cauliflower-shaped sensilla, which are slightly larger than those of the dorsal surface of body.

Pronotum on each side with one campaniform sensillum placed antero-laterally, one minute seta placed antero-medially, and 10 cauliflower-shaped sensilla. Meso- and metanotum with a pair of very minute setae at anterior border of tergite medially, with a pair of cauliflower-shaped sensilla antero-medially, and row of five cauliflower-shaped sensilla on each side posteriorly. Each antero-lateral side of meso-and metanotum with single cauliflower-shaped sensillum. Two minute setae at base of each thoracic spiracle. Two or three minute setae at anterior border of metanotum laterally. Abdominal tergites with a pair of minute setae close to anterior border medially, and with 1-3 minute setae close to each spiracle. First abdominal tergite on each side with three cauliflower-shaped sensilla anteriorly and a pair of sensilla postero-medially. Abdominal tergites II-VIII on each side with two pairs of cauliflower-shaped sensilla: one placed antero-laterally and the second postero-medially. Each side of all abdominal tergites with one cauliflower-shaped sensillum placed laterally close to spiracle.

Pro-, meso- and metasternum with two pairs of minute setae at anterior border of segments, and with two pairs of long pointed setae medially. Abdominal sternites with a pair of very minute setae at anterior border. First abdominal sternite with one seta or elongated cauliflower-shape sensillum on each antero-lateral side, two on each postero lateral side, and with 8 long, pointed setae medially. Second abdominal sternite with one seta or elongated cauliflower-shape sensillum on each antero-lateral side, two elongate cauliflower sensilla on each postero-lateral side, and with 20 long, pointed setae medially. Third abdominal sternite on each side with: three cauliflower-shape sensilla placed antero-medially, a pair of cauliflower-shape sensilla placed postero-laterally and one cauliflower sensillum placed antero-laterally. Segments IV-VI on each side with two pairs of cauliflower-shape sensilla: first pair placed antero-medially, the second postero-laterally; and with one sensillum antero-laterally. Abdominal sternite VII on each side with one sensillum antero-medially; one antero-laterally, and a pair of sensilla postero-laterally. Sternite VIII with sensilla arranged like sternite VII, but lacking one sensillum placed postero-laterally.

Head hypognathous, retracted into pronotum, slightly visible from above, oval, well sclerotized. Median suture (endocarina) complete, connected with fronto-clypeal suture. Frontal and epicranial sutures absent. Frontal side of head with four small, vertical setae (V 1-4) and five frontal rows of setae: row Fa (with three setae), Fb (with four setae), Fc (with three setae), Fd (with a single seta), Fe (with one or two setae). One campaniform sensillum in area close to seta Fc1. Temporal side of head with three setae (T 1-3) and a single campaniform sensillum.

Stemmata six on each side of head. Five of the same size and one very small.

Antennae 2-segmented, set in membranous ring. First segment slightly wider than length, with four campaniform sensilla. Second segment distinctly longer than width, with one small seta on side, and sensory appendix and five small peg-like sensilla at the apex.

Fronto-clypeal suture well developed. Clypeus distinct, wider than long, with a pair of small setae and a pair of campaniform sensilla.

Labrum wider than long, with anterior margin distinctly emarginate. Mid part of ventral surface (epipharyngeal area) with a pair of small setae, two pairs of campaniform sensilla, and two irregular groups of a few small sensilla. Central and lateral parts of ventral surface of labrum armed with numerous small spines. Emargination with six long setae ventrally, and anterior margin with four long and stout setae on each side ventrally: three placed very close and one at a distance. Dorsal surface of labrum with four setae and two pairs of campaniform sensilla medially and two setae at anterior border.

Mandibles heavily sclerotized, palmate, with six triangular, apical teeth: five in a row and a sixth retracted. Dorsal side of mandibles with two setae and two campaniform sensilla at base.

Maxillae and labium connate. Stipes distinct with two setae. Palpiger distinct, at basal part heavily sclerotized with two setae and three campaniform sensilla ventrally, and numerous short and long spines dorso-laterally; spines of similar form to those covering ligula. Maxillary palp 2-segmented. First segment of maxillary palpi with two setae and one campaniform sensillum. Second segment of palpi with a group of apical sensilla, one subapical campaniform sensillum, one digitiform sensillum, and one seta. Mala bearing six long pointed setae, one long blunt seta, one peg-like sensillum and one campaniform sensillum. Labial palp 1-segmented with a group of sensilla at the apex and one subapical campaniform sensillum. Hypopharynx divided, covered with spines, and with six campaniform sensilla at base. Prementum with two long and two short setae and four campaniform sensilla. Postmentum with two long and four shorter setae.

Legs stout, 3-segmented. Tibiotarsus with heavily sclerotized, short, curved, single and simple claw apically. Claw armed basally with a pointed

seta, and surrounded by a complex of 6 setae: pointed and slightly curved at the top to almost hockey-stick-shaped. Tibiotarsus with two campaniform sensilla and one small seta above claw, and with two long setae dorso-medially. Femur with 11 long setae (8 on internal side and 3 on external side), and one short seta close to the base dorsally. At base of femur: a group of five campaniform sensilla and one short seta on internal side, one campaniform sensillum ventrally, and two campaniform sensilla on external side. Coxa on internal side with setae arranged in three groups: first with three short setae and one long seta, second with two short setae and one long seta, and third with one short and one long seta. Externally coxa with three setae.

Mature larva

Body flattened dorso-ventrally, oval, widest across the first abdominal segment (Figs 102, 152). Body with 16 pairs of lateral scoli (pro- and mesothorax with three pairs, metathorax with two pairs, and each abdominal segment I-VIII with one pair) and a pair of supra-anal processes. Lateral scoli with numerous lateral branches; each lateral scolus and lateral branch armed apically with seta. Supra-anal processes usually long, bent dorsally, carry faecal shield composed of larval skin or with larval skin and faeces.

Nine pairs of spiracles, their diameter gradually decreasing posterad. Spiracles of thorax the most prominent. Size of spiracles of abdominal sternites very slightly decreasing posterad. Often spiracles on abdominal segment VIII hardly visible

Tergites with numerous cauliflower sensilla which are gradually shortened posteriorly. Sternites with pointed setae and cauliflower-shape sensilla. Meso-, metasternum and first abdominal segments (I and II) with pointed setae medially. Lateral sides of thoracic sternites, abdominal sternites I and II with cauliflower-shape sensilla. Abdominal sternites III-VIII covered with cauliflower-shape sensilla.

Setae of pronotum often arranged in two circles with one, two or a few sensilla in the middle of each circle. Meso-, metanotum and abdominal tergites with two rows of sensilla; sensilla tend to decrease their number and size posteriorly. Pro-, meso- and metasternum in the middle with group of pointed setae anteriorly and one pair of pointed setae posteriorly. Each lateral side of thoracic sternites with group of pointed setae or cauliflower-shape sensilla. Setae and sensilla on each abdominal sternite forming irregular row along width of segment. Setae in the middle of first two abdominal sternites most numerous and longest. Number and size of setae of sternites decreases posteriorly.

Head hypognathous, retracted into pronotum, not visible from above, oval and well sclerotized. Median suture (endocarina) complete, connected with

fronto-clypeal suture. Clypeus distinct, wider than long, with a pair of small setae and a pair of campaniform sensilla.

Stemmata six on each side of the head.

Frontal side of head with four small, vertical setae (V 1-4) and five frontal rows of setae: row Fa with three setae, Fb with four (five) setae, Fc with three setae, Fd with single seta, Fe with two setae. Temporal side of head with four setae (T 1-4) and two or three campaniform sensilla (*Laccoptera foveolata* – RANE et al. 2004). According to PATERSON (1941) frontal part of head of *Conchyloctenia hybrida* with numerous setae.

Antennae 2-segmented, set in membranous ring. First segment of antennae stout, slightly wider than long, second distinctly longer than width (*Aspidimorpha tecta, Conchyloctenia hybrida, C. punctata, Laccoptera foveolata* – PATERSON 1941; RANE et al. 2004).

Labrum wider than long, with emarginate anterior margin. Mid part of ventral surface (epipharyngeal area) with a pair of small setae, four campaniform sensilla and two irregular groups of a few sensilla (sensilla placodea?). Central and lateral parts of ventral side of labrum armed with numerous small spines. Anterior margin with six setae medially (in emargination), and with 3-5 setae on each side. Dorsal side of labrum with four setae, and four campaniform sensilla medially and two setae close to anterior margin.

Mandibles heavily sclerotized, 6-dentate, teeth blunt at apex, teeth 2-5 with crenulate anterior margin. Sixth tooth distinctly moved back. At base of dorsal side of the mandible two setae and two campaniform sensilla.

Maxillae and labium connate. Stipes and palpiger distinct. Palpiger with distinct tubercle on dorsal side (*Conchyloctenia hybrida* – PATERSON 1941). Maxillary palp 2-segmented. Mala, prementum and postmentum distinct. Labial palp 1-segmented. Hypopharynx covered with numerous spines. Ligula inconspicuous (*Aspidimorpha tecta, Conchyloctenia hybrida, C. punctata, Laccoptera foveolata* – PATERSON 1941; RANE et al. 2004).

Legs stout 3-segmented, with heavily sclerotized, single and simple claw armed basally with a pointed seta. Claw surrounded by complex of six, quite long, straight setae. Moreover tibiotarsus with two campaniform sensilla and one small seta above claw, and usually with a few (5-7) long setae. Femur with long setae (12-17). Moreover internal side of femur with a group of 5 campaniform sensilla and a short pointed seta, and campaniform sensillum at a distance basally; external side with two campaniform sensilla basally. Internal side of coxa with setae arranged in three groups: first with one long, stout seta and a few shorter setae (placed very close to the first one), second group with three small setae, and third group with two small setae (*Laccoptera foveolata* – RANE et al. 2004).

Pupa

Body dorso-ventrally flattened, short-oval.

Prothorax broad with anterior margin broadly rounded. Anterior margin of prothorax with numerous lateral processes usually often two processes on each side longer than remainder. There were also observed prothorax only with two short processes on each side (*Aspidimorpha miliaris* – TAKIZAWA 1980). Meso- and metathorax without lateral scoli. Abdominal segments I-V with distinct leaf-like lateral scoli, which posses lateral processes and gradually shortened posteriorly; abdominal segments VI-VIII with short process on each side; and abdominal segment IX with quite long supra-anal processes. In *Aspidimorpha miliaris* were observed very short supra-anal processes (TAKIZAWA 1980).

Seven pairs of spiracles on abdominal tergites I-VII. Spiracles of segments I-V distinct, diameter of spiracles gradually shortened posteriorly, spiracles of segments VI and VII very small.

Head not visible from above.

REMARKS

Larvae carry shield composed only of exuvia (*Aspidimorpha furcata*) or of exuvia and faeces (Figs 102, 151-154). In shield composed of feaces and exuvia feaces can be in form of long strands (*Asoidimorpha sanctaecrucis*) or thick mass (*Laccoptera foveolata*). Within tribe Aspidomorphini species with gregarious larvae are known (*Aspidimorpha miliaris* – SCHULTZE 1908, VERMA 1992, Figs 155, 156; *Aspidimorpha puncticosta, Conchyloctenia punctata* – HERON 1992).

CHARACTERS OF CASSIDINAE LARVAE

Introduction

Many chrysomelids (Alticinae, Chrysomelinae, Eumolpinae, Galerucinae) have mature larvae of eruciform type, characteristic for exophagous forms, which are caterpillar-like with more or less cylindrical body and moderately or well-developed legs (Böving and Craighead 1931; Takizawa 2005; Duckett et al. 2006; Baselga and Novoa 2006; Baselga 2007, 2008; Linzmeier et al. 2007). Larvae of other Chrysomelidae present types which are modifications of eruciform type. Criocerinae and many Chrysomelinae have larvae which are strongly convex dorsally (especially their abdomen is strongly convex) but more or less flattened ventrally (cyphosomatic type) whereas the larvae of Sagrinae, Cryptocephalinae, Clytrinae Chlamysinae and Eumolpinae are C- or U-shaped (grub type) and look like eruciform type larvae more or less strongly curved ventrally (Frers 1923; Böving and Craighead 1931; Paterson 1931, 1941; Costa et al. 1988; Lawrence 1991; Lawson 1991; Steinhausen 1994; LeSage and Stiefel 1996).

Completely different type is presented by larvae of hispoid and cassidoid Cassidinae. Many hispoid Cassidinae larvae are leaf miners and their body are elongated, strongly dorso-ventrally flattened with short lateral scoli and prognathous head (*Hispa armigera* Olivier, *Platypria andrewesi* Weise – Maulik 1919; *Gyllenhaleus bipunctatus* Baly, *Estigmena chinensis* Hope – Maulik 1932; *Heterispa vinula* (Erichson) – Casari and Teixeira 2004; *Sceloenopla pretiosa* (Baly), *Octuroplata walker* (Baly) – Casari and Queiroz 2005; *Metaxycera purpurata* (Guérin) – Casari 2005; *Chaeridiona picea* Baly, *Oncocephala quadrilobata* (Guérin) – Świętojańska et al. 2006; *Ch. thailandica* Kimoto – Świętojańska and Kovac 2007). Some exophagous larvae of hispoid Cassidinae present onisciform type (disc-like), they are strongly dorso-ventrally flattened and oval with head and legs concealed beneath the body (*Cephaloleia mauliki* Uhmann, *Cephaloleia belti* Baly, *Chelobasis perplexa* Baly – Maulik 1932; *Arescus monoceros* Olivier – Böving and Craighead 1931), others are very similar in their habitus to typical larvae of cassidoid Cassidinae (*Callispa bowringi* Baly – Gressit and Kimoto 1963 after Chen 1931; *Callispa brettinghami* Baly – Yu Pei-Yu 1981).

Most of mature larvae of cassidoid Cassidinae are of very unique type of body. Their are usually dorso-ventrally flattened, oval, with head and legs concealed by body, sides of body usually have elongate lateral scoli in number of 16th pairs (3/3/2/8): three pairs on prothotax and on mesothorax (within one on thoracic spiracles level), two on metathorax and one pair on each abdominal segment I-VIII (Figs 93, 99, 101-103, 143, 144, 146, 148, 152).

Comparative data of cassidoid mature larvae

Shape of body

In some species of cassidoid Cassidinae shape of body, length and number of scoli is different than in typical larvae described above. Body dorso-ventrally flattened and oval have known larvae of Aspidimorphini, Basiprionotini, Cassidini (except for genus *Ischyronota*), Goniocheniini, Eugenysini, Mesomphaliini and Dorynotini (Figs 89, 90, 92, 99, 101-104, 141-144, 146, 148, 152). Some mature larvae of Physonotini (*Cistudinella obducta*) are very similar to typical cassidoid Cassidinae and some are different. Mature larvae of *Physonota alutacea* have strongly convex thorax (especially pronotum) and their abdomen is strongly narrowed posteriorly whereas larvae of *Asteriza flavicornis* have broadly oval almost rounded body (Figs 93-95). Known last instar larvae of Omocerini, present two types (Figs 86-88, 134). In this tribe larvae of habitus typical of Cassidini (*Discomorpha languinosa, Cassidinoma denticulata*), as well as unusual disc-like, almost round in form, and strongly dorso-ventrally flattened (*Omocerus klugi*) are known. Larvae of tribe Spilophorini are also atypical with elongated bodies and pronotum clearly differentiated, slightly wider than mesonotum, and as wide as first abdominal segment (Fig. 84). Hemisphaerotini larvae are shortly oval and stout (Figs 83, 136, 137). Within Cassidinae larvae with bodies parallelsided and exceptionally strongly dorso-ventrally flattened occur in tribe Notosacanthini. This may be an adaptation to leaf mining behaviour, which is also suggested by prognathous head and very short lateral scoli (Fig. 80). Strongly dorso-ventrally flattened bodies are also found in the larvae of the tribe Delocranini (Fig. 82) which can also be taken as an adaptation to certain lifestyle as they are known to inhabit narrow crevices between leaves that are binded together or inside rolled up leaves (information by Donald Windsor and Lukas Sekerka). However, larvae of Delocranini, as most other Cassidinae, posess hypognathous head, while Notosacanthini, as an exception in cassidoid Cassidinae, have the heads prognathous. Exceptionally strongly convex bodies, especially in dorsal part of thorax, occur in genus *Ischyronota* (Cassidini) (Fig. 100). Larvae of this genus live in harsh desert environments and their special body shape may prevent excessive dessication. Additionally, these larvae lack lateral scoli or have them short and strongly reduced limited to abdominal segments which seems to confirm speculation that body shape depends on environmental conditions.

Spiracles

All the hitherto described larvae have nine pairs of spiracles: one pair on thorax and eight on abdominal segments (one pair on each abdominal segment I-VIII). Thoracical spiracles are probably situated on mesonotum, but

frequently parts of segments bearing spiracles are so distinctly differentiated from mesonotum that it is hard to unambiguously state whether they arise on pro- or mesonotum. Therefore, many authors described and continue describing thoracic spiracles as belonging to pronotum. Also, number of pairs of abdominal spiracles is problematic, as in most larvae diameter of spiracles is decreasing posteriorly and frequently spiracles of the last pair (pair of abdominal segment VIII) are so small that they can be discerned on microscopic slides only. In most mature larvae the spiracles are slighlty elevated above the body surface, annular and uniforous. Among the tribes discussed here, larvae of Notosacanthini, Delocranini, and Hemisphaerotini are unique in respect of form and size of the spiracles (Figs 80, 82, 83). Notosacanthini possess, similarly to leaf-mining hispoid Cassidinae, elongated spiracles of abdominal segment VIII. Such form of the spiracles without doubt arose as an adaptation to leaf-mining behaviour. Elongate spiracles that can be taken above leaf surface (mine) enable larvae, especially at the time of rain, efficient respiratation (Świętojańska and Kovac 2007). Larvae of Delocranini and Hemisphaerotini have, in turn, highly elongated thoracical spiracles, which character is probably not a synapomorphy but arose independently in the two groups (homoplasy).

Lateral scoli

The term 'lateral scoli' is the most commonly used but some authors use some other ambiguous names like: **branched spines** (Gardiner 1887), **spikes** (Muir and Sharp 1904), **spines** (Walsh and Riley 1869; Schultze 1908; Maulik 1919; John George and Venkataraman 1986), **spinule projections** (Yeung 1934), **setose spines** (Westwood 1939), **spinose projections** (Maulik 1949), **multispinulate projections** (Woodruff 1975), **lateral projections** (Schultze 1908; Maulik 1919; Maulik 1948b; Woodruff 1965; Sankaran and Krishnaswamy 1974; Woodruff 1976a; Takizawa 1978; Takizawa 1980; Singh et al. 1984; Lee and Park 1996; Hawkeswood et al. 1997; Cho and Lee 2006), **lateral spines** (Chittenden 1924; Hill and Hulley 1995; Heron 1999), **lateral expansions** (Genty et al. 1978) or **lateral processes** (Hawkeswood 1982; McBridge et al. 2000; Rane et al. 2001; Borowiec et al. 2001; Ghate and Ranade 2002).

It seems that 16 is the generalised number of pairs of lateral scoli. These structures are frequently relatively long (as long as half of body width or longer), situated three pairs on prothorax and mesothorax, two on metathorax, and one on each abdominal segment I-VIII. Lateral scoli of mature larvae are covered with setae and often have lateral branches and are usually covered and armed apically with pointed seta (except for larvae of genus *Ischyronota* which lateral scoli are covered and armed apically with cauliflower-shape sensilla).

Sixteen pairs of lateral scoli have been counted in all of the known mature larvae of Aspidimorphini and most Cassidini (with exception of genus *Ischyronota*), in some Basiprionotini (like *Basiprionota decemmaculata, B. sinuata, B. schultzei, B. cerata, Craspedonta mouhoti*), and in *Cistudinella obducta* of the tribe Physonotini (Figs 93, 99, 102, 103, 144, 146, 148). Markedly lower number of lateral scoli has been observed in Notosacanthini (8 pairs on abdominal segments I-VIII, and very short pair on abdominal segment IX), Delocranini (12 pairs: 4 on thorax and 8 on abdominal segments I-VIII; abdominal segment IX with a pair of very short scoli) and Hemisphaerotini (8 pairs on abdominal segments I-VIII) (Figs 80, 82, 83). In Notosacanthini and Hemisphaerotini short (shorter than half of body width), conical lateral scoli occur on abdominal segments only. Larvae of Delocranini lack: one pair of lateral scoli of prothorax (second pair?), two pairs of mesothorax (4th, 5th pair) and one of metathorax (7th pair). One of the shortest lateral scoli can be observed in larvae of Hemisphaerotini, but also among representatives of Cassidini there are known larvae with short, conical or tuberculiform lateral scoli (*Oxylepus deflexicollis* – 16 pairs) or with partly (*Ischyronota conicicollis* – 8 pairs of scoli only on abdominal segments, Fig. 98) or completely reduced lateral scoli (*Ischyronota desertorum*).

Fewer than 16 pairs have also been recorded in mature larvae of Mesomphaliini (usually 14 pairs but in *Acromis spinifex* 10 pairs were observed and in *Paraselenis axillaris* 8 pairs only), Spilophorini (14 pairs), Basiprionotini (16 pairs were observed in *Basiprionota decemmaculata, B. sinuata, B. schultzei, B. cerata, Craspedonta mouhoti*; but 14 pairs were observed in *Craspedonta leayana, Epistictina reicheana, E. viridimaculata*), Eugenysini (14 pairs), Physonotini (11 in *Physonota helianthi*; 14 in *Eurypepla calochroma, E. jamaicensis, Ph. alutacea, Ph. unipunctata*; and 15 in *Asteriza flavicornis*) and Goniocheniini (13 pairs). Lateral scoli of Basiprionotini, Eugenysini, Goniocheniini, most species of Mesomphaliini (*Anacassis cribrum, A. sulcipennis, A. fuscata, Botanochara impressa, Chelymorpha varians, Cyrtonota lateralis, Zatrephina lineata*) and some Physonotini (*Cistudinella obducta*) are typical in their structure for the Cassidinae: they are quite long, covered with setae or with short lateral branches (Figs 89, 90, 92, 93, 104). Scoli of Spilophorini are short (length shorter than half of body width) and conical (Fig. 84). Short lateral scoli without lateral branches are also present in mature larvae of some species of Mesomphaliini (*Acromis spinifex*) and Physonotini (*Physonota alutacea, Asteriza flavicornis*) (Figs 94, 95).

In mature larvae of Eugenysini (*Eugenysa columbiana*), Basiprionotini (*Craspedonta leayana*) and most of Mesomphaliini (except for *Acromis spinifex* which scoli of first, second, 4th, 5th, 6th and 7th pair were reduced and *Paraselenis axillaris* which scoli of thorax were reduced) lateral scoli of 5th

and 7th pair were reduced (Figs 89, 90, 104); in Goniocheniini (*Chlamydocassis cribripennis*) scoli of 4th, 5th and 7th pair (Fig. 92); in *Eurypepla calochroma, E. jamaicensis, Physonota alutacea, Ph. unipunctata*, (Physonotini) scoli of 4th and 16th pair (Fig. 94); in *Asteriza flavicornis* (Physonotini) of 4th pair (Fig. 95); in *Physonota helianthi* (Physonotini) one pair of prothorax (second pair?), two of mesonotum (4th and 5th pair), one pair of matathorax (7th pair) and pair of abdominal segment VIII (16th pair); in Spilophorini one pair of prothorax and one of mesothorax (second and 4th pair) were reduced (Fig. 84).

It is plausible that the reduction of lateral scoli in individual tribes is not accidenal and if there is a reduction in number of lateral scoli in a given tribe, the same pairs are reduced. However, at the moment it is hard to unambiguously state that it is a real evolutionary trend for those tribes.

Description of mature larva of *Microctenochira difficilis* (Cassidini) by Teixeira and Casari (2003) seems very unreliable. According to the authors of the description, larva of *M. difficilis* has 14 pairs of short and conical lateral scoli and lacks of scoli of 4th and 16th pairs. Among known mature larvae 14 pairs of lateral scoli were observed in mature larvae of species of 5 tribes (Spilophorini, Basiprionotini, Eugenysini, Mesomphaliini, Physonotini) but the lack of scoli of 4th and 16th pairs was hitherto observed only in mature larvae of Physonotini (*Eurypepla calochroma, E. jamaicensis, Physonota alutacea, Ph. unipunctata*). Short and sometime reduced scoli occur also in some Cassidini genera associated with succulent saline plants (genera *Oxylepus* and *Ischyronota*) but most other Cassidini larvae, of which a large proportion is presently known, have 16 pairs of lateral scoli. Also other species of genus *Microcteniochira* like *Microctenochira flavonotata* (Boheman, 1855) or *Microctenochira championi* (Spaeth, 1926b) have the typical for Cassidini oval and dorso-ventrally flattened bodies with 16 pairs of long lateral scoli (Donald Windsor, personal communication – Figs 147, 148). Such a big difference in body build between larvae which belong not only to the same tribe but also to the same genus would be puzzling. By courtesy of E. P. Teixeira and D. Windsor I had a chance to study a photo of the adults of the beeetles reared from larvae identified as *M. difficilis*. In fact, the beetle was misidentified and belongs to *Eremionycha bahiana* (Boheman, 1855), the curious cassid placed by Spaeth (1911) within the tribe Dorynotini (under synonymic name *Eremionycha miraculosa*). His decision was based only on the reduction of one tarsal claw (in *Eremionycha* only single claw is present on all tarsi). Borowiec (1999) transferred the genus *Eremionycha* to the tribe Cassidini without comments. Adults of *Eremionycha bahiana* share most characters with members of the tribe Cassidini (elongate, flat, completely horizontal clypeus, very short prosternal collar, antennae of *Cassida* type, as opposed to flattened and not telescoped and cylindrical as in all genera of Dorynotini). Larva described by Teixeira and Casari (2003) at first glance

is similar to the larvae of the Cassidine genera associated with saline plants but probably it is homoplastic smilarity. On the other hand known larvae of true Dorynotini taxa (Buzzi 1976 and my unpublished data) are very similar to the larvae of Cassidini and differ only in number of pairs of scoli (17 pairs in Dorynotini versus 16 in most of Cassidini). The close relationships between Dorynotini and Cassidini were observed also by Hsiao and Windsor (1999) based on the molecular data where members of both genera have been placed in the same clade.

More than the basic number of 16 pairs, namely 17, was observed in Dorynotini (*Dorynota pugionata*) and Omocerini (*Cassidinoma denticulata*, *Omocerus klugi*). In some species of Cassidini (*Charidotella bifossulata*, *Drepanocassis profana*) lateral branches of second pair of lateral scoli can be so big that some authors treated them as additional lateral scoli and in descriptions of these larvae they gave the count of 17 pairs (Dugés 1887; Buzzi and Winder 1986). It is possible that in the case of Dorynotini and Omocerini 17th process is also nothing more than a prominent lateral branch of scoli of the first or second pair. Data on the number of lateral scoli in Dorynotini and Omocerini need to be verified. Lateral scoli of Dorynotini larvae are as long as the half of the body width or longer. Lateral scoli of Omocerini are of different length: very short (shorter than half body width) were observed in *Omocerus klugi*, moderately long in *Cassidinoma denticulata* and very long (longer than half body width) in *Discomorpha languinosa*.

The reduction in the number of pairs, as well as size of lateral scoli can be connected to adaptation to environmental conditions in which a larva lives. Long lateral scoli could make it difficult to move through narrow crevices of mines (larvae of Notosacanthini) or inside leaf sheats (in case of Delocraninі larvae). On the other hand, larvae of the genus *Ischyronota* (Cassidini), living in arid, desert and semi-desert environments, are probably protected from excessive transpiration by reducing the number and size of lateral scoli, similarly to larvae of *Oxylepus deflexicollis* (Cassidini).

Lateral scoli and their lateral branches always terminate with one or few setae or cauliflower-shaped sensilla (McBride et al. 2000; Świętojańska and Ghate 2003; Świętojańska 2004; Ranade et al. 2004; Świętojańska et al. 2005; Świętojańska and Borowiec 2007b; Świętojańska 2008; Świętojańska and Windsor 2008) which indicates that they are organs of mechanoreception, that probably participate in recognition of potential danger. Larvae of many Cassidinae are very sensitive to mechanical stimuli toward lateral scoli. Such stimuli, directed at lateral scoli or other body parts results in sudden reaction of larva by tilting its faecal shield toward the stimulated side (Hingston 1928; Eisner et al. 1967; Barrows 1979; Olmstead 1994). It is possible that exceptionally well developed faecal shields of Hemisphaerotini, that give

the larvae defense from enemies, are the reason of the reduction of lateral scoli in this tribe.

Abdomen and supra-anal processes

Chen (1973) noticed that abdomen of generalized Cassidinae is composed of eleven segments. Analysis of larval morphology of casidoid Cassidinae seems to confirm this hypothesis. Analysed abdomens of cassidine larvae are composed of eleven segments, of which three final became modified (Fig. 126). Abdominal segment IX in most cassidoid Cassidinae larvae is reduced to half of ring visible only on dorsal side of body, on which there usually are two shorter or longer processes, so called **supra-anal processes** (Takizawa 1980; Singh et al. 1984; Lee and Park 1996; Hawkeswood et al. 1997; Heron 1999; Rane et al. 2001; Borowiec et al. 2001; Ghate and Ranade 2002; Borowiec and Świętojańska 2003; Ghate et al. 2004; Ranade et al. 2004; Świętojańska 2004a, 2004b, 2005a, 2005b, 2005c, 2008; Rane and Ghate 2005; Świętojańska and Borowiec 2007a; Świętojańska and Borowiec 2007b; Świętojańska and Ghate 2003; Świętojańska and Medeiros 2007; Świętojańska et al. 2005; Świętojańska and Wiondsor 2008) also named as: **supra-anal process** (Maulik 1919; Cho and Lee 2006), **forked supra-anal spine or supra-anal projection** (Maulik 1919; Maulik and Dover 1924; Takizawa 1983), **supra-anal prolongation** (Maulik 1948b; Maulik 1949), **supra-anal projections** (Sankaran and Krishnaswamy 1974; Takizawa 1978), **supra-anal furca** (Heron 2004; Heron 2007), **anal processes** (Visalakshi et al. 1980), **caudal process** (Ferris and Nissen 1927; Chaboo and Nguyen 2004), **caudal processes** (Hawkeswood 1982), **elongate fork, forked appendage (**Olliff 1884) or **anal faecifork** (Westwood 1939), **feci-forks** (Yeung 1934), **pygidial fork** (Bruch 1939 ["horqueta pygidial"]), **two-prolonged fork** (Eisner et al. 1967), **caudal fork** (Sanderson 1948; Eisner and Eisner 2000; Bordy 2000 ["fourche caudale"]), **caudal furcae** (Chaboo 2002), **fecal fork** (Paterson 1931; Paterson 1941; Woodruff 1965, 1975, 1976b), **anal fork** (Rolston et al. 1965; Buzzi and Garcia 1983; Buzzi and Winder 1986; Buzzi 1988; Buzzi and Miyazaki 1999), **forked caudal processes** or **forked caudal appendage** (McBridge et al. 2000), **fork-like structure** (Nogueira-de-Sá and Trigo 2002), **fork** (Müller and Hilker 2004), **paired forked process** (Teixeira and Casari 2003), **abdominal urogomphi** (Barrows 1979), **appendix** (Candèze 1861 ["appendice"]), **long spikes** (Muir and Sharp 1904), **posterior spikes** (Kershaw and Muir 1907), **subanal spines** (Schultze 1908), **caudal spines** (Chittenden 1924; John George and Venkataraman 1986; Hill and Hulley 1995), **caudal appendage** (Mohamedsaid and Sajap 1996), **spines** (Müller 2002).

Posterior to segment IX there is a structure called anal turret (Eisner and Eisner 2000; Müller and Hilker 2003) composed of two rings which are

probably the remaining of two abdominal segments (X and XI). Supra-anal processes probably represent modified lateral scoli of abdominal segment IX, adapted to carrying of defensive shield (FERRIS and NISSEN 1927). In leaf-mining Notosacanthini that are not building faecal shield, supra-anal processes are absent but abdominal segment IX has a pair of very short scoli directed posteriorly (Fig. 80). In Delocranini larvae there is no faecal shield as well, and its abdominal segment IX have short processes that look like lateral scoli of remaining segments of body (Fig. 82). Mature larvae of most tribes build more or less elaborate defence shields and their supra-anal processes are usually two, relatively long processes different in form from lateral scoli of other body segments. Two long, free-standing supra-anal processes have been observed in mature larvae of Aspidimorphini, Cassidini (except for *Oocassida pudibunda*), Eugenysini, and Physonotini (Figs 93, 94, 126, 146). Moderately long and free supra-anal processes are found in larvae of Dorynotini, Mesomphaliini, some Omocerini (*Omocerus klugi*), and some Physonotini (*Asteriza flavicornis*) (Figs 86, 87, 90, 95). Short and stout are supra-anal processes of Goniocheniini and Basiprionotini (Fig. 104). Supra-anal processes of Hemisphaerotini, Spilophorini, some Cassidini (*Oocassida pudibunda*) and some Omocerini (*Cassidinoma denticulata, Discomorpha languinosa* and *Discomorpha nevermanni*) are of very unique shape (Figs 83, 84, 88, 134). Supra-anal processes of Hemisphaerotini are short, stout and each process is two branched. Each process of Spilophorini is build with two parts: stout basal and fine apical. Processes of some Omocerini are fused and make one, quite elaborate structure. Mature larvae of *Oocassida pudibunda* have one process biforous at the top but their first instar larvae have two long and free supra-anal processes, typical for Cassidinae (TAKIZAWA 1980). Unfortunately, first instar larvae are unknown for Hemisphaerotini, Spilophorini, and Omocerini, so it is impossible to say whether in their development there are any structural changes of supra-anal processes similar to those observed in *Oocassida*. Supra-anal processes of the known first instar larvae are very similar to lateral scoli of otherbody segments, differing only in length (usually longer) and apex usually without any setae or sensilla. In first instar larva of *Cyrtonota lateralis* supra-anal processes are identical with other lateral scoli, which may confirm thesis that supra-anal processes are modified lateral scoli of abdominal segment IX.

Type of shield (faecal-shield or defence shield)

Most Cassidinae larvae have supra-anal processes and often carry over the body shield attached to them, composed of previous larval skins (exuvia) or skins and faeces. Shield is often retained by pupal stages but also quite often are observations that exuvium of only the last instar larva was retained by pupa. It is thought that these shields are used for mechanical and chemical

defense from predators and parasitoids (Fiebrig 1910; Maulik 1919; Hingston 1928; Eisner et al. 1967; Takizawa 1980; Buzzi 1988; Olmstead and Denno 1993; Gómez et al. 1999; Vencl and Morton 1999; Vencl et al. 1999; Eisner and Eisner 2000; Nogueira-de-Sá and Trigo 2002; Müller 2002; Müller and Hilker 2004; Nogueira-de-Sá and Trigo 2005; Vencl et al. 2005; Bacher and Luder 2005; Vencl et al. 2009). No shields were observed in larvae of Notosacanthini and Delocranini. The most interesting and most prominent shield is built by larvae of Hemisphaerotini (Figs 135-137). This shield is built of exuvia and faeces (Candéze 1861; Bruch 1939; Woodruff 1965; Beshear 1969; Genty et al. 1978; Eisner and Eisner 2000; Chaboo and Nguyen 2004). Faeces in this type of shield is present in form of numerous long filaments, so that the whole shield is reminiscent of bird nest turned upside down. Larvae of remaining tribes have shields made of exuvia (Spilophorini – Buzzi and Miyazaki 1992; Mesomphaliini – Marques 1932, Buzzi 1977; Physonotini – Świętojańska and Medeiros 2007; Cassidini – Kershaw and Muir 1907, Yeung 1934, Matys 1970, Medvedev and Zaitsev 1978, Zaitsev 1988, 1992a, Hawkeswood et al. 1997, Ghate et al. 2004, Świętojańska and Borowiec 2007b; Aspidimorphini – Muir and Sharp 1904, Kershaw and Muir 1907, Gressitt, 1952, Takizawa 1980, Heron 1999; Figs 128, 129, 140) or of exuvia and faeces (Omocerini – Candèze 1861; Goniocheniini – Świętojańska et al. 2005; Basiprionotini – Świętojańska and Ghate 2003; Eugenysini – Chaboo 2002; Mesomphaliini – Ferris 1922, Chittenden 1924, Marques 1932, Zolessi 1968, Buzzi 1975b, Buzzi and Garcia 1983, Buzzi 1988, Buzzi 1996, Buzzi and Miyazaki 1999, Eisner and Eisner 2000; Dorynotini – Fiebrig 1910, Buzzi 1976a; Physonotini – Chaboo 2004; Cassidini – Muir and Sharp 1904, Frers 1923, Paterson 1931, Westwood 1939, Rolston et al. 1965, Matys 1970, Woodruff 1975, Woodruff 1976b, Takizawa 1978, Barrows 1979, Takizawa 1980, Singh et al. 1985, Leblanc 1986, Buzzi and Winder 1986, Zaitsev 1988, Mahomedsaid and Sajap 1996, Borowiec et al. 2001, Ghate et al. 2004, Świętojańska 2004a, 2005b, Cho and Lee 2006, Świętojańska and Borowiec 2007a, 2007b; Aspidimorphini – Muir and Sharp 1904, Gressitt 1952, Takizawa 1980; Figs 98, 100-103, 127, 130-133, 138, 139, 141-145, 147-154). Some mature larvae of Physonotini species (*Physonota alutacea, Asteriza flavicornis* – Świętojańska and Windsor 2008) without shield have been observed (Figs 94, 95).

Chaetotaxy

Chaetotaxy of body, head and legs of many Cassidinae larvae is not described or described very superficially. Chaetotaxy is unknown for Notosacanthini, Delocranini, Hemisphaerotini, Omocerini, Spilophorini (except for head and leg), Eugenysini, Dorynotini (except for head and leg). Mature larvae of Aspidimorphini and Cassidini have chaetotaxy of head as in first

instar larvae: four setae on vertex (V 1-4) five rows of frontal setae (Fa-Fe) and three, or sometimes more, temporal setae (T 1-3). Body, head and legs of Basiprionotini, Goniocheniini, Mesomphaliini and Physonotini are mostly covered with numerous pointed setae. Body and legs of Aspidimorphini and Cassidini are covered with pointed setae and more or less elongated cauliflower-shaped sensilla, sensilla predominate on tergites and abdominal sternites whereas thoracic sternites are always covered with pointed setae. Setae and sensilla of Aspidimorphini and Cassidini are less numerous than setae which cover bodies of Basiprionotini, Goniocheniini, Mesomphaliini and Physonotini larvae.

Head

Except for Notosacanthini, which has prognathous head, known mature larvae of remainder tribes have hypognathous heads. In most known larvae there are six pais of stemmata (Figs 106, 108). In some larvae stemmata of 6th pair are much smaller than other and present in form of pigmented spot. Only in Notosacanthini five pairs of stemmata were observed and in Delocranini number of pairs is unknown. Notosacanthini differ from other tribes in having 3-segmented antennae, while in other tribes the antennae are 2-segmented (Fig. 119). Number of antennal segments is unknown for the larvae of the Delocranini. Fronto-clypeal suture is present in larvae of most tribes, except for Notosacanthini, Delocranini and Omocerini where authors do not mention this character in their descriptions. Labrum in all larvae is free and transverse with more or less distinct emargination at anterior margin and is usually with four setae and four campaniform sensilla dorsally (Figs 107, 111, 113, 114). Labrum of Delocranini larvae is unknown. Mandibles of Delocranini and Omocerini are still unknown but known larvae of Notosacanthini, Hemisphaerotini and Spilophorini have triangular mandibles whereas Goniocheniini, Basiprionotini, Eugenysini, Mesomphaliini, Dorynotini, Physonotini, Cassidini and Aspidimorphini posses palmate mandibles with 3 to 6 teeth. In all described larvae maxillae and labrum are connate (Figs 111, 112). Maxillae consist of stipes, palpiger, 2-segmented maxillary palp (except for *Ischyronota desertorum*, in which 1-segmented maxillary palpi was observed, Fig. 117) and mala (Figs 112, 115, 116, 118, 125). It is unclear whether lacinia and galea are confluent because in many species [*Chlamydocassis cribripennis* (Goniocheniini) – Świetojańska et al. 2005; *Cistudinella obducta* (Physonotini) – Świętojańska and Medeiros 2007; *Ischyronota conicicollis, I. desertorum* (Cassidini) – Świętojańska and Borowiec 2007b; *Cyrtonota lateralis* (Mesomphaliini) – Świętojańska 2008; *Physonota alutacea, Asteriza flavicornis* (Physonotini) – Świętojańska and Windsor 2008] distinct tubercle covered with numerous spines placed on dorsal side of palpiger is present (Figs 117,

124), and in other species [*Craspedonta leayana* (Basiprionotini) – Świętojańska and Ghate 2003; *Laccoptera foveolata* (Aspidimorphini) – Rane et al. 2004; *Aethiopocassis rhodesiana* (Cassidini) – Świetojańska 2004; *Cassida uniorbis* (Cassidini) – Świętojańska 2005; *Cassida informis, C. varians* (Cassidini) – Świętojańska and Borowiec 2007a, *Cassida rubiginosa* – Fig. 118] distinct group of short and long spines were observed in this place. It is unknown whether the described tubercle or group of spines represent lacinia or other structure in its place, however, Buzzi and Miyazaki (1992) in their description of maxillae of *Calyptocephala paralutea* distinguished lacinia and galea as separate structures.

Maxillae and labium of larvae of Notosacanthini, Delocranini, Hemisphaerotini, Omocerini, Eugenysini and Dorynotini are still not described.

Legs

All Cassidinae larvae possess 3-segmented legs composed of coxa, femur and tibiotrsus which armed apically with claw (Fig. 110). Some authors distinguish four segments, treating tibiotarsus and claw as separate segments: tibia and tarungulus; the others treat episternum and epimeron as coxa, and coxa as trochanter (Teixeira and Casari 2003). In larvae of other Chrysomelidae species (Cox and Windsor 1999; Baselga and Nova 2006; Baselga 2007, 2008; Duckett 2002), which really have 4-segmented legs, trochanter of each leg has a group of campaniform sensilla (pores) ventrally. This group of sensilla in cassidoid Cassidinae is placed ventrally at base of femur. Location of group of pores suggests that in cassidoid Cassidinae trochanter is not distinguised from femur and these two segments form one structure.

Chaetotaxy of legs of mature larvae of tribe Notosacanthini, Delocranini, Hemisphaerotini, Omocerini and Eugenysini is still unknown. Legs of mature larvae covered with numerous and long setae were observed in Goniocheniini, Mesomphaliini, Dorynotini and Physonotini. In Basiprionotini (*Craspedonta leayana*) mature larvae were observed with legs covered with numerous but short setae. Legs of Aspidimorphini, Cassidini and Spilophorini larvae are covered with long but not very numerous setae. The least numerous are setae covering legs of mature larvae of *Cassida* species.

Comparative data of known cassidoid first instar larvae

(see table I on pages 86 and 87)

Shape of body

All described first instar larvae have body dorso-ventrally flattened, oval, slightly narrowed posteriorly (Figs 1-11).

Spiracles

All described first instar larvae have 9 pairs of spiracles: one on thorax and 8 pairs on abdomen (one pair on each abdominal segment I-VIII). SEM photo shows that spiracles of known first instar larvae are annular-biforous usually with U-shaped opening (only spiracles of *Cistudinella obducta* have openings different than other first instar larvae (Figs 64-69).

Lateral scoli

First instar larvae as well as mature larvae of Aspidimorphini and Cassidini have 16 pairs of well developed lateral scoli (Figs 5-7, 11). Mature larvae of *Craspedonta leayana* (Basiprionotini) have 14 pairs of lateral scoli but first instar larvae of this species posses in place of 5th and 7th pair 3-tubercled structures, which can be modified lateral scoli (Fig. 1). Similar situation is in *Cyrtonota lateralis* (Mesomphaliini) where larvae of first instar in place of 5th and 7th pair posses tubercles, each with three long and one short seta

Table 1. Comparative data of known first instar larvae

	Basiprionotini	Mesomphalini	Physonotini	Cassidini	Aspidimorphini
number of lateral scoli pro-/meso-/ metanotum/ abdominal segments	14 + 2 tubercles 3/3/2/1x8	14 + 2 tubercles 3/2+1/1+1/1x8	14 or 16 3/3/2/1x8 3/2/2/1x7	16 3/3/2/1x8	16 3/3/2/1x8
lateral branches of scoli	absent	absent	absent	absent or present on first pair	present on first pair
lateral scoli apically armed with	cauliflower-shape sensilla or elongate, in apical half plumose seta	long pointed seta	long, at the top covered with spinules	cauliflower-shape sensilla or elongate seta with plumose top	cauliflower-shape sensilla or elongate seta with plumose or clavate top
tops of supra-anal processes	flask-shaped without apical setae	with one long pointed seta	flask-shaped or acute without apical setae	rounded or flask-shaped, without apical setae	flask-shaped without apical setae
sensillae of tergites	cauliflower-shape sensillae	long pointed setae	moderately long setae, pointed or with spinules at the top	cauliflower-shape sensilla	cauliflower-shape sensilla
sensillae of sternites	pointed setae and elongate cauliflower-shape sensilla	long pointed setae	long pointed setae	pointed setae and cauliflower-shape sensilla	pointed setae and cauliflower-shape sensilla
stemmata	6	6	6	6	6

(Fig. 2). First instar larva of *Cistudinella obducta* (Physonotini) has 16 pars of lateral scoli but scoli of 4, 5, 7 and 9 pair are very short (Fig. 3). In turn, larvae of first instar of *Physonota alutacea* (Physonotini) have completely reduced lateral scoli of 4th and 16th pair, as mature larvae of this species (Fig. 4). Further studies, especially of the first instar larvae, should demonstrate whether given number of pairs of lateral scoli observed in mature larvae is an effect of reduction that occurs during subsequent instars and is characteristic of given taxon. At present when most of the first instar larvae are unknown it is impossible to unambiguously resolve this issue.

Table 1. Comparative data of known first instar larvae (continuation)

	Basiprionotini	Mesomphalini	Physonotini	Cassidini	Aspidimorphini
setae of head	T 1-3; V 1-4; rows: Fa, Fb, Fc, Fd, Fe	T 1-3; V 1-4; rows: Fa, Fb, Fc, Fd, Fe	T 1-3; V 1-4; rows: Fa, Fb, Fc, Fd, Fe +additional setae	T 1-3; V 1-4; rows: Fa, Fb, Fc, Fd, Fe	T 1-3; V 1-4; rows: Fa, Fb, Fc, Fd, Fe
type of setae of head	moderately long, pointed or truncate setae	long pointed or truncate setae	long, at the top covered with spinules	cauliflower-like sensilla or moderately long or short seta, at the top pointed, truncate or plumose	moderately long, pointed or truncate setae
mandibules palmate	5+1 teeth	4 teeth	3 or 4+2 teeth	5+1 teeth	5+1 teeth
setae of coxa internally in three groups	3/3/2	4/3/2	4/3/2 or more	4/3/2	4/3/2
setae of coxa externally	3	3	3 or more	3	3
setae of femur: long setae + short at base dorsally	10 + 1	11 + 1	11 + 1 or more	11 +1	11 + 1
setae of tibiotarsus: dorso-medially + above claw + around and at base of claw	2 + 1 + numerous setae	numerous + 1 + numerous setae	4 + 1 + numerous setae or numerous + 1 + numerous setae	2 + 1 + complex of 6 setae	2 + 1 + complex of 6 setae

Lateral scoli are always covered with cauliflower-shape sensilla or setae and armed apically with one sensillum or seta (Figs 16, 18-22). Lateral scoli of known larvae of Aspidimorphini, Basiprionotini and Cassidini covered with cauliflower-shaped sensilla and armed apically with cauliflower-like sensillum, elongated cauliflower-like sensillum or elongated plumose sensillum. Lateral scoli of larvae of Mesomphaliini and Physonotini are covered with setae and armed apically with one seta. In Mesomphaliini setae of lateral scoli are pointed at the top. In Physonotini setae of lateral scoli are with small spinules at the top.

Chaetotaxy

Tergites of Aspidimorphini, Basiprionotini and Cassidini are covered with cauliflower-shape sensilla (Figs 1, 5-7, 18). Tergites of Mesomphaliini and Physonotini are covered with setae, in Mesomphaliini setae are pointed in Physonotini with small spinules at the top (Figs 2-4, 17, 30-33). Sternites of thorax and first two to three abdominal sternites of Aspidimorphini, Basiprionotini and Cassidini are covered with pointed setae, remainder sternites of abdomen are covered with cauliflower-shape sensilla (Figs 15, 35, 36). All sternites of Mesomphaliini and Physonotini are covered with pointed setae (Figs 12-14, 28, 29).

Except for larvae of *Physonota alutacea* which bodies are covered with numerous setae, remainder known first instar larvae present the same type of chaetotaxy: pronotum on each side with 10-11 sensilla or setae; meso- and metanotum on each side with one sensillum or seta antero-medially (only in *Cyrtonota lateralis* 3-4 pointed setae antero-medially were observed), row of 5 sensilla or setae posteriorly and sensillum or seta antero-laterally; first abdominal tergite on each side with three sensilla or setae anteriorly, two postero-medially and one at spiracle; abdominal tergites II-VIII on each side with two sensilla or setae antero-laterally, two postero-medially and one at spiracle; pro-, meso- and metasternum with two pairs of pointed setae medially; first three abdominal sternites on each side with 3-5 pointed setae (sometimes pointed setae and elongated cauliflower-shaped sensilla), two sensilla or setae postero-laterally and one antero-laterally; abdominal sternites IV-VI on each side with two sensilla or setae antero-medially, two postero-laterally and one antero-laterally; abdominal sternite VII on each side with one sensillum or seta antero-medially, two postero-laterally and one antero-laterally, abdominal sternite VIII with one sensillum or seta antero-medially, one postero-laterally and one antero-laterally.

In Aspidimorphini, Basiprionotini and Cassidini, the longest are pointed setae on first two or three abdominal sternites (Fig. 15), in Mesomphaliini (*Cyrtonota lateralis*) the longest setae are on abdominal sternites III-VI, in Physonotini on abdominal sternites III-VII (*Cistudinella obducta*), in *Phy-*

sonota alutacea (Physonotini) all abdominal sternites are covered with numerous setae of different length but the longest are on sternites in the middle of abdomen (Figs 12-14).

Chaetotaxy of head and legs are very similar in all described first instar larvae. All known first instar larvae have heads with four setae on vertex (V 1-4), five rows of frontal setae (Fa-Fe) and three temporal setae (T 1-3).

Legs of known first instar larvae of Cassidini and Aspidimorphini have the same chaetotaxy. In comparison to Cassidini and Aspidimorphini legs of Basiprionotini larvae lack one seta of coxa and one of femur. Moreover, claws of Basiprionotini are surrounded by numerous setae, not by complex of 6 setae like in Aspidimorphini and Cassidini larvae (Figs 71, 79). Legs of Mesomphaliini are different from Aspidimorphini and Cassidini in numerous setae surrounding claw and in numerous setae which are placed on tibiotarsus dorso-medially (Figs 70, 72), whereas tibiotarsi of Aspidimorphini and Cassidini have two setae placed dorso-medially (Figs 71, 79). Legs of *Cistudinella obducta* (Physonotini) are different from Aspidimorphini and Cassidini in four setae placed dorso-medially on tibiotarsi and numerous setae surrounding claws (Figs 76, 78). Legs of *Physonota alutacea* (Physonotini) have numerous setae on all segments (Figs 74, 75).

Setae and cauliflower-shape sensilla

Cauliflower-shape sensilla (Figs 36, 41) seem to be, like setae, mechanoreceptors. Frequently mature larvae possess elongated cauliflower-shaped sensilla or pointed setae in places where in first instar larvae there are typical cauliflower sensilla. It seems as if cauliflower-shaped sensilla were transformed into typical pointed setae during larval development. It is unclear why cauliflower-shaped sensilla predominate in first instar larvae and why do they "transform" into setae. It is interesting as well that they have not been observed in first instar larvae of Mesomphaliini and Physonotini, and on the other hand they are known in fifth instar larvae of *Ischyronota conicicollis* and *I. desertorum* (Cassidini). Because first instar larvae are still poorly known, resolving this problem requires additional studies.

Head

All described first instar larvae have head well sclerotized, hypognathous (Fig. 45) and oval (Fig. 46) with median suture complete, connected with fronto-clypeal suture. Clypeus is distinct and free, wider than long, with a pair setae and pair of campaniform sensilla. In all known first instar larvae 6 pairs of stemmata (Figs 42-44) and 2-segmented antennae (Figs 47-50) were observed.

Mouth part

Dorsal and ventral (epipharyngeal area) side of labrum look the same in all species (Figs 51-55). Very variable is anterior margin of labrum. The margin can be more or less distinctly incised. In emargination of anterior margin there are 6 setae but setae can be long and thin, long and stout, stout and short, short and thin. On each side of anterior margin there are 2-4 long and stout setae, and each side of anterior margin dorsally is equipped with one seta. Number and size of setae which are placed on each side of anterior margin seem to rather be diagnostic characters of species than characters specific for tribes or genus.

Mandibles of known first instar are palmate with 3 to 6 teeth but we still don't know first instar larvae of any Notosacanthini, Delocranini, Hemisphaerotini and Spilophorini. Known mature larvae of Notosacanthini, Hemisphaerotini and Spilophorini have triangular mandibles. Aspidimorphini, Basiprionotini and Cassidini have very similar mandibles with 5 teeth in row and one tooth slightly moved back. Mandibles of *Cyrtonota lateralis* is with 4 teeth, of *Cistudinella obducta* with 3 teeth whereas of *Physonota alutacea* with 4 distinct teeth in row and 2 smaller moved back.

In all described larvae maxillae and labrum are connate (Figs 52, 53, 56). Maxillae consist of stipes, palpiger, 2-segmented maxillary palp and mala (Figs 56, 57, 59, 60, 61). In Basiprionotini, Cassidini, Aspidimorphini stipes is with two pointed setae. Stipes of *Cyrtonota lateralis* (Mesomphaliini) and *Cistudinella obducta* (Physonotini) is with three pointed setae whereas of *Physonota alutacea* (Physonotini) with four pointed setae. Except for *Physonota alutacea* palpiger of all known first instar larvae has two pointed setae and 2-3 campaniform sensilla ventrally. *Physonota alutacea* has four pointed setae. In first instar larvae of *Cyrtonota lateralis, Cistudinella obducta* i *Physonota alutacea* (Mesomphaliini and Physonotini) presence of distinct tubercle covered with spines placed on palpiger dorsally was observed (Figs 57, 58, 60). In first instar larvae of *Craspedonta leayana* (Basiprionotini), *Laccoptera foveolata* (Aspidimorphini), and in all described *Cassida* species (Cassidini) were observed distinct group of long and short spines on palpiger dorsally (Fig. 59). First segment of maxillary palp, except for *Physonota alutacea,* is with two pointed setae and one campaniform sensillum. First segment of maxillary palp of *Physonota alutacea* is with three pointed setae and one campaniform sensillum. Second segment of maxillary palp in Basiprionotini, Cassidini and Aspidimorphini is with one pointed seta, one campaniform sensillum and one digitiform sensillum on sides and a group of peg-like sensilla at the apex. Second segment of maxillary palp of Mesomphaliini and Physonotini is with one pointed seta and one campaniform sensillum on sides and a group of peg-like sensilla at the apex. Labium consist of postmentum, prementum,

hypopharynx and two 1-segmented labial palpi (Figs 52, 53, 56, 63). Labial palpi in all known first instar larvae are with one campaniform sensillum on sides and a group of peg-like sensilla at the apex (Fig. 63). Hypopharynx is covered with numerous spines. At base of hypopharynx there are 4-6 campaniform sensilla, and in *Physonota alutacea* four small setae were observed. Prementum has four campaniform sensilla, two long pointed setae and two short pointed setae. Postmentum except for *Physonota alutacea*, with six pointed setae. Postmentum of *Physonota alutacea* is with 8 setae.

DISCUSSION

Characters of first instar larvae in phylogeny

First instar larvae are the most informative objects for morphological-systematic studies (Reid 1995; Cox and Windsor 1999; Borowiec and Świętojańska 2003). In paper by Borowiec and Świętojańska (2003) morphological data of Cassidinae (based on characters of *Cassida nebulosa* (Cassidini)) were compared with data on first instar larvae for five chrysomelid subfamilies: Acauloscelinae, Chrysomelinae, Eumolpinae, Megascelinae and Orsodacninae summarized by Cox and Windsor (1999). Table 2 presents morphological characters of first instar larvae of cassidoid Cassidinae previously presented in Borowiec and Świętojańska (2003) corrected and supplemented with data obtained by research on further first instar larvae of cassidoid species. Showed in Table 2 characters and states are discussed below.

Morphological characters in Table 2 are based on data for first instar larvae of only five tribes: Basiprionotini, Mesomphaliini, Physonotini, Cassidini and Aspidimorphini. It is possible that further research on first instar larvae of species belonging to remaining tribes will result in more corrections and additions to the character set.

Comments to Table 2 (see p. 93):

1. Head shape: in hitherto described first instar larvae of cassidoid Cassidinae head is normal, almost round like in the known mature larvae. The head of mature larvae of the Notosacanthini is strongly dorso-ventrally depressed and it is possible that the first instar larvae of Notosacanthini species have depressed head as well but thus far no first instar larvae of Notosacanthini are known.

Oval head is the plesiomorphic character state for most chrysomelid lineages (0). Head strongly dorso-ventrally depressed is apomorphic (1).

2. Head position: all known first instar larvae as well as mature larvae of cassidoid Cassidinae have hypognathous head. The mature larvae of Notosacanthini have prognathous head.

Prognathous head is the plesiomorphic character state (0) whereas hypognathous is apomorphic (1).

3. Epicranial suture: in all known first instar as well as in mature larvae epicranial suture was not observed.

The reduced epicranial suture is apomorphic (1), presence of epicranial suture is plesiomorphic (0).

Table 2. Morphological characters of first instar larvae

Character	Cassidinae	State
1. Head shape	normal, oval/?	0/?
2. Head position	hypognathous/?	1/?
3. Epicranial suture	absent	1
4. Frontal suture	absent/?	1/?
5. Endocarina	present	0
6. Frontal setae	3+ pairs	0
7. Frontal papillate setae	absent	0
8. Fronto-clypeal suture	present/?	0/?
9. Clypeo-labral suture	present	0
10. Antennal segments	2/?	1/?
11. Stemmata	6/?	0/?
12. Occipital foramen	single	0
13. Hypopharyngeal sclerite	absent	1
14. Anterior margin of labrum	incised/not incised?	1/0?
15. Labral setae	> 8	0
16. Mandibles shape/teeth	palmate/5+1 or 3+4 or 4	1/0?
17. Penicillus	absent	0
18. Mandibular setae	2	0
19. Cardo	absent	1
20. Maxillary palpi	2-segmented	1
21. Galea/lacinia	fused/not fused	0/1?
22. Postmental setae	6-8	1
23. Labial palpi	1-segmented	1
24. Thoracic egg bursters	absent	2
25. Abdominal egg bursters	absent	4
26. Spiracles	annular biforous	1
27. Dorsal body setae	clubbed/pointed	1/0
28. Dorsal ampullae	absent	0
29. Anal plate with pores	absent	0
30. Paired urogomphi	absent	1
31. Supra-anal processes	present/?	1/?
32. Lateral scoli	present	1
33. Abdominal sternite with long setae	absent/present	0/1
34. Tibio-tarsal paronychium/pulvillus	absent/present	0/1
35. Claw	short	1
36. Claw seta	present	1
37. Number of leg segments	3-segmented	1

4. Frontal sutures: in all known first instar larvae and in most mature larvae frontal suture were not observed but in mature larvae of Notosacanthini the frontal sutures are present.

The reduced frontal sutures is apomorphic (1). Presence of the frontal sutures is plesiomorphic (0).

5. Endocarina: all known first instar as well as mature larvae have distinct endocarina.

Distinct endocarina is plesiomorphic within Chrysomelidae beetles (0), absence of endocarina is apomorphic (1).

6. Frontal setae: more than 3 pairs of frontal setae is a plesiomorphic character state within Chrysomelidae (0).

7. Frontal papillate setae: absent in all known first instar cassidoid Cassidinae larvae.

The character is plesiomorphic within Chrysomelidae (0).

8. Fronto-clypeal suture: present in all described first instar larvae of cassidoid Cassidinae but the state of this character is not clear in larvae of Notosacanthini species.

Presence of fronto-clypeal suture i is plesiomorphic character state within Chrysomelidae (0). Absence of fronto-clypeal suture is apomorphic (1).

9. Clypeo-labral suture: present.

The character plesiomorphic within Chrysomelidae (0).

10. Antennal segments: in all known first instar and most mature larvae antennae are two-segmented except for mature larvae of Notosacanthini in which three-segmened antennae were observed.

Three-segmented antennae are plesiomorphic (0) whereas two-segmented apomorphic (1).

11. Number of stemmata: in all described first instar and last instar larvae 6 pairs of stemmata were observed except for the mature larvae of Notosacanthini in which 5 stemmata were observed. Stemmata of sixth pair are often (especially in larvae of Cassidini tribe) distinctly smaller than remainder or in form of pigmented spot.

Six stemmata is the character of the most generalized group and is plesiomorphic within Chrysomelidae (0) whereas no stemmata is the character of the most derived groups (6).

12. Occipital foramen: single.

This character state is plesiomorphic (0), present in most chrysomelid subfamilies.

13. Hypopharyngeal sclerite: not observed in any known first and last instar larvae.

This character state is apomorphic (1), generalized groups have distinct sclerites (0).

14. Anterior margin of labrum: in most known first instar larvae of cassidoid Cassidinae anterior margin of labrum is more or less distinctly incised but in *Physonota alutacea* and *Cistudinella obducta* (Physonotini) anterior margin is very slightly incised almost not emarginate. Also in some Cassidini species first instar larvae (*Cassida vittata*) and mature larvae (*Ischyronota conicicollis, I. desertorum*) with very slightly incised anterior margin of labrum were observed.

Incised anterior margin of labrum is apomorphic character state (1)whereas not incised is plesiomorphic (0).

15. Labral setae: more than 8.

This character state is plesiomorphic (0).

16. Mandibles shape/teeth: in all known first instar larvae mandibles are palmate with 5 teeth in one row and one slightly moved back (5+1). The first instar larvae of *Cistudinella obducta* (Physonotini) have mandibles with 3 distinct teeth in one row and 3-4 very small moved back (3+4). The mandibles of *Cyrtonota lateralis* (Mesomphaliini) are with 4 teeth in one row. The mandibles of the first instar larvae of Notosacanthini, Hemisphaerotini, Spilophorini, Delocranini, Goniocheniini, Eugenysini, Dorynotini and Omocerini are still unknown. In case of Delocranini and Omocerini even the mandibles of mature larvae are still unknown. Mature larvae of Notosacanthini, Hemisphaerotini, Spilophorini have triangular mandibles. On the other hand, mature larvae of *Chlamydocassis cribripennis* (Goniocheniini) have palmate mandibles with 4 teeth and distinct tubercle at molar part.

Palmate mandibles and large number of teeth are apomorphic (1), triangular plesiomorphic (0).

17. Penicillus: absent.

This character state is plesiomorphic (0), the presence of penicilus is apomorphic (1).

18. Mandibular setae: in all described until now first instar larvae two setae and two campaniform sensilla dorsally were observed.

Mandibles with two setae are plesiomorphic within Chrysomelidae (0).

19. Cardo: inconspicuous.

This character state is apomorphic (1).

20. Maxillary palpi: in all described larvae as well as first and last instar were observed 2-segmented but in mature larva of *Ischyronota desertorum* (Cassidini) were observed 1-segmented maxillary palpi.

The maxillary palpi 2-segmented is apomorphic character state (1), 3-segmented are plesiomorphic (0).

21. Galea/lacinia: it seems that in all known first instar larvae lacinia is present. In some species it occurs in form of group of numerous short and long spines and in other in form of distinct tubercle covered with spines.

Not fused galea and lacinia is apomorphic character state (1), fused is plesiomorphic (0).

22 Postmental setae: usually 6 postmental setae were observed but first instar larva of *Physonota alutacea* has 8 setae.

In generalized groups there are only 4 setae (0) thus number of setae more than 4 is apomorphic character state (1).

23. Labial palpi: 1-segmented.

The character state is apomorphic (1) because generalized groups of Chrysomelidae have 2-segmented labial palpi (0).

24. Thoracic egg bursters: absent.

This character state is apomorphic for cassidoid Cassidinae (2) (compare with Table 1. in Borowiec and Świętojańska 2003).

25. Abdominal egg bursters: absent.

This character state is apomorphic for cassidoid Cassidinae (4) (compare with Table 1. in Borowiec and Świętojańska 2003).

26. Spiracles: spiracles of known first instar larvae are annular-biforous with U-shaped opening. Different spiracle openings were observed only in *Cistudinella obducta*.

Uniforous spiracles are plesiomorphic character (0), annular-biforous are apomorphic (1).

27. Dorsal body setae: in known cassidoid Cassidine mostly clubbed setae (cauliflower-shape sensilla) were observed but some species have dorsally pointed (*Cyrtonota lateralis*) setae or pointed with small spines at the top (*Cistudinella obducta*, *Physonota alutacea*).

Clubbed setae are apomorphic (1) within Chrysomelidae, pointed setae are plesiomorphic (0).

28. Dorsal ampullae: absent in cassidoid Cassidinae.

This character state is plesiomorphic within Chrysomelidae (0).

29. Anal plate: in cassidoid Cassidinae without pores.

This character state is plesiomorphic within Chrysomelidae (0).

30. Paired urogomphi: absent in cassidoid Cassidinae.

This character state is apomorphic within Chrysomelidae (1).

31. Supra-anal processes: in all described first instar larvae these are present but in the known mature larvae of Notosacanthini and Delocranini the supra-anal processes are absent.

Supra-anal processes are a synapomorphy of cassidoid Cassidinae (1) whereas their absence is plesiomorphic (0).

32. Lateral scoli: present.

This chracter is apomorphic (1) within Chrysomelidae.

33. Abdominal sternite with long setae: in known first instar larvae of Aspidimorphini, Basiprionotini and Cassidini the first three (sometimes two) abdominal sternites are covered with quite long, pointed setae medially whereas remainder of sternites are covered with cauliflower-shaped sensilla, in larvae of Physonotini (*Cistudinella obducta*, *Physonota alutacea*) and Mesomphaliini (*Cyrtonota lateralis*) long pointed setae were observed on abdominal sternites.

Short ventral setae are plesiomorphic (0) and long apomorphic (1).

34. Tarsal paronychium/pulvilli: within known first instar larvae pulvilli were observed in *Cistudinella obducta* (Physonotini) only. In mature larvae except for *Cistudinella obducta* pulvilli were also observed in *Calyptocephala paralutea* (Spilophorini) and *Chlamydocassis cribripennis* (Goniocheniini).

Absence of pulvilli is plesiomorphic character (0) but presence is apomorphic (1).

35. Claw: short.
The character is apomorphic (1) within Chrysomelidae.

36. Claw seta: present.
The character is apomorphic (1) within Chrysomelidae.

37. Number of leg segments: all known first and last instar larvae of cassidoid Cassidinae have 3-segmented legs without differentiated trochanters.
Generalized groups have legs with differentiated trochanters (0). The characters is apomorphic (1) within Chrysomelidae.

Phylogenetic relationships within Cassidinae

Thus far phylogenetic relationships among cassidine tribes has been investigated, among others, by Borowiec (1995), Hsiao and Windsor (1999) and Chaboo (2007). Cladogram in Borowiec (1995) is based mostly on characters of adult morphology that were previously used by Spaeth (Spaeth in Hincks 1952) in his key to tribes. Hsiao and Windsor (1999) used molecular data (12S mtDNA sequence data). Chaboo (2007) used morphological characters of adults and immatures known to her. However, results obtained by Chaboo (2007) have to be taken with caution since the author committed a number of factual errors, already visible at the stage of taxon sampling. By placing species in wrong tribes she frequently used one species under different names (as many species have synonyms) to characterize different tribes. Besides, her analysis lacks few tribes, for example Goniocheniini and Charidotini. From the very large tribe Cassidini she included only three species while examining ten more representatives of this tribe (plus two representatives of Charidotini) without incorporating their characters into data matrix. She placed *Batonota lerouxii* (synonym of *Paratrikonota lerouxii*) in the Goniocheniini, a species in fact belonging to the tribe Dorynotini. Additionally, she included the same species in Dorynotini, only under its valid name – *Paratrikonota lerouxii*. In the Dorynotini she also included *Polychalca punctatissima* and *Discomorpha biplagiata* (as *Oxynodera biplagiata*), both species belonging to the Omocerini. In addition, *Oxynodera biplagiata* appears once more in the analysis, correctly classified in Omocerini. The author examined one member of Goniocheniini (*Zeugophora quadrinodosa*) but did not code any character. In Charidotini she included two species that have never been placed in this tribe: *Coptocycla* (*Psalidonota*) *dorsoplagiata* and *Metrionella bilimeki*. She examined a member of Charidotini – *Charidotis punctatostriata* (twice, as Cassidini and Charidotini), but she did not code any character. Species of the geus *Cistudinella* appear in both Ischyrosonychini (*Cistudinella obducta*) and Physonotini (*Cistudinella* near *apiata*) but characters of these species have not been coded in any of these tribes.

In cladogram by Borowiec (1995) Notosacanthini, Delocranini, Hemisphaerotini and Spilophorini constitute, together with two tribes belonging to hispoid Cassidinae (Cephaloleini, Callispini), monophyletic clade sister to remaining tribes. Unfortunately, cladgram in Hsiao and Windsor (1999) lacks members of Notosacanthini and Delocranini, but Hemisphaerotini and Spilophorini (together with Oediopalpini) appear at the base of clade, close to tribes belonging to the hispoid Cassidinae. These four tribes also appeared at the base of the clade in Chaboo (2007). In all the cladograms Notosacanthini, Delocranini, Hemisphaerotini, and Spilophorini are transitional between tribes belonging to cassidoid and hispoid Cassidinae. In Borowiec (1995) the closest to hispoid Cassidinae are Hemisphaerotini, followed by Spilophorini, Delocranini and Notosacanthini. In Hsiao and Windsor (1999) the closest to hispoid tribes are Spilophorini, with Hemisphaerotini closer to cassidoid Cassidinae. Cladogram in Chaboo (2007) shows Spilophorini as the closest to cassidoid Cassidinae, followed by Hemisphaerotini and Delocranini and Hemisphaerotini is closest to hispoid Cassidinae.

Morphological characters of immatures of Notosacanthini (prognathous head; 5 pars of stemmata; 3-segmented antennae; triangular mandibles; body strongly dorso-ventrally flattened and parallel-sided; 8 pairs of lateral scoli placed on abdominal segments I-VIII; supra-anal processes absent; elongated spiracles of last pair – Fig. 80), Delocraniini (hypognathous head; body strongly dorso-ventrally flattened, elongated, parallel-sided; 12 pairs of lateral scoli on thorax and abdominal segments I-VIII; supra-anal processes absent but scoli of their abdominal segment IX are very short, look like lateral scoli of other segments; thoracic spiracles elongated – Fig. 82), Hemisphaerotini (head hypognathous; 6 pars of stemmata; 2-segmented antennae; triangular mandibles; stout, shortly oval body; 8 pairs of lateral scoli placed on abdominal segments I-VIII; each supra-anal process two-branched; and elongated thoracic spiracles – Fig. 83) and Spilophorini (head hypognathous; 6 pars of stemmata; 2-segmented antennae; triangular mandibles; body dorso-ventrally flattened, elongated; 14 pairs of lateral scoli, lack scoli of second and 4th pair; each supra-anal process consist of two parts: stout base and fine apex; and legs with pulvilli – Fig. 84) indicate that these tribes are very different and distinct from other tribes, the observation supported by cladistic analyses to date, especially cladogram in Borowiec (1995), in which these tribes formed a clade.

However, origin and relationships between the above mentioned tribes remains problematic. Known immatures and their morphology are insufficient for unequivocal answers. On the basis of morphological characters of the immatures it is hard to settle whether Spilophorini are closer to cassidoid Cassidinae, as suggested by Chaboo (2007), or hispoid tribes, as in cladogram in Hsiao and Windsor (1999) or whether Hemisphaerotini are the closest

relatives of hispoid Cassidinae as in cladogram by Borowiec (1995). On the other hand, Delocranini and Notosacanthini in both cladograms by Borowiec (1995) and Chaboo (2007) are close, which suggests their close relationship, but analysis of morphological characters suggests that resemblance of immatures may be a consequence of similar life histories and not necessarily an effect of close relatedness. For example, bionomics of Notosacanthini and Delocranini determines lack of faecal shields in these tribes, which in turn probably is the reason that in these tribes typical supra-anal processes are not developed. The lack of supra-anal processes in these larvae is probably not a synapomorphy but only an adaptation to conditions of life. Probably elongated thoracic spiracles of Delocranini and Hemisphaerotini are also the effect of an adapation to environment rather than synapomorphy. Mature larvae of Notosacanthini seem to be the most distinguished within subfamily Cassidinae. Hitherto known morphological characters of immatures of Notosacanthini suggest their closer relationship with hispoid rather than with cassidoid Cassidinae.

The shields of Hemisphaerotini and Spilophorini are very unique, unknown in any other larvae of remaining tribes. Larvae of Hemisphaerotini build most elaborate faecal shields among Cassidinae consisting of exuvia and faeces, reminiscent more of bird nest turned upside down than shield (Figs 135-137). Larvae of Spilophorini, in turn, build their shields only with exuvia. Specific shape of supra-anal processes of Spilophorini larvae gives their shields very unique and characteristic shape. The shields of Hemisphaerotini and Spiloporini additionally highlight the distinctness of these tribes. Morphological characters of known immatures of species belonging o Notosacanthini, Delocranini, Hemisphaerotini and Spilophorini confirm their distinctness from other tribes. However, the immature stages of members of these tribes are still poorly known and it is hard to infer phylogenetic relationships between these tribes basing on morphological characters.

Morphology typical for cassidoid Cassidinae (head hypognathous; 6 pairs of stemmata; 2-segmented antennae; palmate mandibles; body dorso-ventrally flattened, oval; free supra-anal processes) is represented by mature larvae of tribes Aspidimorphini, Basiprionotini, Cassidini, Dorynotini, Eugenysini, Goniocheniini, Mesomphaliini, Omocerini i Physonotini (Figs 89, 90, 92-95, 98-104, 134, 141-144, 146, 148, 152). Tribes which in classification by Borowiec (1995) formed sister clade to clade of Notosacanthini, Delocranini, Spilophorini and Hemisphaerotini (Figs 80, 82-84), and in classifications by Hsiao and Windsor (1999), as well as Chaboo (2007) are situated high in cladograms.

With the respect of the body shape the lavae of the Omocerini are somewhat different from the other tribes because represented by two types (Figs 86-88, 134): larvae of oval body shape, dorso-ventrally flattened as in

typical Cassidinae but with very short supra-anal processes (*Discomorpha languinosa*; *Cassidinoma denticulata*) and larvae that have free and long supra-anal processes but strongly dorso-ventrally flattened and almost round body (*Omocerus klugi*). Omocerini in cladogram by Borowiec (1995) as well as Hsiao and Windsor (1999) is placed basally relative to other mentioned tribes of cassidoid Cassidinae which suggests that this group is more primitive. In cladogram by Borowiec (1995) the most primitive tribe, and at the same time the closest to Omocerini, is Basiprionotini. In Chaboo (2007) Omocerini are also close to Basiprionotini. In classification by Hsiao and Windsor (1999) Basiprionotini was not included, so nothing can be said about relative position of Omocerini relative to Basiprionotini. On the basis of immature stages morphology it is difficult to confirm close relationship of Basiprionotini and Omocerini. Mature larvae of Basiprionotini, similarly to Egenysini and Mesomphaliini, have 14 pairs of lateral scoli, lacking scoli of 5th and 7th pair. In turn, 17 pairs of lateral scoli have been observed in mature larvae of Omocerini. Judging only by the number of lateral scoli Basiprionotini should be more closely related to Eugenysini and Mesomphaliini and Omocerini would be closer to Dorynotini that also possess 17 pairs of lateral scoli. If we would assume that the number of lateral scoli indicates degree of evolutionary advancement, Omocerini together with Dorynotini would be situated on the top of the cladogram as the most advanced tribes. Number of lateral scoli in Drynotini and Omocerini, however, should be subject to verification since in some members of Cassidinae various authors describe lateral branches of second pair of lateral scoli as 17th pair of lateral scoli. It is possible that 17 pairs of lateral scoli in Omocerini and Dorynotini is an example of parallelism and not synapomorphy.

Mature larvae of Basiprionotini, Mesomphaliini and Eugenysini lack lateral scoli of 5th and 7th pairs, and Goniocheniini lack scoli of 4th, 5th and 7th pair. Larvae of Goniocheniini are characterized by the presence of tubercle at molar part of the mandibles (character not observed in immatures of any other tribe), they have the longest setae of body on abdominal sternites I-III medially, pulvilli at base of claw (character observed also in Spilophorini and in *Cistudinella obducta* of Physonotini), and very short and stout supra-anal processes. In classification by Borowiec (1995) Goniocheniini have been synonymised under Omocerini due to the lack of any synapomorphy supporting the tribe. Known mature larvae of Omocerini and Goniocheniini are different enough to suggest that the synonymisation of these tribes is unjustified. In Hsiao and Windsor (1999), Goniocheniini is placed between Mesomphaliini and Physonotini. General habitus, i.e., the shape and number of lateral scoli could support this placement. In mature larvae of the tribes Goniocheniini, Mesomphaliini and Physonotini the number of observed lateral scoli is lower than 16 pairs. Goniocheniini and Mesomphaliini lack scoli of pairs 5th and 7th

and Goniocheniini additionally lack 4th pair. Physonotini usually lack scoli of 4th pair or 4th and 16th in some species also scoli of 5th and 7th pair. Nothing can be said about placement of Goniocheniini in cladogram by Chaboo (2007) because she coded *Paratrikonota lerouxii* (as *Botanota lerouxii*) as Goniocheniini, while this species belongs in fact to Dorynotini.

The mature larvae of Aspidimorphini and Cassidini do not differ and cannot be distinguished by any characters specific to larvae of one or the other tribe (oval body; 16 pairs of long lateral scoli; well developed supra-anal processes; chaetotaxy of body, head and legs are similar as well as in first and last instar larvae) which may support suggestion of their synonymy by Borowiec (1995). Similarly situation is found in Eugenysini and Mesomphaliini (body oval; 14 pairs of lateral scoli in mature larvae, lack of scoli of 5th and 7th pair; well developed supra-anal processes). Unfortunately, thus far immatures of only one Eugenysini species (*Eugenysa columbiana*) are known. Descriptions of *Eugenysa columbiana* immatures (Chaboo 2002) are very superficial and lack many relevant characters (first instar virtually not described; concerning mature larva: no information on chaetotaxy of body, head, legs and no detailed information on mouthparts) and thus it is impossible to decide if Eugenysini should be synonymised with Mesomphaliini or not. Only future studies of other Eugenysini members and redescription of *Eugenysa columbiana* can shed light on this problem. However, at the moment it is impossible to point any morphological character of mature larva that supports differentiating Eugenysini as a separate tribe. In classification of Borowiec (1995) these tribes were synonymised due to the lack of any apparent synapomorphy, in Hsiao and Windsor (1999) Eugenysini were placed among Mesomphaliini, and in Chaboo (2007) Eugenysini are the closest relatives of Mesomphaliini.

Dorynotini tribe in cladograms by Borowiec (1995) and by Hsiao and Windsor (1999) are sister to Cassidini. Larval morphology supports such placement. Dorynotini differ from Cassidini only in possesion of 17 pairs of lateral scoli and moderately long supra-anal processes but immatures of only four species of Dorynotini are thus far known and only future studies can support or invalidate permanence of these differences. Moderately long supra-anal processes were also observed in Omocerini and Mesomphaliini and in some Physonotini. Short and stout are supra-anal processes of Goniocheniini and Basiprionotini.

The most variable in respect of body shape and number of lateral scoli are larvae of Physonotini (Figs 93-95). The mature larva of *Cistudinella obducta* in respect of shape and number of lateral scoli (16 pairs) is reminiscent of mature larvae of Cassidini and Aspidimorphini. The lateral scoli of mature larvae of other known species of Physonotini are shorter and occur in lower number than in *C. obducta*: 11 pairs were observed in *Physonota helianthi*, 14 in *Eurypepla calochroma, E. jamaicensis, Ph. alutacea* and *Ph. unipunctata*,

15 in *Asteriza flavicornis*. The lateral scoli of mature larvae of *C. obducta* are quite long and covered with short lateral branches and setae whereas scoli of larvae of *Physonota*, *Eurypepla* and *Asteriza* species are short and simple, covered with setae but without lateral branches.

The differences between first instar larvae of *Cistudinella obducta* and *Physonota alutacae* are not as distinct as in mature larvae (Figs 3, 4, 8, 9, 93, 94). Scoli of *C. obducta* (they are as long as body width or longer) are longer in ratio to the body width than scoli of *Ph. obducta* (they are as long as half of body width) but both represent the same type: in both instances scoli are simple, covered with long setae and armed apically with very long seta which bearing spinule at the apex. In both species the tergites are covered with long setae which bearing spinule at the apex; sternites are covered with long pointed setae; and the longest setae of body are in the middle of abdomen (Figs 12, 13, 32, 33). First instar larvae of *Ph. alutacea* and *C. obducta* are apparently similarly built, which supports suggestion of Borowiec (1995) to synonymise Ischyrosonychini and Physonotini. In classification by Hsiao and Windsor (1999) these tribes form one clade.

CONCLUSIONS

Cassidinae are characterized by strong homgenity of morphology in both immature and adult forms. The result of this is a small number of characters available for cladistic analyses, hence the great importance of detailed descriptions taking into account as many characters as possible. Poor state of knowledge of cassidine immatures in respect of both number of species (8.2%), low quality of descriptions to date, numerous reversions and parallel evolution, reconstruction of the phylogeny of the Cassidinae using only characters of immature morphology is immensly difficult. Presently, when attempting any such reconstruction, it seems advisable to include all available characters, derived from the morphology of adults, immature stages, and molecular data as well.

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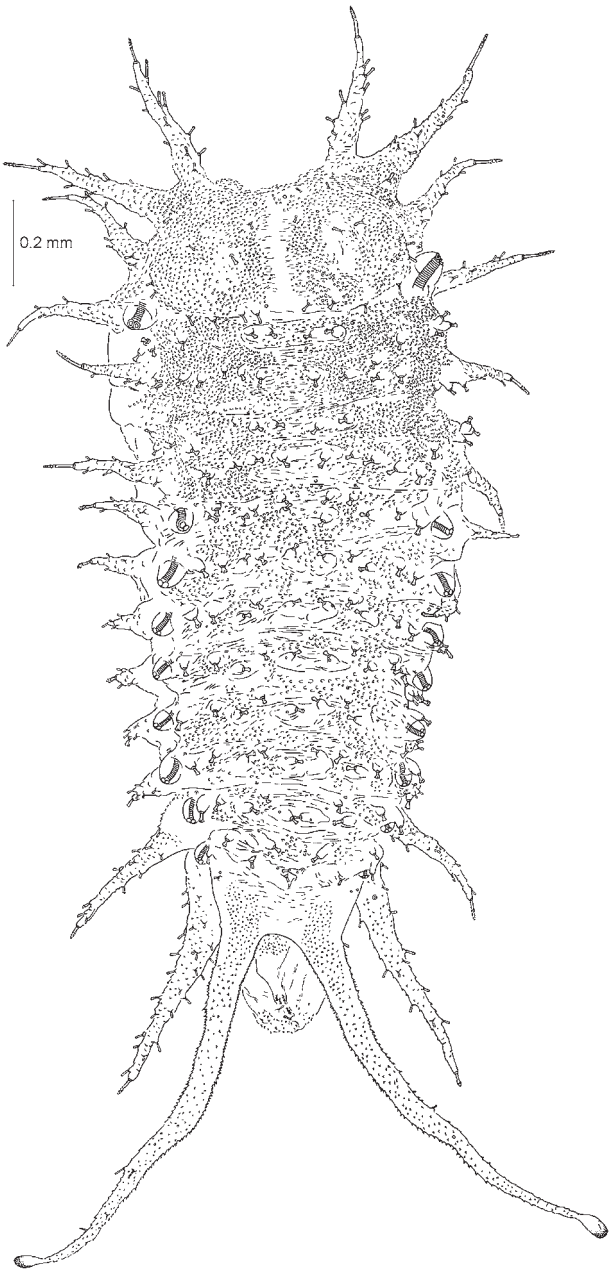
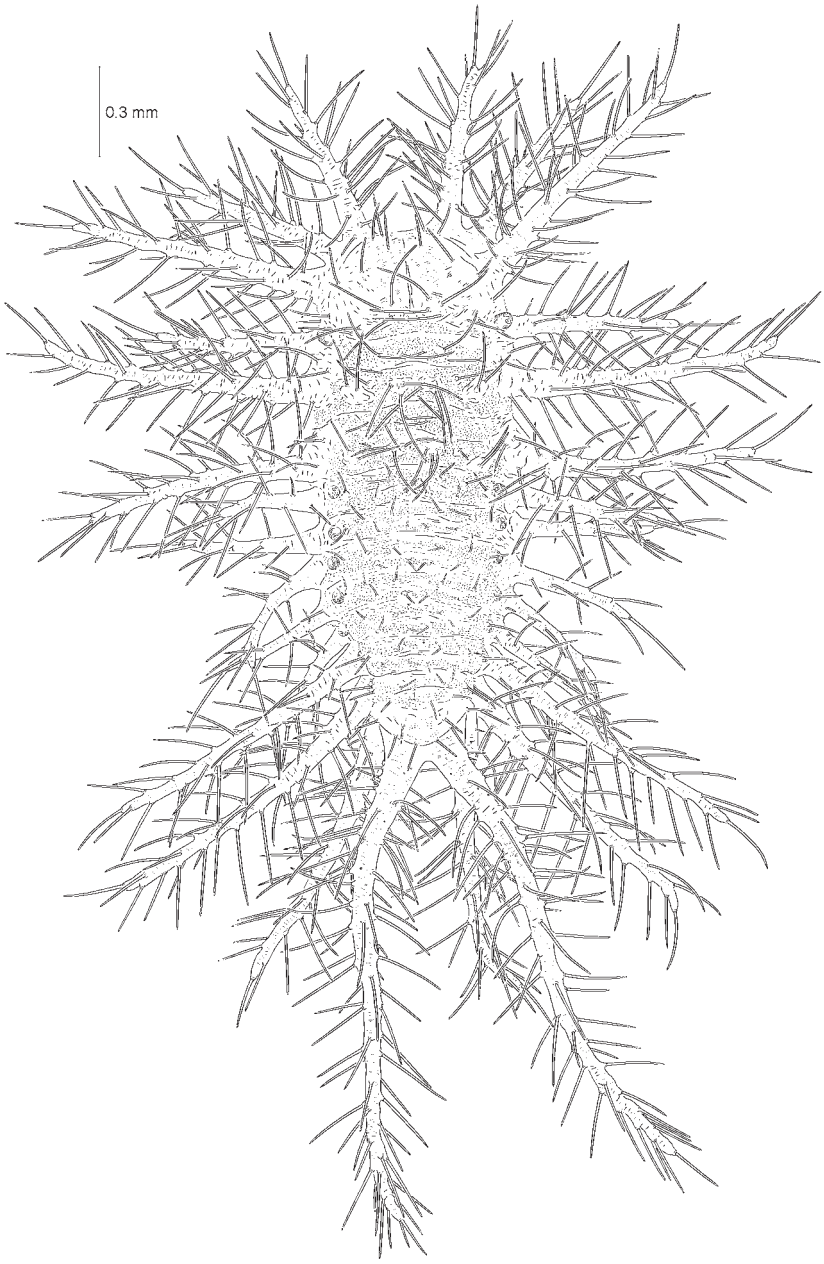
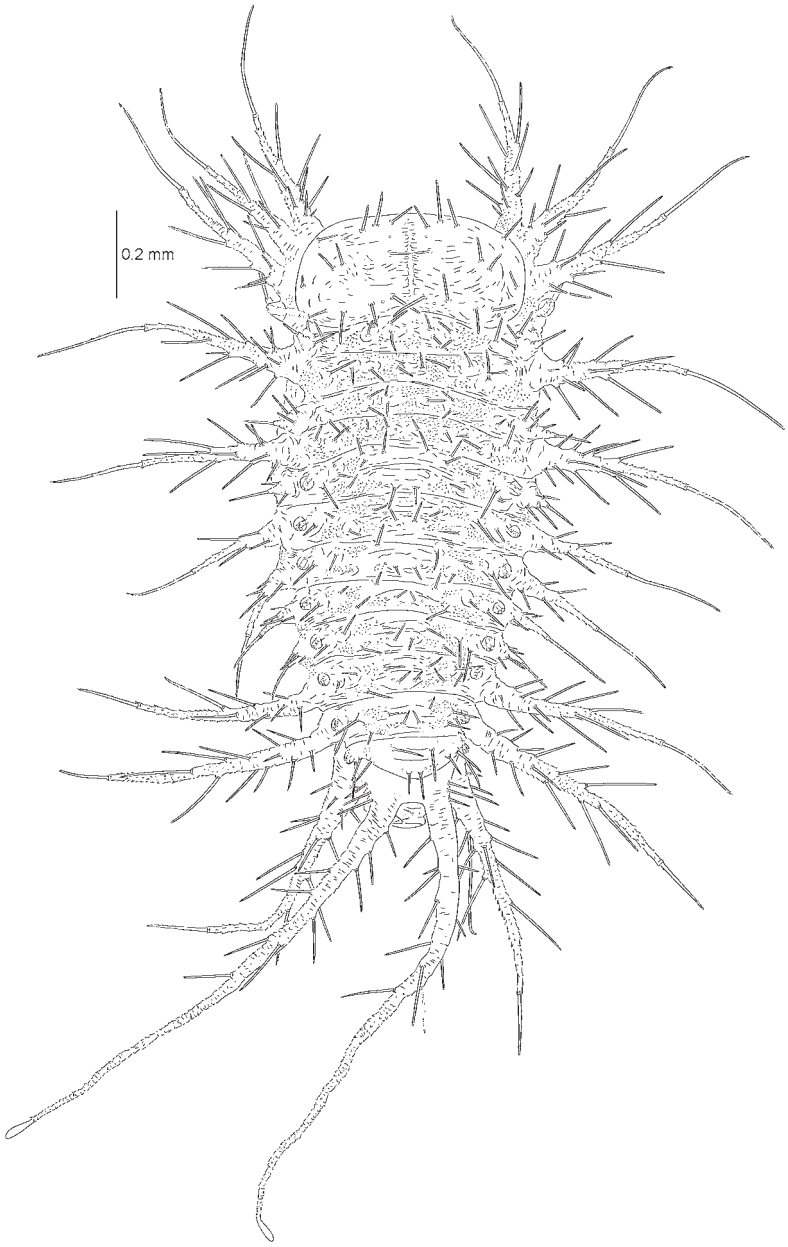


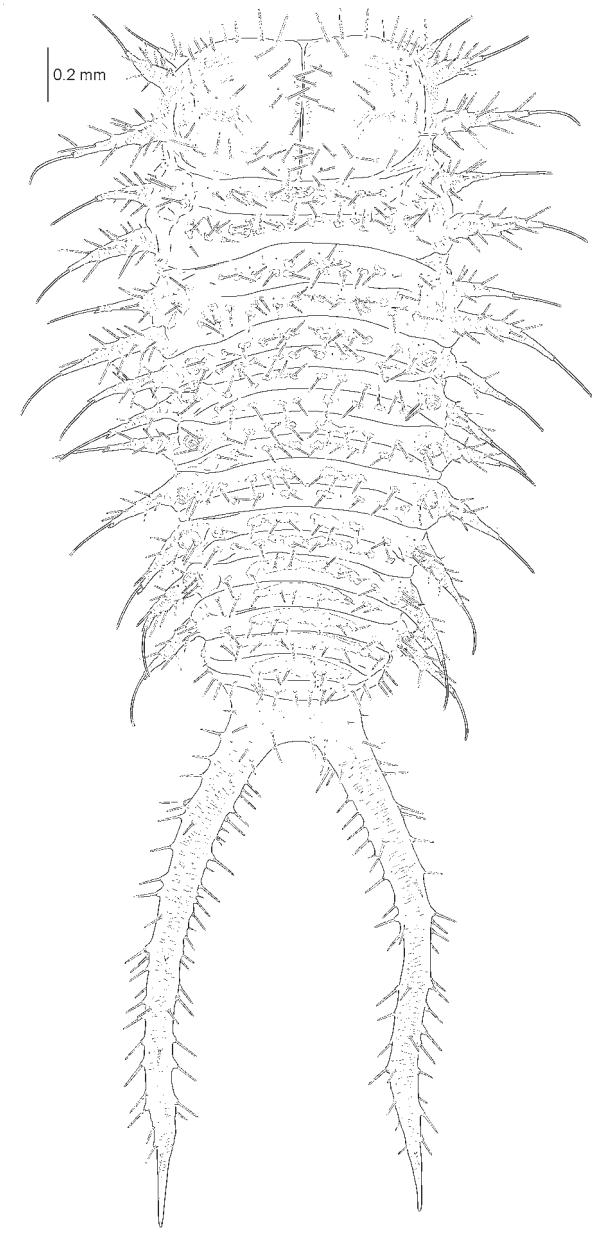
1. *Craspedonta leayana*, first instar larva, dorsal aspect, after Świętojańska and Ghate 2003



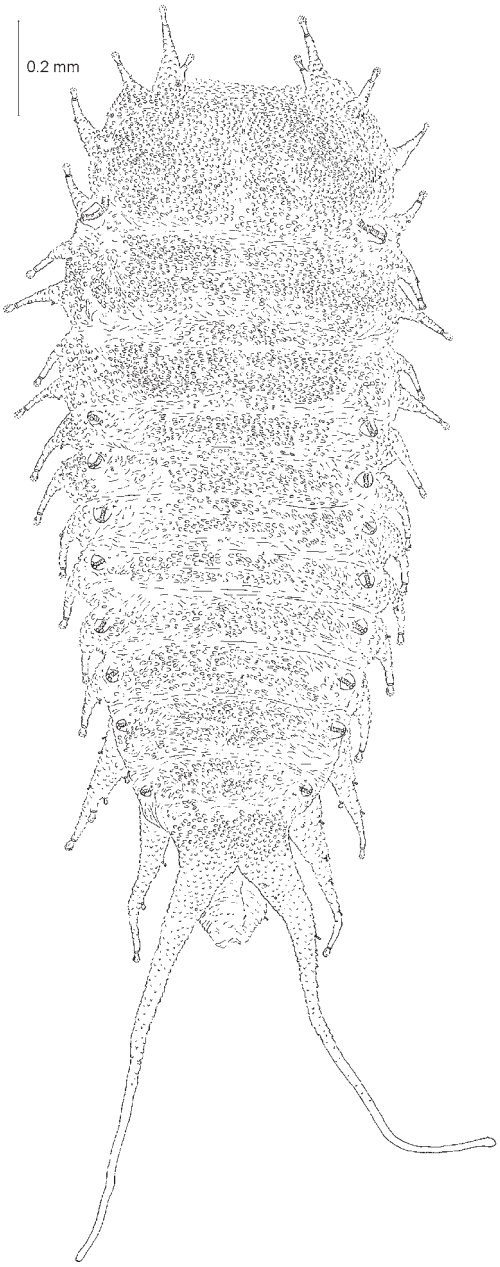
2. *Cyrtonota lateralis*, first instar larva, dorsal aspect, after Świętojańska 2008



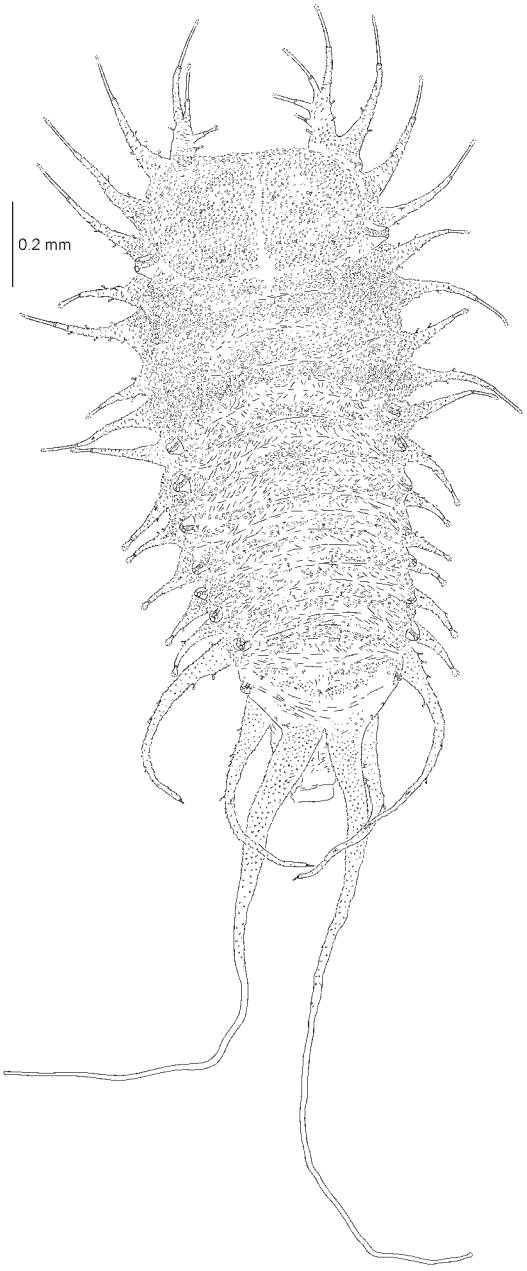
3. *Cistudinella obducta*, first instar larva, dorsal aspect, after Świętojańska and Medeiros 2007



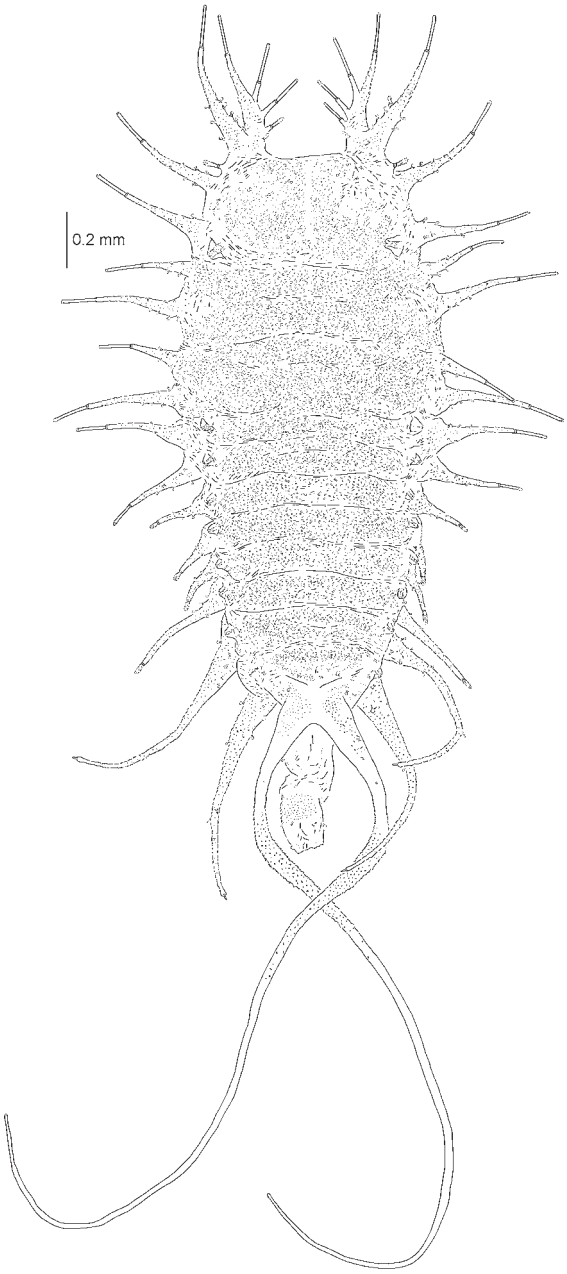
4. *Physonota alutacea*, first instar larva, dorsal aspect, after Świętojańska and Windsor 2008



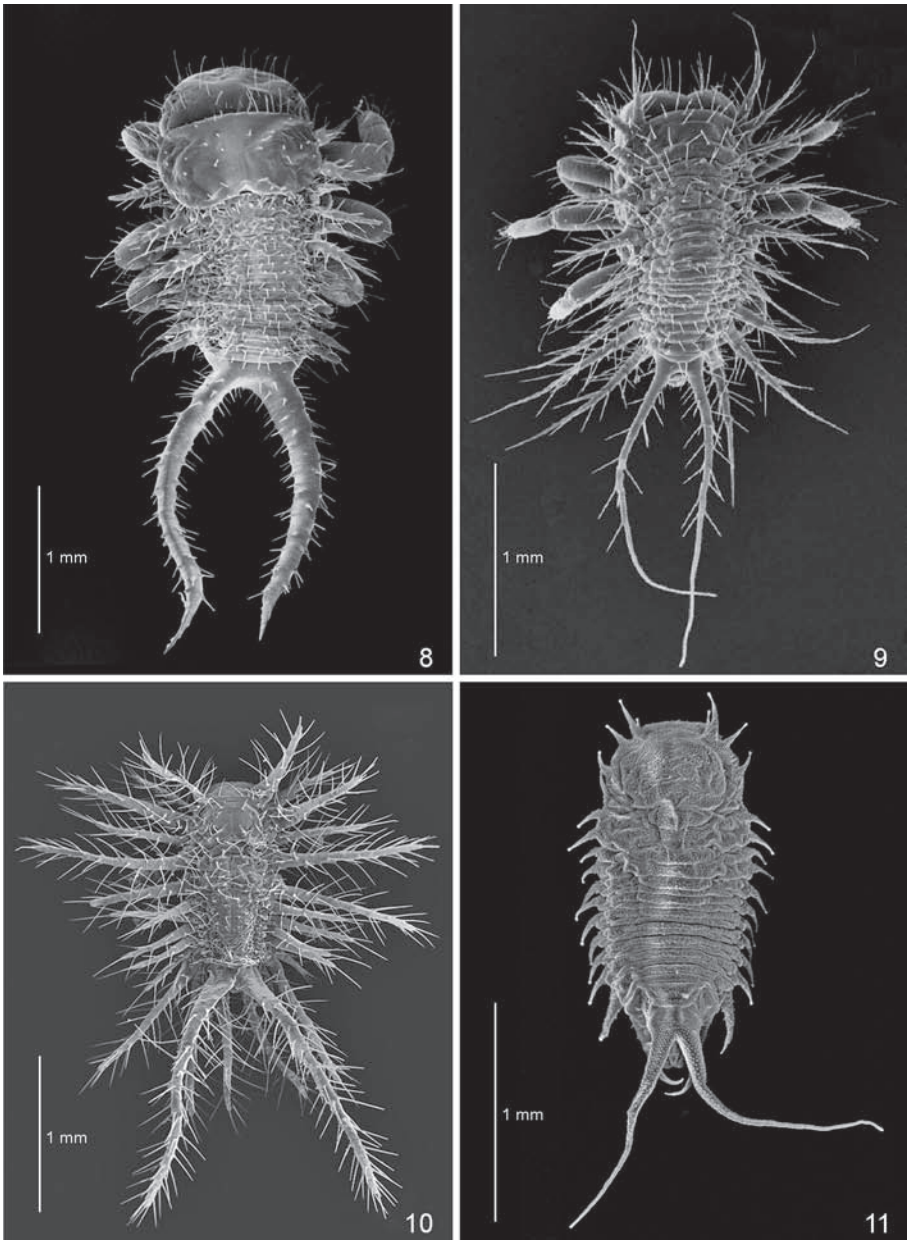
5. *Cassida stigmatica*, first instar larva, dorsal aspect, after Świętojańska 2004b



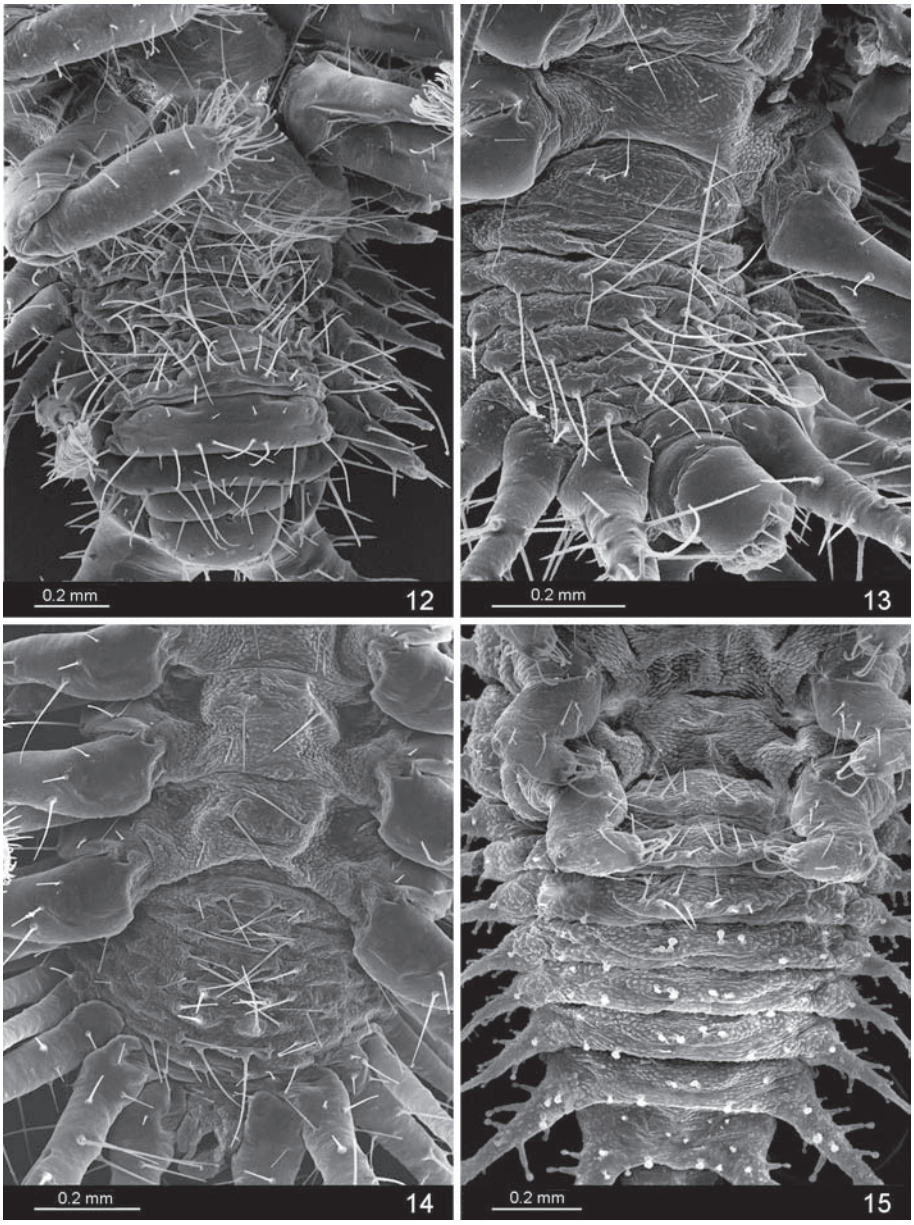
6. *Cassida rubiginosa*, first instar larva, dorsal aspect, after Świętojańska 2004b



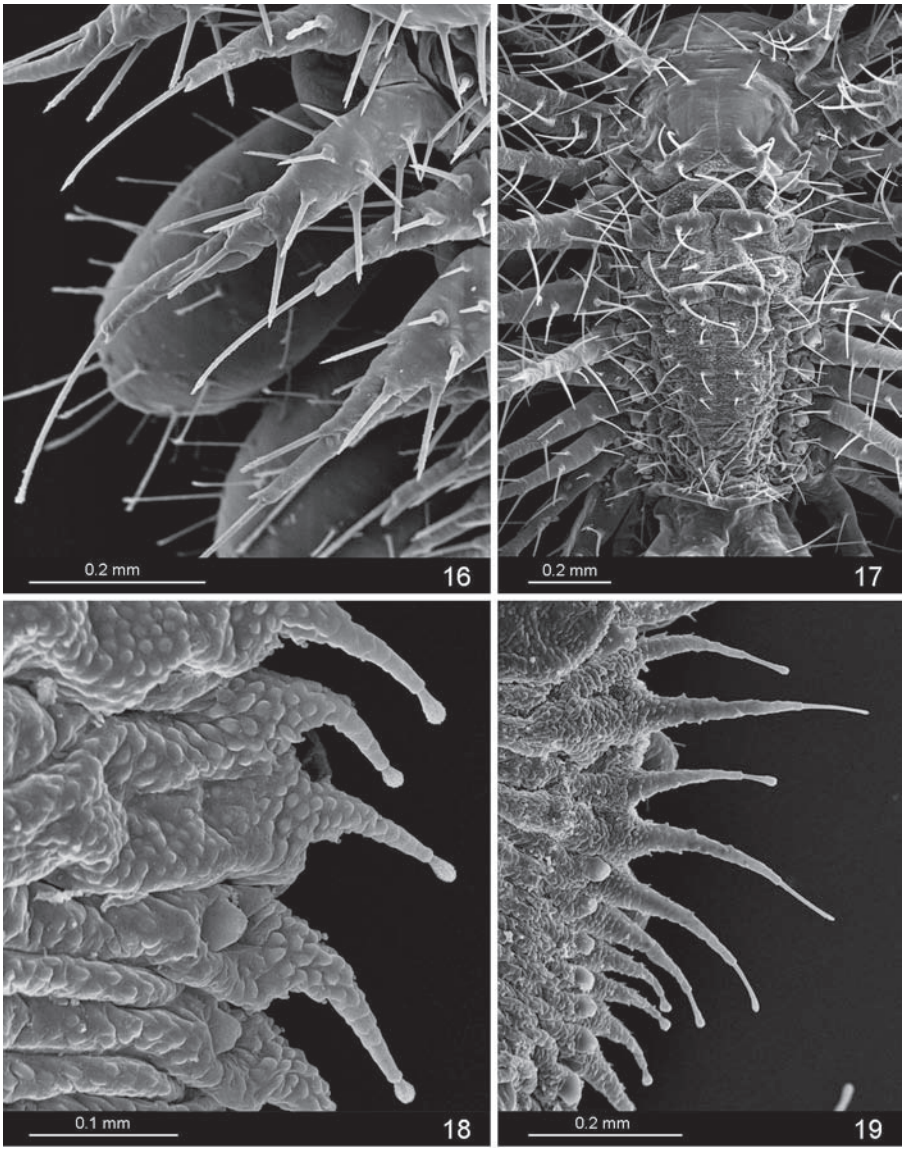
7. *Laccoptera foveolata*, first instar larva, dorsal aspect, after Ranade et al. 2004



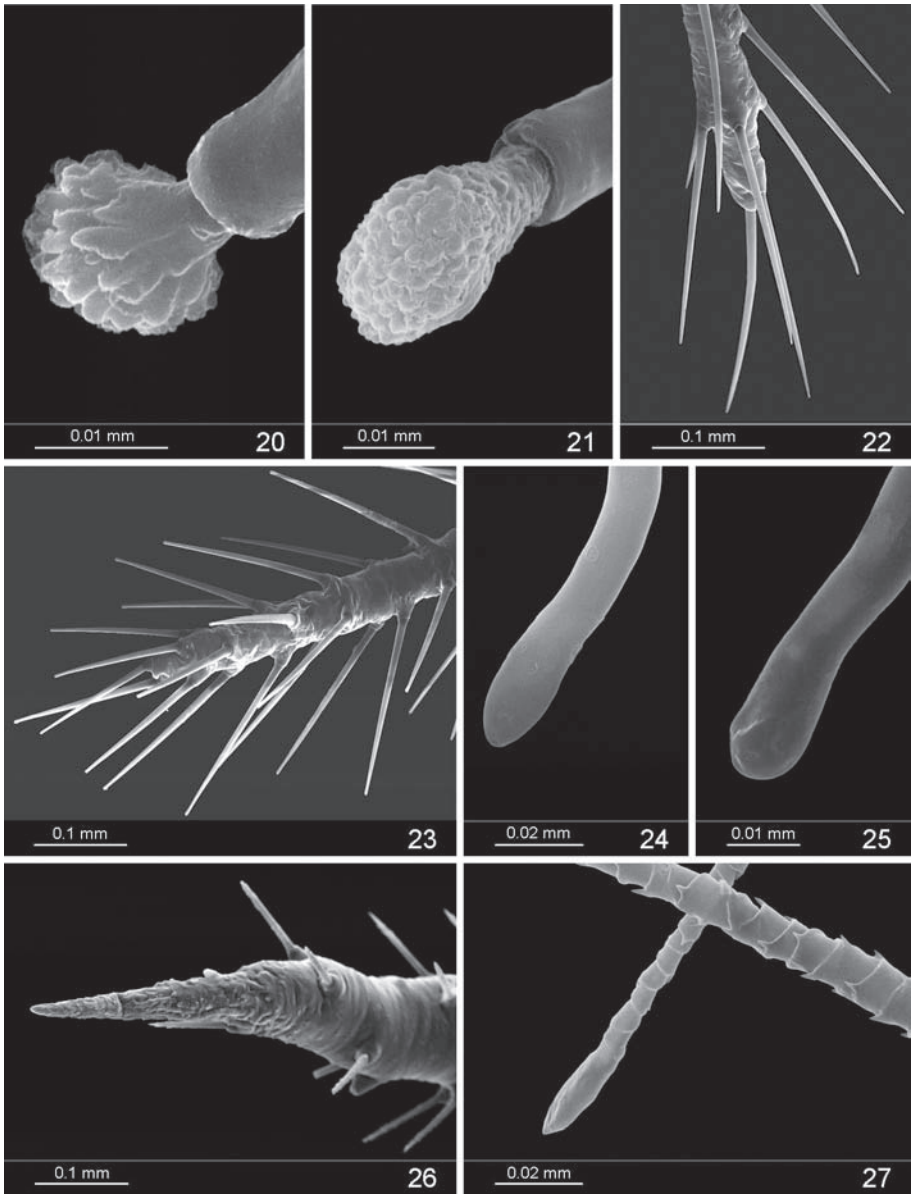
8-11. First instar larva, dorsal aspect. (8) *Physonota alutacea*, after Świętojańska and Windsor 2008; (9) *Cistudinella obducta*, after Świętojańska and Medeiros 2007; (10) *Cyrtonota lateralis*, after Świętojańska 2008; (11) *Cassida stigmatica*



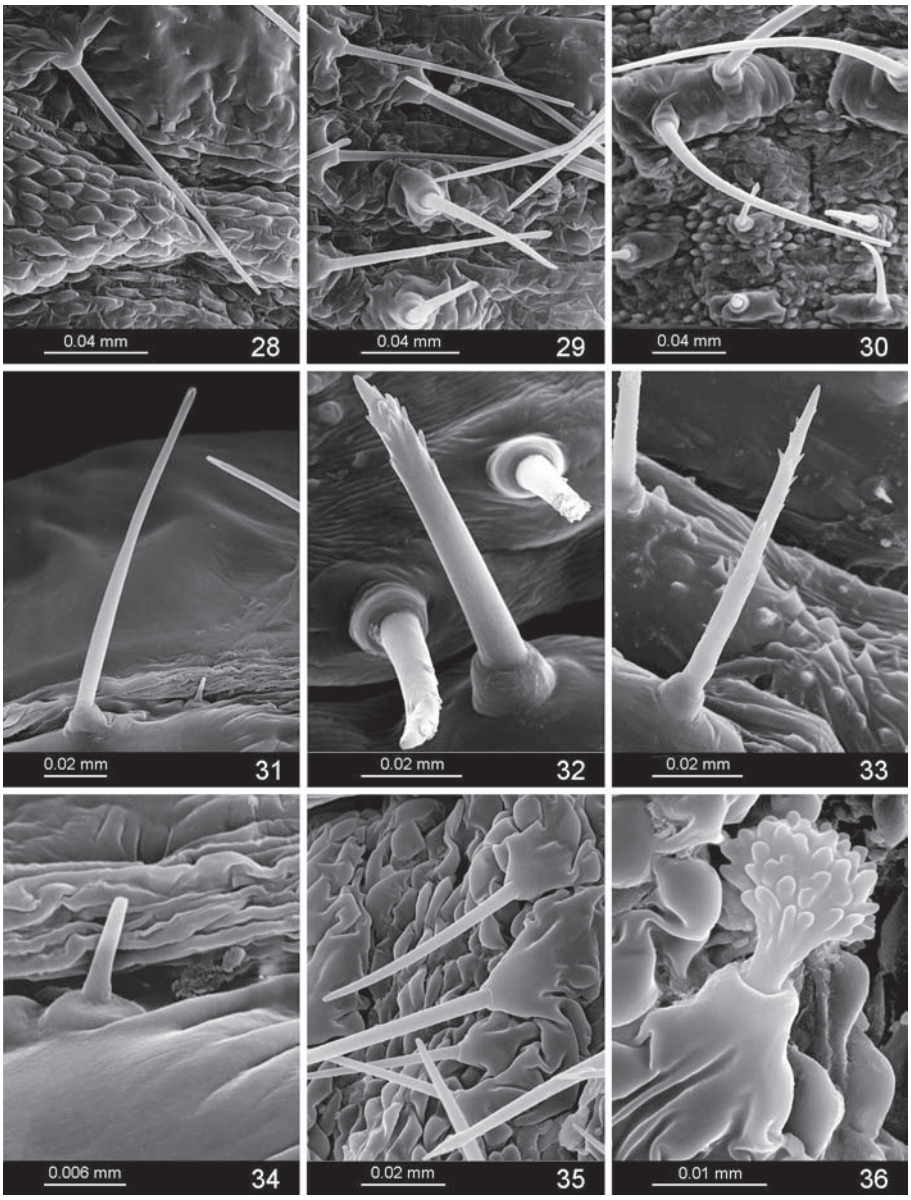
12-15. First instar larva, ventral side. (12) *Physonota alutacea*, after Świętojańska and Windsor 2008; (13) *Cistudinella obducta*, after Świętojańska and Medeiros 2007; (14) *Cyrtonota lateralis*, after Świętojańska 2008; (15) *Cassida vibex*



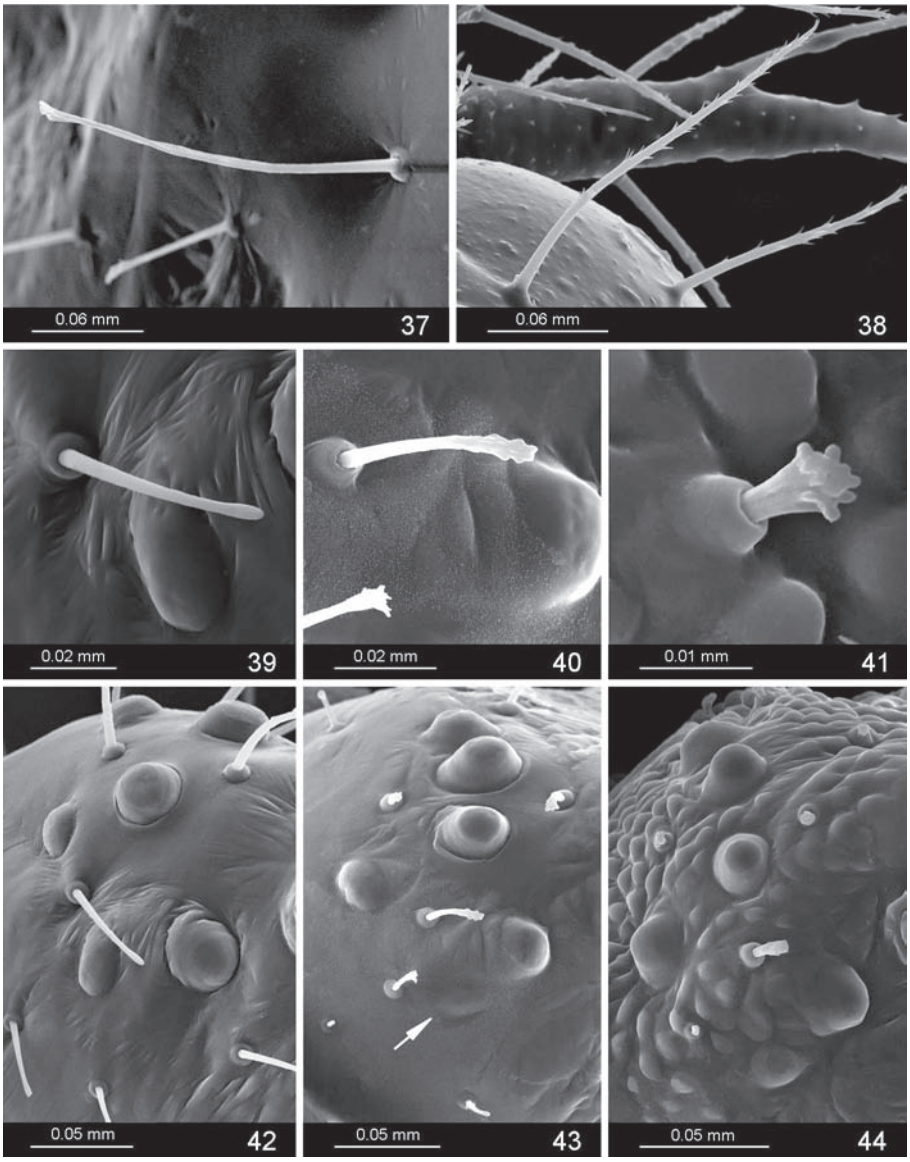
16-19. First instar larva. (16) Lateral scoli of *Physonota alutacea*; (17) *Cyrtonota lateralis*, dorsal side, after Świętojańska 2008; (18) lateral scoli of *Cassida stigmatica*; (19) lateral scoli of *Cassida rubiginosa*



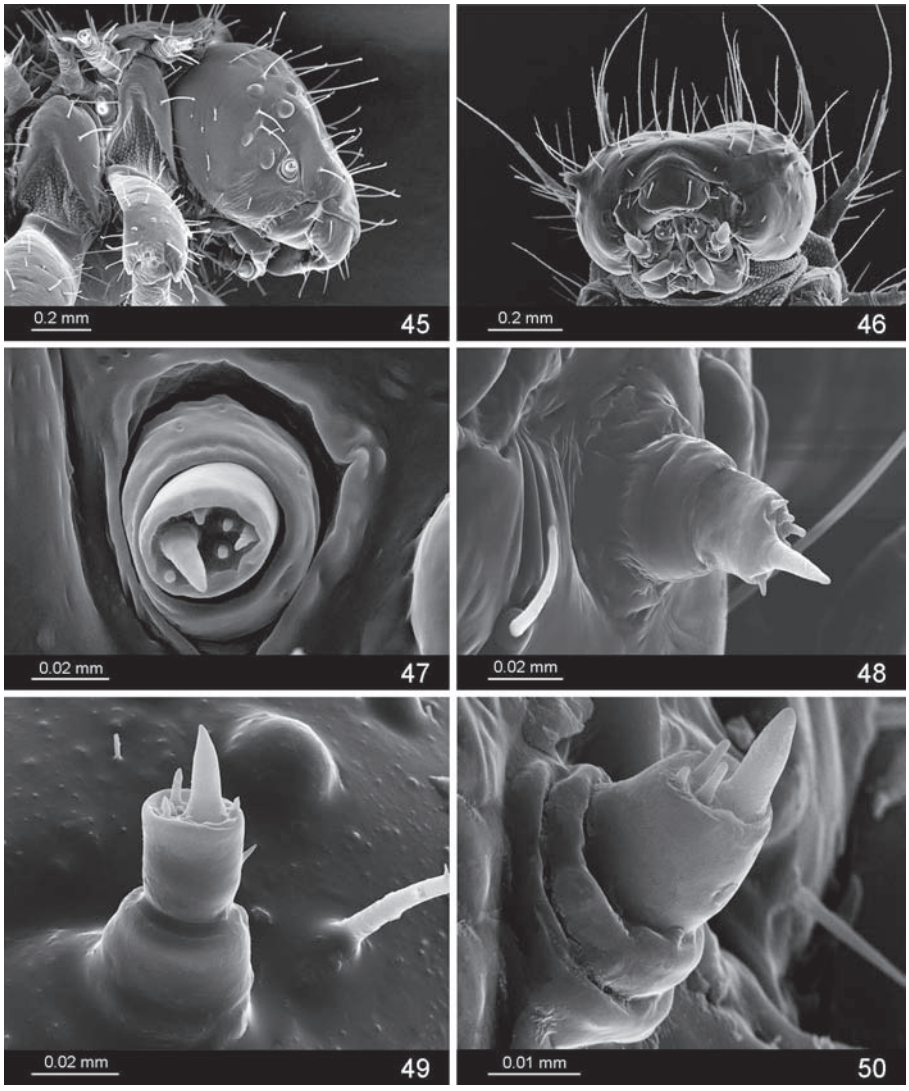
20-27. First instar larva. (20-22) Top of lateral scoli: (20, 21) *Cassida vibex*; (22) *Cyrtonota lateralis*, after Świętojańska 2008. (23-27) Top of supra-anal process: (23) *Cyrtonota lateralis*, after Świętojańska 2008; (24) *Cassida stigmatica*; (25) *Cassida rubiginosa*; (26) *Physonota alutacea*, after Świętojańska and Windsor 2008; (27) *Cistudinella obducta*, after Świętojańska and Medeiros 2007



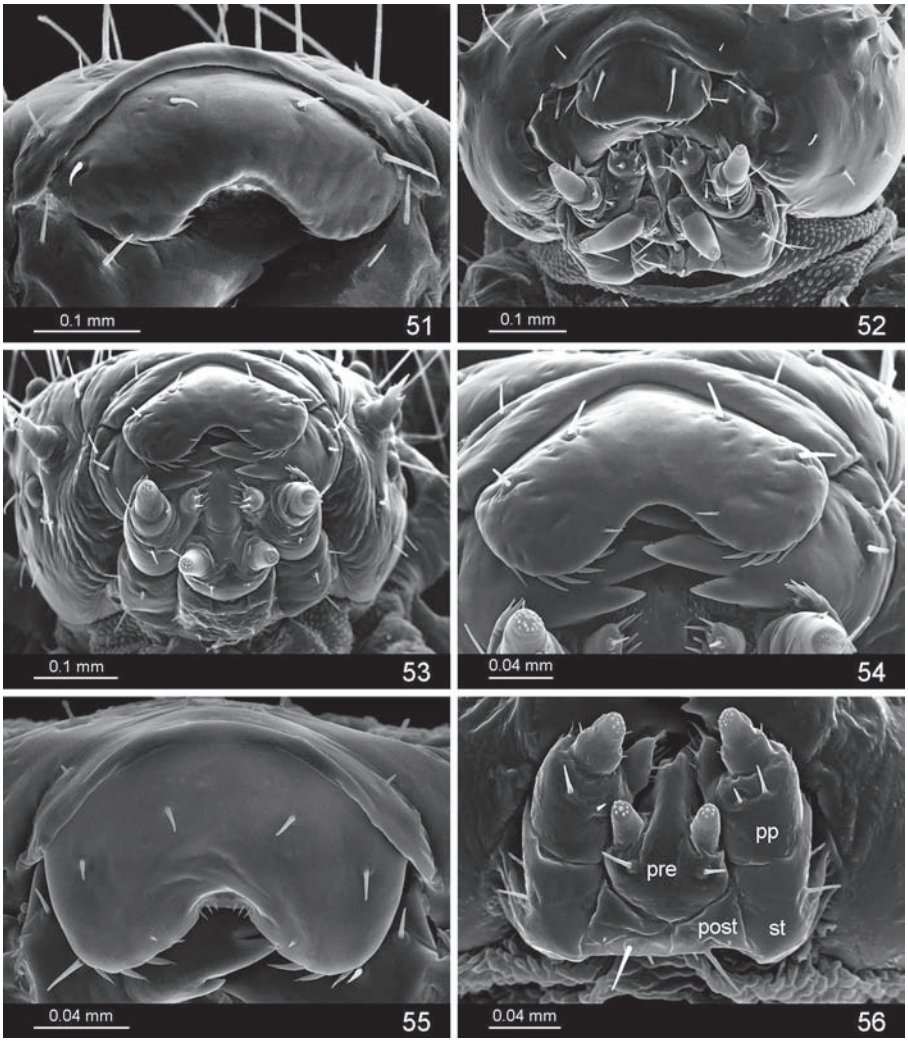
28-36. First instar larva. (28) *Cyrtonota lateralis*, seta of mesosternum; (29) *Cyrtonota lateralis*, setae of abdominal sternites; (30) *Cyrtonota lateralis*, setae of tergites; (31) *Cyrtonota lateralis*, setae of pronotum; (32) *Physonota alutacea*, setae of tergie; (33) *Cistudinella obducta*, seta of tergite; (34) *Cyrtonota lateralis*, minute seta of pronotum; (35) *Cassida rubiginosa*, setae of abdominal sternites medially; (36) *Cassida rubiginosa*, cauliflower-shape sensilla of abdominal setnite. (28-31, 34) After Świętojańska 2008; (32) after Świętojańska and Windsor 2008; (33) after Świętojańska and Medeiros 2007



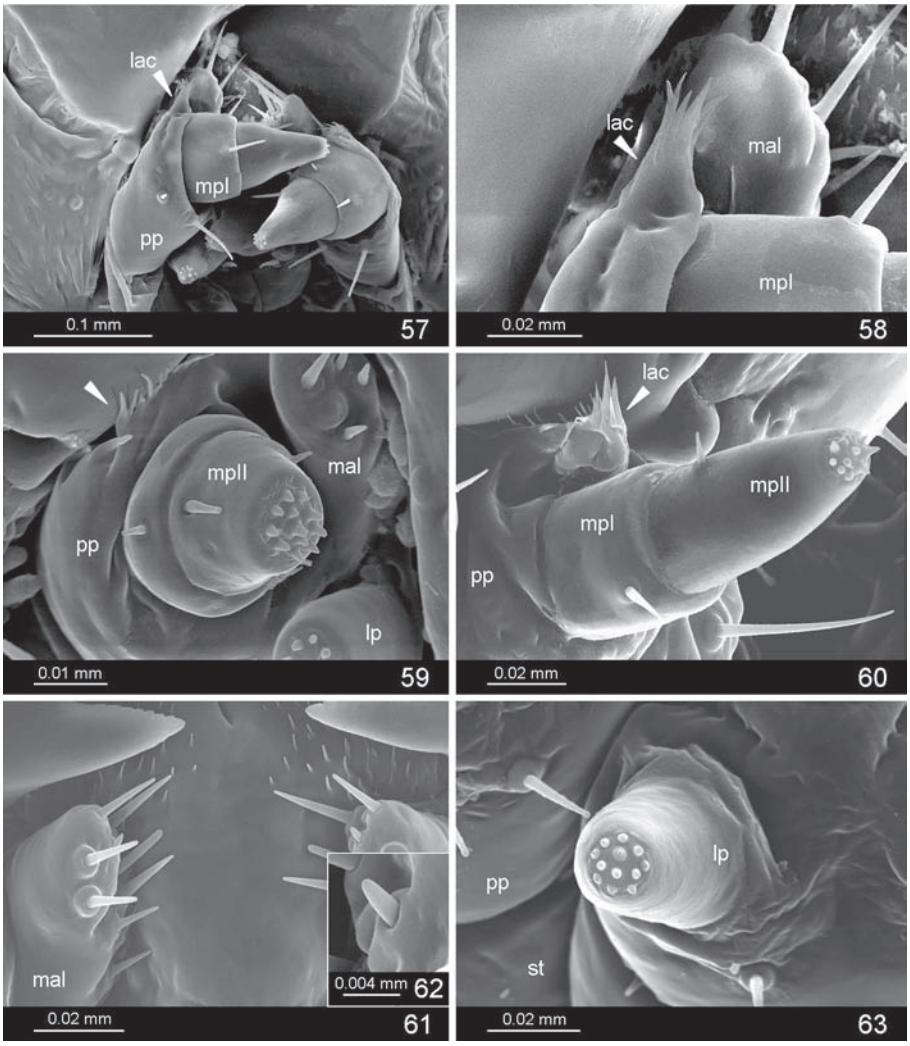
37-44. First instar larva. (37-40) Setae of head: (37) *Physonota alutacea*, after Świętojańska and Windsor 2008; (38) *Cistudinella obducta*, after Świętojańska and Medeiros 2007; (39) *Cyrtonota lateralis*, after Świętojańska 2008; (40) *Cassida vibex*; (41) *Cassida stigmatica*, caulifower-shape sensilla of head. (42-44) Lateral aspect of head with six stemmata: (42) *Cyrtonota lateralis*, after Świętojańska 2008; (43) *Cassida vibex*, white arrow pointed at stemma of sixth pair; (44) *Cassida stigmatica*



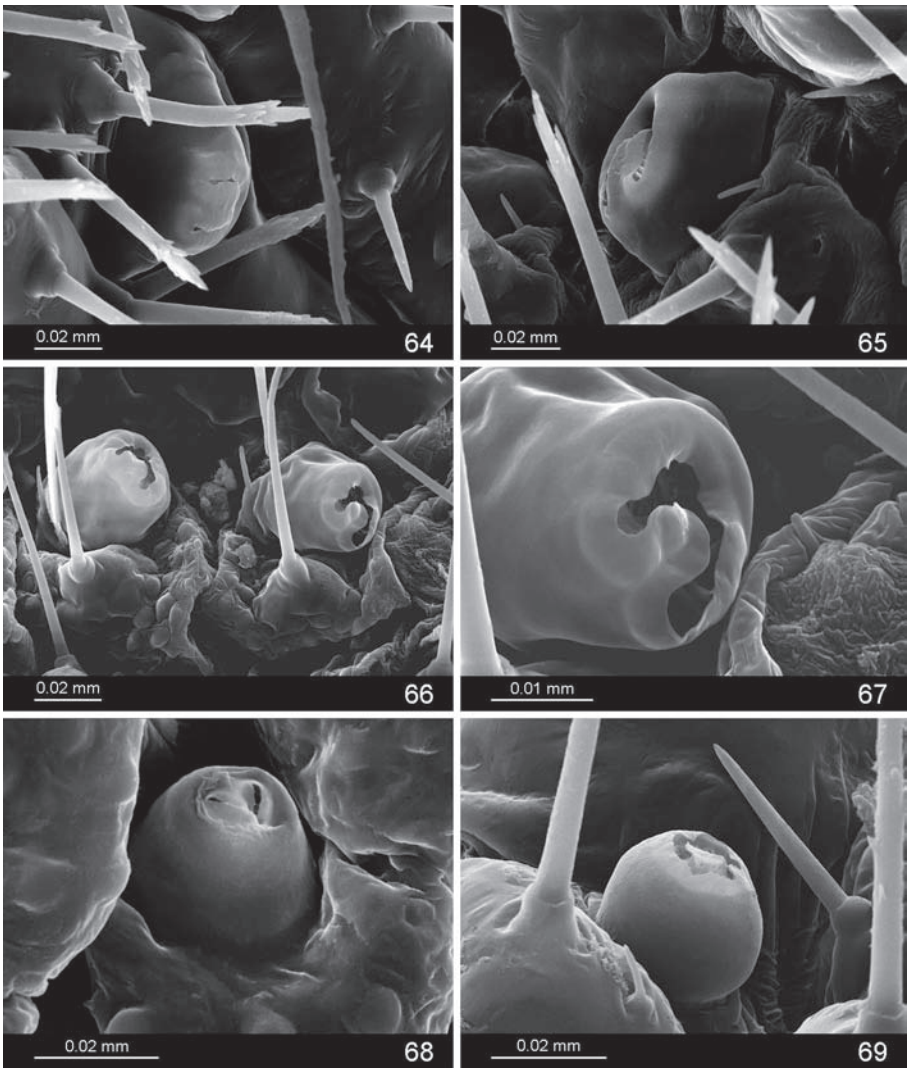
45-50. First instar larva. (45) *Physonota alutacea*, head lateral aspect, after Świętojańska and Windsor 2008; (46) head of *Cistudinella obducta*, after Świętojańska and Medeiros 2007. (47-50) Antenna: (47) *Physonota alutacea*, after Świętojańska and Windsor 2008; (48) *Cyrtonota lateralis*, after Świętojańska 2008; (49) *Cistudinella obducta*, after Świętojańska and Medeiros 2007; (50) *Cassida stigmatica*



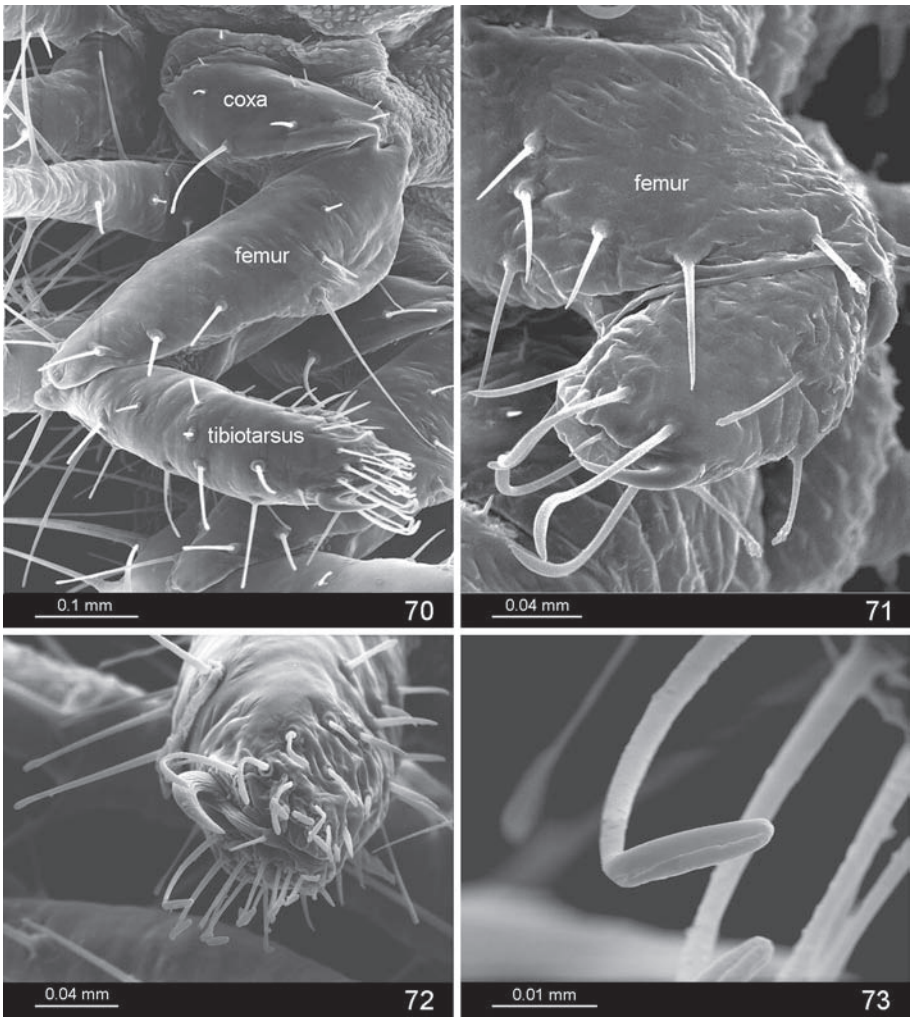
51-56. First instar larva. (51) *Physonota alutacea*, labrum, after Świętojańska and Windsor 2008; (52) *Cistudinella obducta*, mouth part, after Świętojańska and Medeiros 2007; (53) *Cyrtonota lateralis*, mouth part, after Świętojańska 2008; (54) *Cyrtonota lateralis*, labrum, after Świętojańska 2008; (55) *Cassida stigmatica*, labrum; (56) *Cassida rubiginosa*, maxillae and labium, st – stipes, pp – palpiger, pre – prementum, post – postmentum



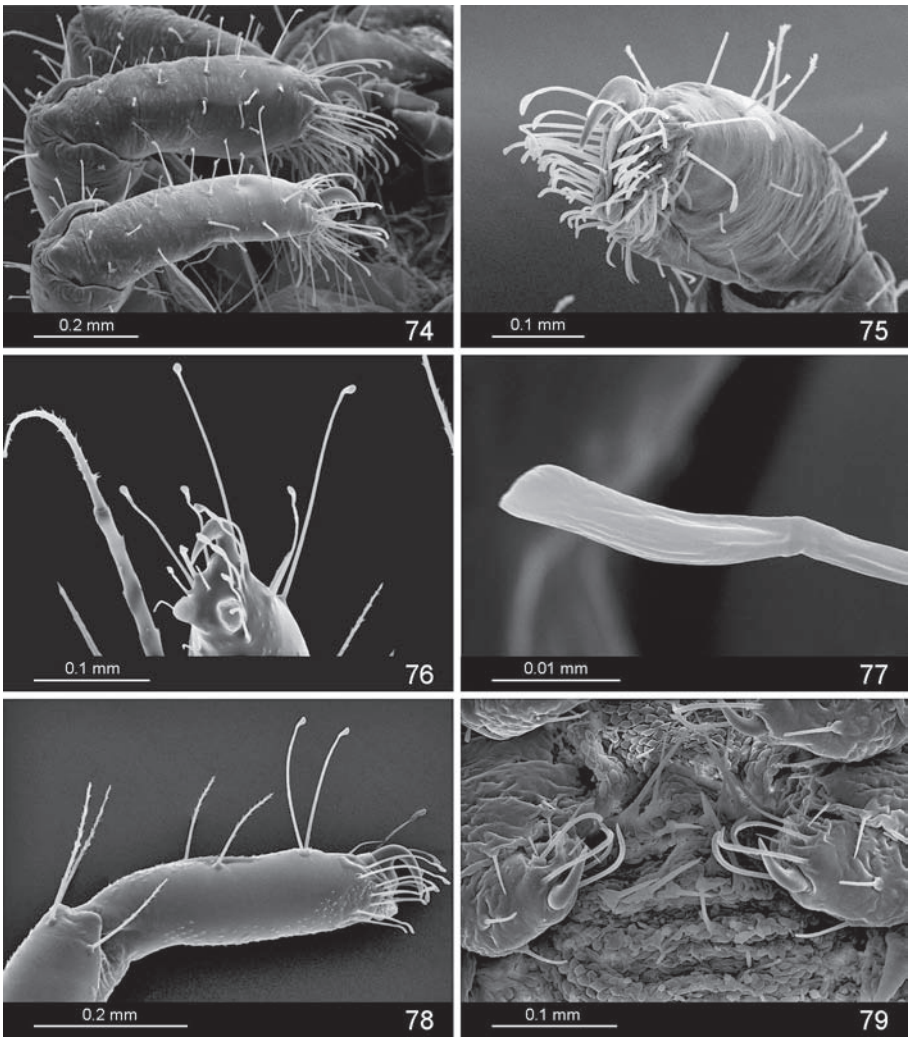
57-63. First instar larva, mouth part. (57) *Physonota alutacea*, pp – palpiger, mpI – first segment of maxillary palp, lac – lacinia; (58) *Physonota alutacea*, lac – lacinia, mpI – first segment of maxillary palp, mal – mala; (59) *Cassida stigmatica,* pp – palpiger, mpII – second segment of maxillary palp, mal – mala, lp – labial palp, arrow pointed at the group of spines (lacinia?); (60) *Cistudinella obducta,* pp – palpiger, mpI – first segment of maxillary palp, mpII – second segment of maxillary palp, lac – lacinia; (61) *Cyrtonota lateralis*, mal – mala; (62) *Cyrtonota lateralis*, small sensillum of mala; (63) *Cyrtonota lateralis*, lp – labial palp, pp – palpiger, st – stipes. (57, 58) After Świętojańska and Windsor 2008; (60) after Świętojańska and Medeiros 2007; (61, 62) after Świętojańska 2008



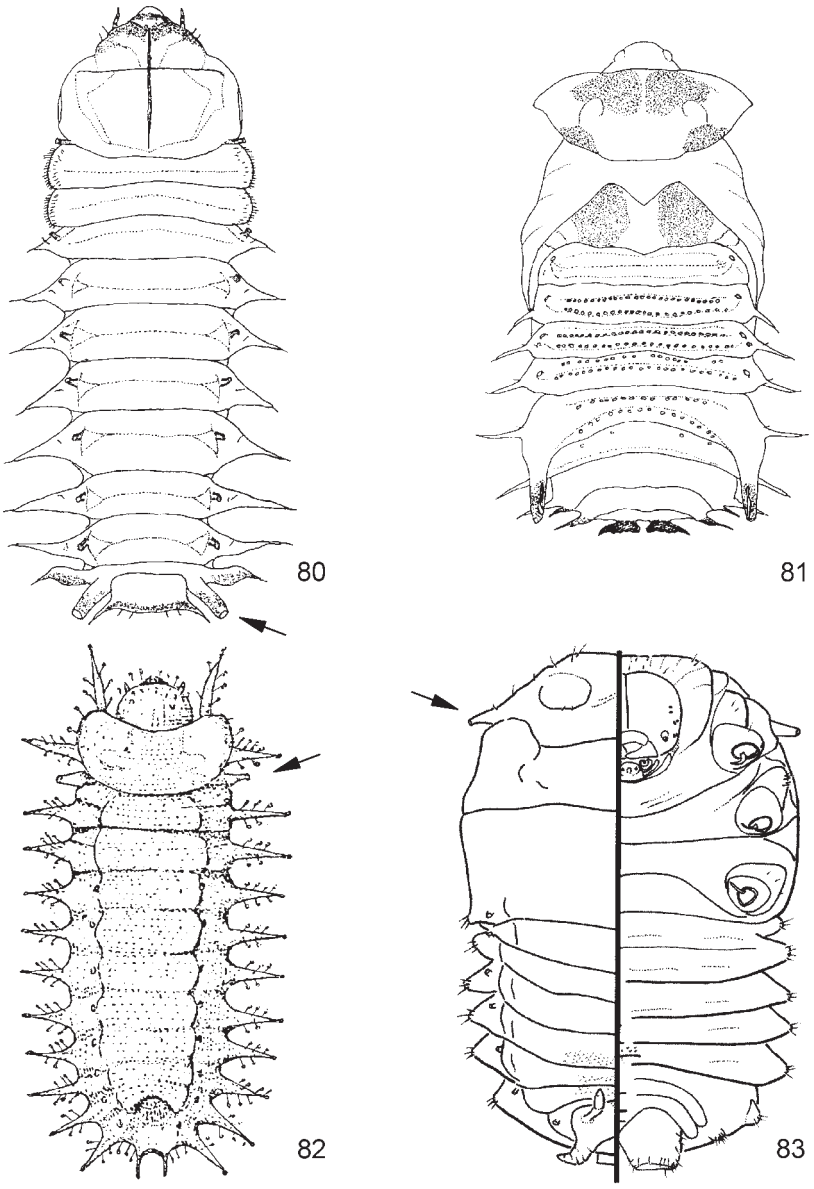
64-69. First instar larva, spiracles. (64, 65) *Physonota alutacea,* after Świętojańska and Windsor 2008; (66, 67) *Cyrtonota lateralis,* after Świętojańska 2008; (68) *Cassida stigmatica*; (69) *Cistudinella obducta*, after Świętojańska and Medeiros 2007



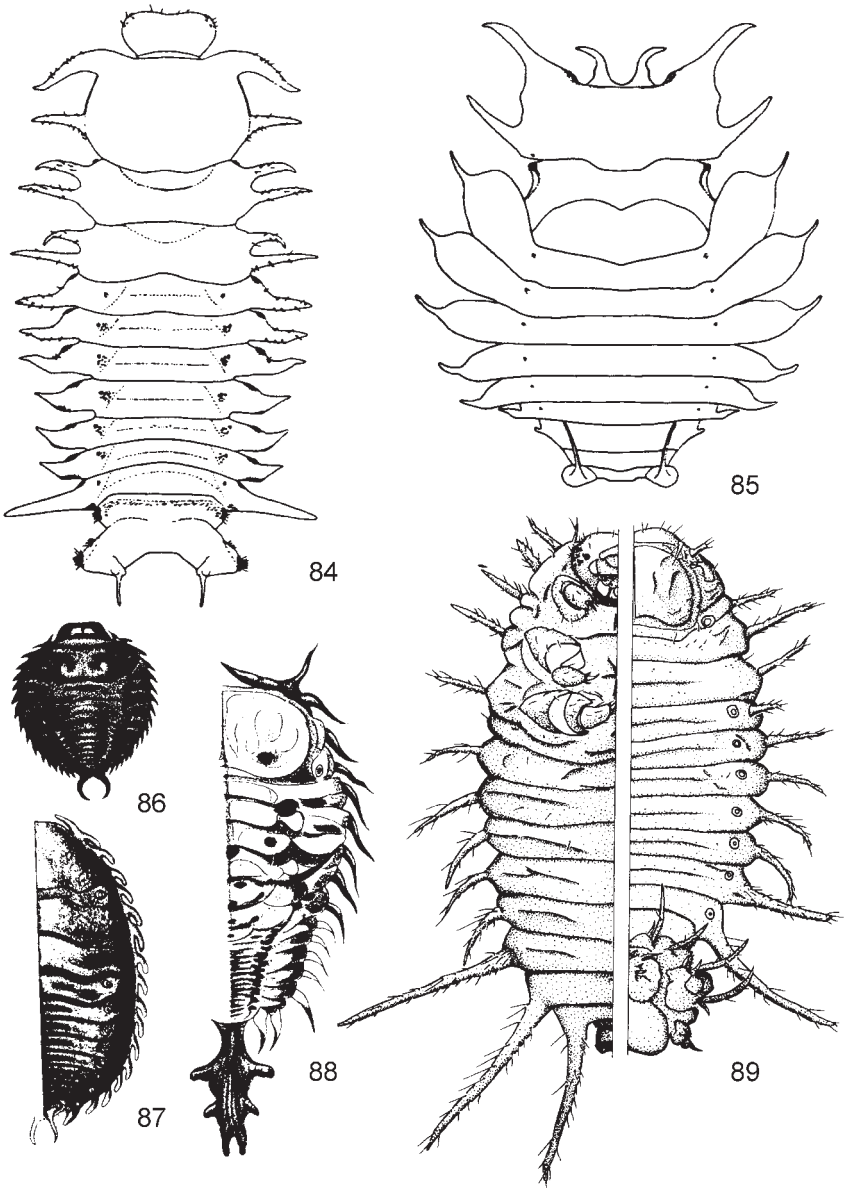
70-73. First instar larva. (70) *Cyrtonota lateralis*, leg; (71) *Cassida vibex*, leg; (72) *Cyrtonota lateralis*, top of tibiotarsus with claw; (73) *Cyrtonota lateralis*, top of seta placed close to claw. (70, 72, 73) After Świętojańska 2008



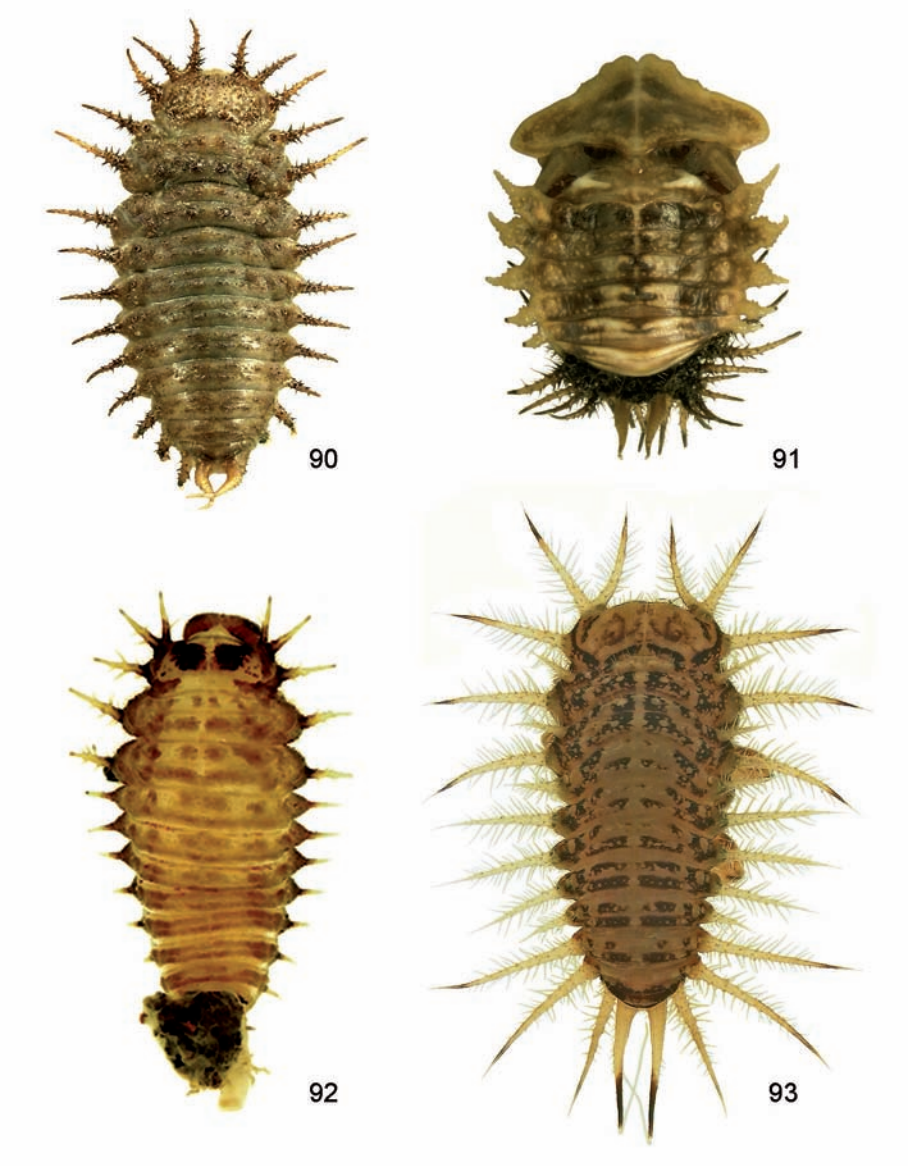
74-79. First instar larva. (74) *Physonota alutacea*, tibiotarsi of legs of second and third pair; (75) *Physonota alutacea*, tibiotarsus apically armed with claw, after Świętojańska and Windsor 2008; (76) *Cistudinella obducta*, top of tibiotarsus, claw surrounded by complex of hockey stick setae, one seta and pulvilli at base, after Świętojańska and Medeiros 2007; (77) *Cistudinella obducta*, top of hockey stick seta, after Świętojańska and Medeiros 2007; (78) *Cistudinella obducta*, tibiotarsus lateral aspect; (79) *Cassida stigmatica*, tops of legs of third pair



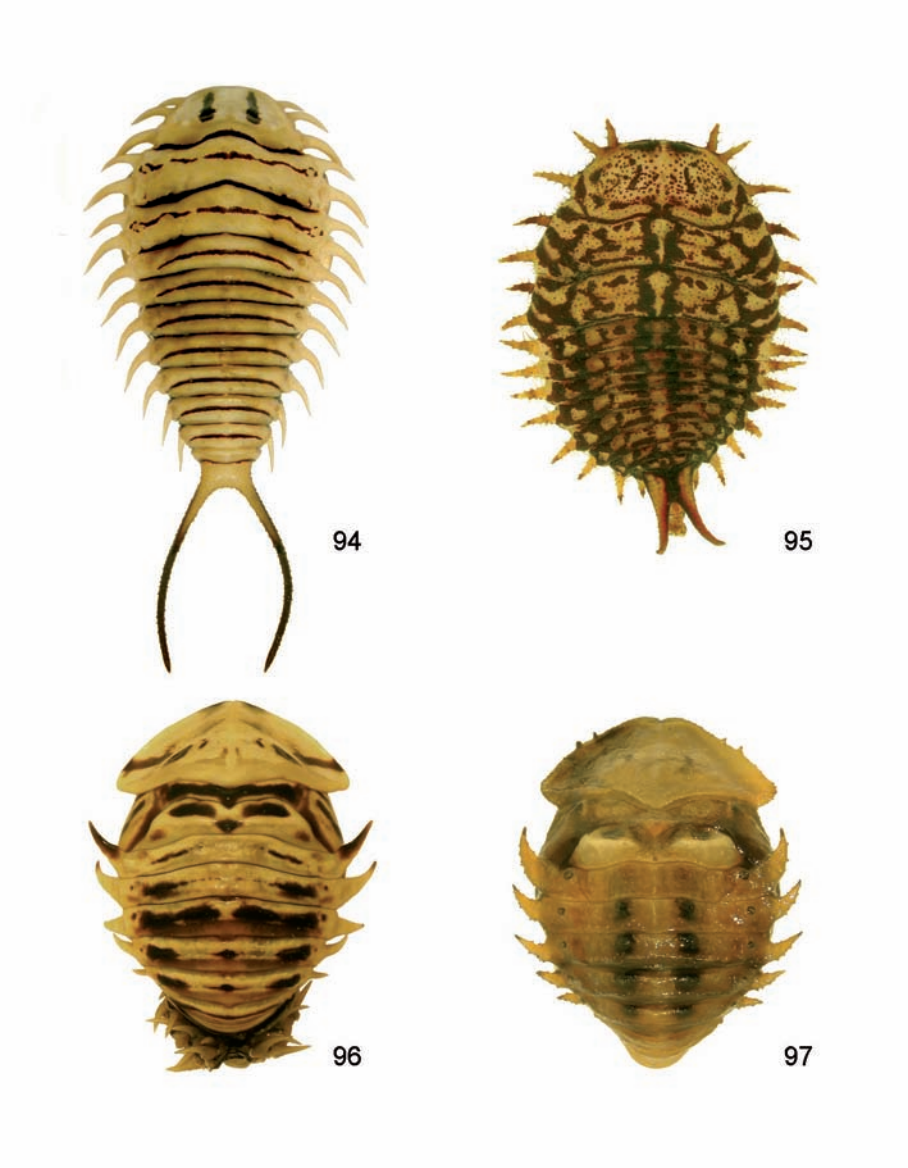
80-83. (80) *Notosacantha vicaria*, dorsal aspect of mature larva, after Rane et al. 2000, arrow pointed at spiracle of VIII abdominal segment; (81) *Notosacantha vicaria*, dorsal aspect of pupa, after Rane et al. 2000; (82) *Delocrania cossyphoides*, dorsal aspect of mature larva, after Bondar 1940, arrow pointed at spiracle of thorax; (83) *Hemisphaerota palmarum*, dorsal and ventral aspect, after Chaboo and Nguyen 2004, arrow pointed at spiracle of thorax



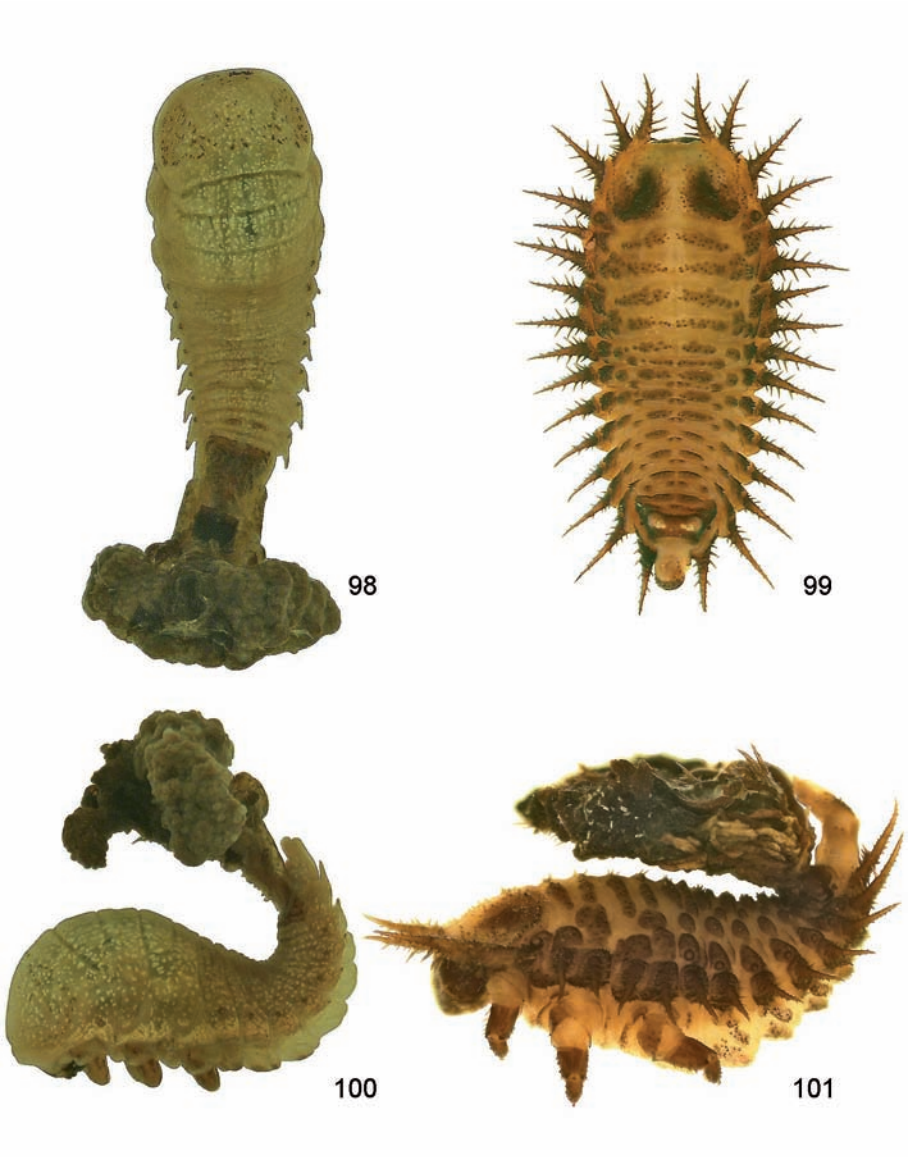
84-89. (84) *Calyptocephala paralutea*, dorsal aspect of mature larva, after Buzzi and Miyazaki 1992; (85) *Calyptocephala paralutea*, dorsal aspect of pupa, after Buzzi and Miyazaki 1992; (86, 87) *Omocerus klugi*, dorsal aspect of mature larva, after Fiebrig 1910; (88) *Cassidinoma denticulata*, dorsal aspect of mature larva, after Fiebrig, 1910; (89) *Eugenysa columbiana*, dorsal and ventral aspect of mature larva, after Chaboo 2002



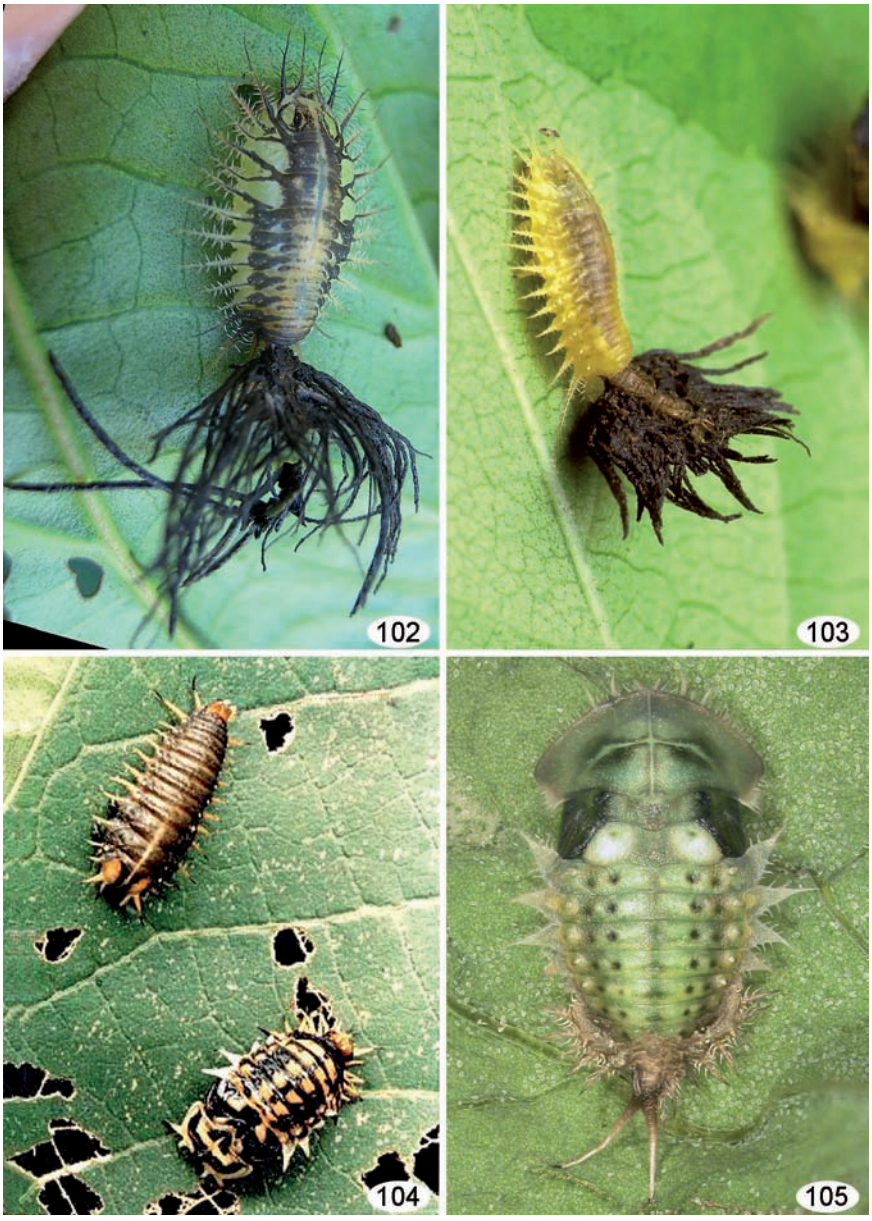
90-93. (90) *Cytronota lateralis*, dorsal aspect of mature larva, after Świętojańska 2008; (91) *Cyrtonota lateralis*, dorsal aspect of pupa, after Świętojańska 2008; (92) *Chlamydocassis cribripennis*, dorsal aspect of mature larva, after Świętojańska et al. 2005; (93) *Cistudinella obducta*, dorsal aspect of mature larva, scoli of 4th pair not visible they are only visible from ventral view, after Świętojańska and Medeiros 2007



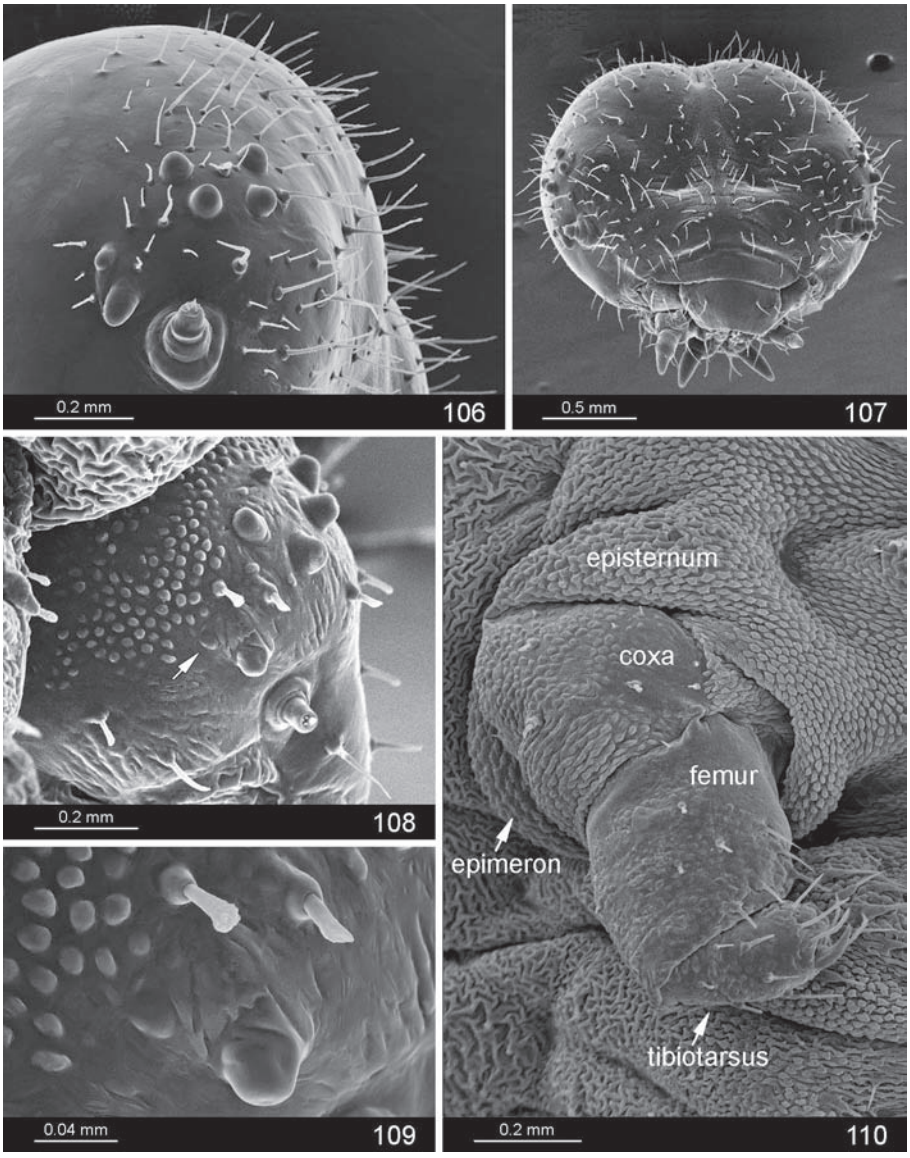
94-97. (94) *Physonota alutacea*, dorsal aspect of mature larva; (95) *Asteriza flavicornis*, dorsal aspect of mature larva; (96) *Physonota alutacea*, dorsal aspect of pupa; (97) *Asteriza flavicornis*, dorsal aspect of pupa. All after Świętojańska and Windsor 2008



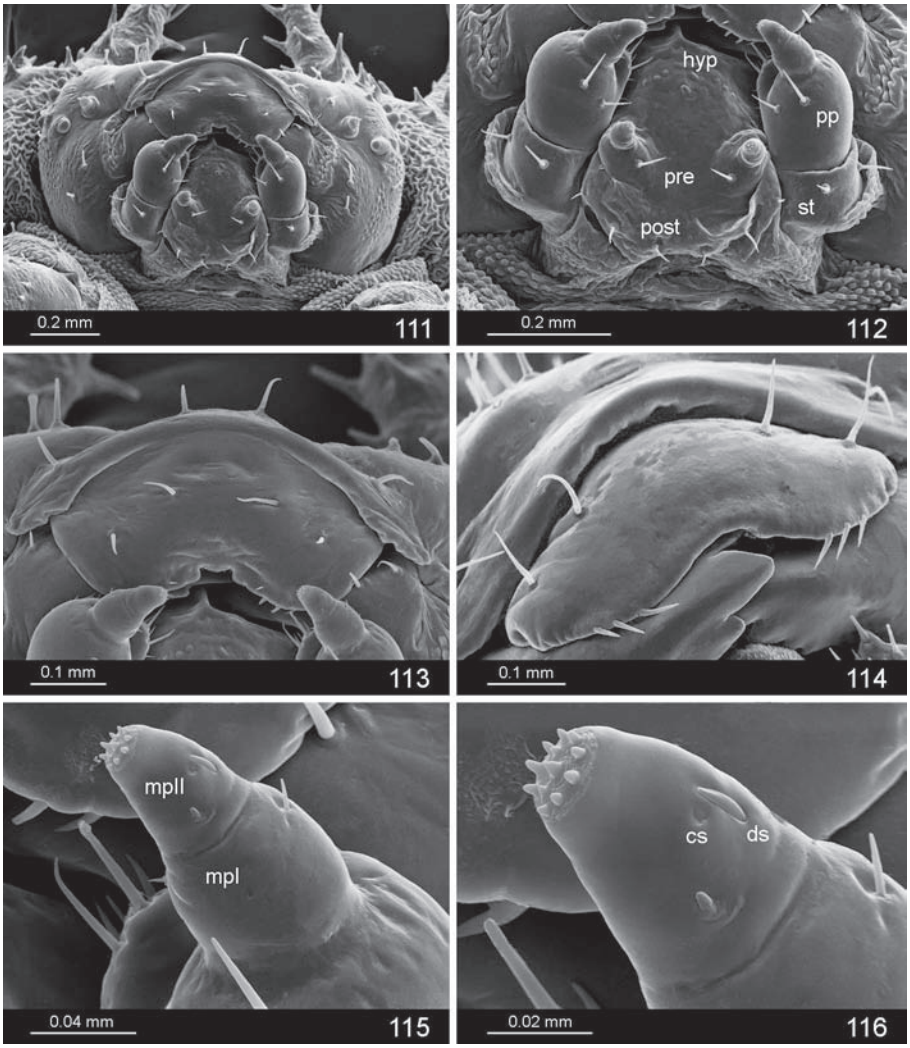
98-101. (98) *Ischyronota conicicollis*, dorsal aspect of mature larva; (99) *Aethiopocassis rhodesiana*, dorsal aspect of mature larva, after Świętojańska 2004a; (100) *Ischyronota conicicollis*, lateral aspect of mature larva; (101) *Aethiopocassis rhodesiana*, lateral aspect of mature larva, after Świętojańska 2004a



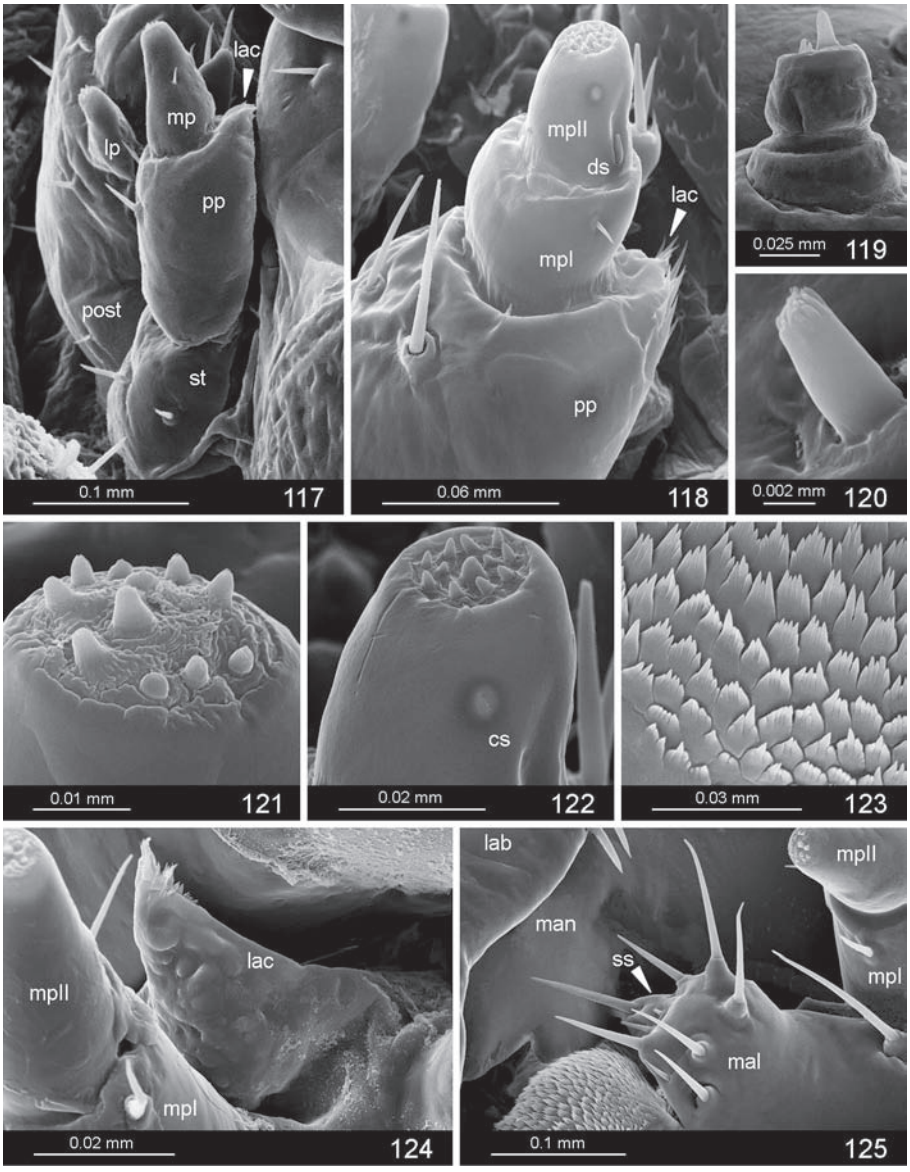
102-105. (102) *Aspidimorpha sanctaecrucis*, dorsal aspect of mature larva; (103) *Thlaspida biramosa*, dorsal aspect of mature larva, by courtesy of Paweł Jałoszyński; (104) *Craspedonta leayana*, dorsal aspect of mature larva and pupa, after Świętojańska and Ghate 2003; (105) *Cassida vittata*, dorsal aspect of pupa



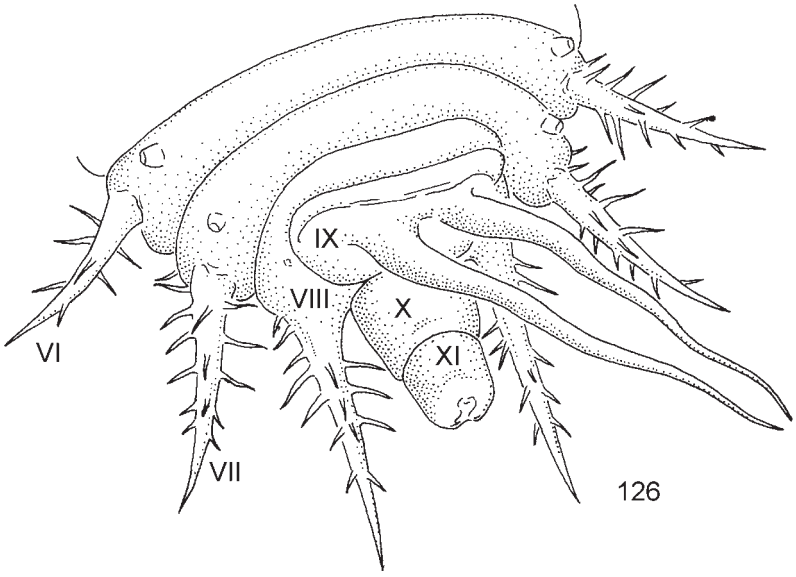
106-110. Mature larva. (106) *Cistudinella obducta*, lateral aspect of head with six stemmata, after Świętojańska and Medeiros 2007; (107) *Cistudinella obducta*, head, after Świętojańska and Medeiros 2007; (108) *Cassida stigmatica*, lateral aspect of head with six stemmata, white arrow pointed at stemma of sixth pair; (109) *Cassida stigmatica*, setae of head; (110) *Cassida stigmatica*, leg

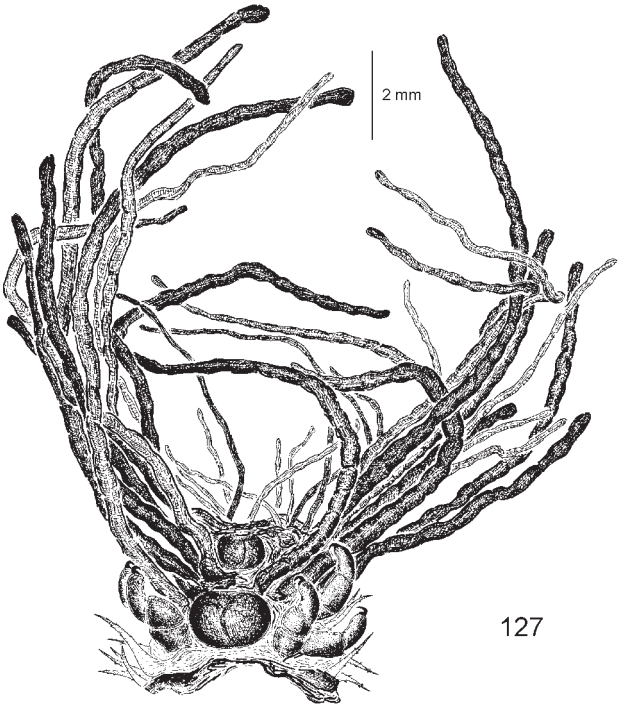


111-116. Mature larva, mouth part. (111) *Cassida stigmatica*, head; (112) *Cassida stigmatica*, maxillae and labium, st – stipes, pp – palpiger, hyp – hypopharynx, pre – prementum, post – postmentum; (113) *Cassida stigmatica*, labrum; (114) *Cistudinella obducta*, labrum, after Świętojańska and Medeiros 2007; (115) *Cassida stigmatica*, maxillary palp: mpI – first segment, mpII – second segment; (116) *Cassida stigmatica*, second segment of maxillary palp, cs – campaniform sensillum, ds – digitiform sensillum

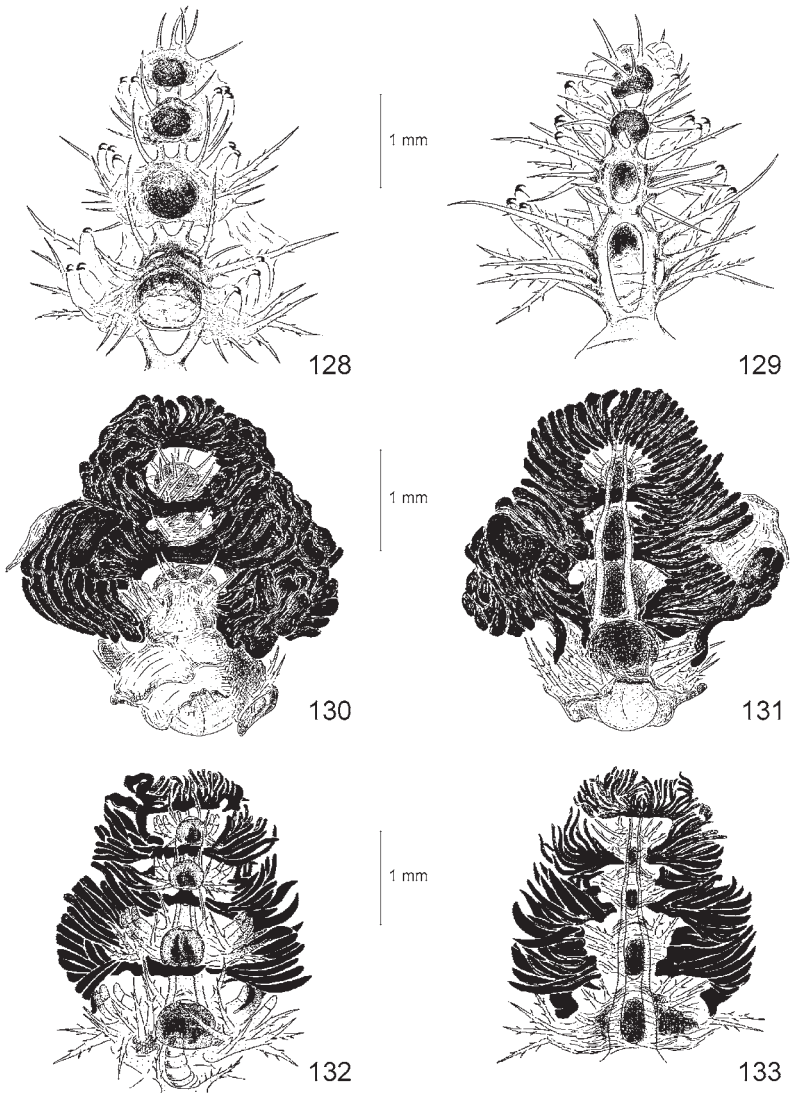


117-125. Mature larva. (117) *Ischyronota desertorum*, st – stipes; pp – palpiger, mp – maxillary palp, lac – lacinia, post – postmentum, lp – labial palp; (118) *Cassida rubiginosa*, pp –palpiger, mpI – first segment of maxillary palp, mpII – second segment of maxillary palp, ds – digitiform sensillum, lac – lacinia; (119) *Cistudinella obducta*, antenna; (120) *Cistudinella obducta*, small sensillum of mala; (121) *Cistudinella obducta*, top of labial palp with peg-like sensilla; (122) *Cassida rubiginosa*, top of maxillary palp, cs – campaniform sensillum; (123) *Cistudinella obducta*, hypopharynx; (124) *Cistudinella obducta*, mpI – first segment of maxillary palp, mpII – second segment of maxillary palp, lac – lacinia; (125) *Cistudinella obducta*, mal – mala, ss – small sensillum, mpI – first segment of maxillary palp, mpII – second segment of maxillary palp, man – mandibula, lab – labrum. (119-121, 123-125) After Świętojańska and Medeiros 2007

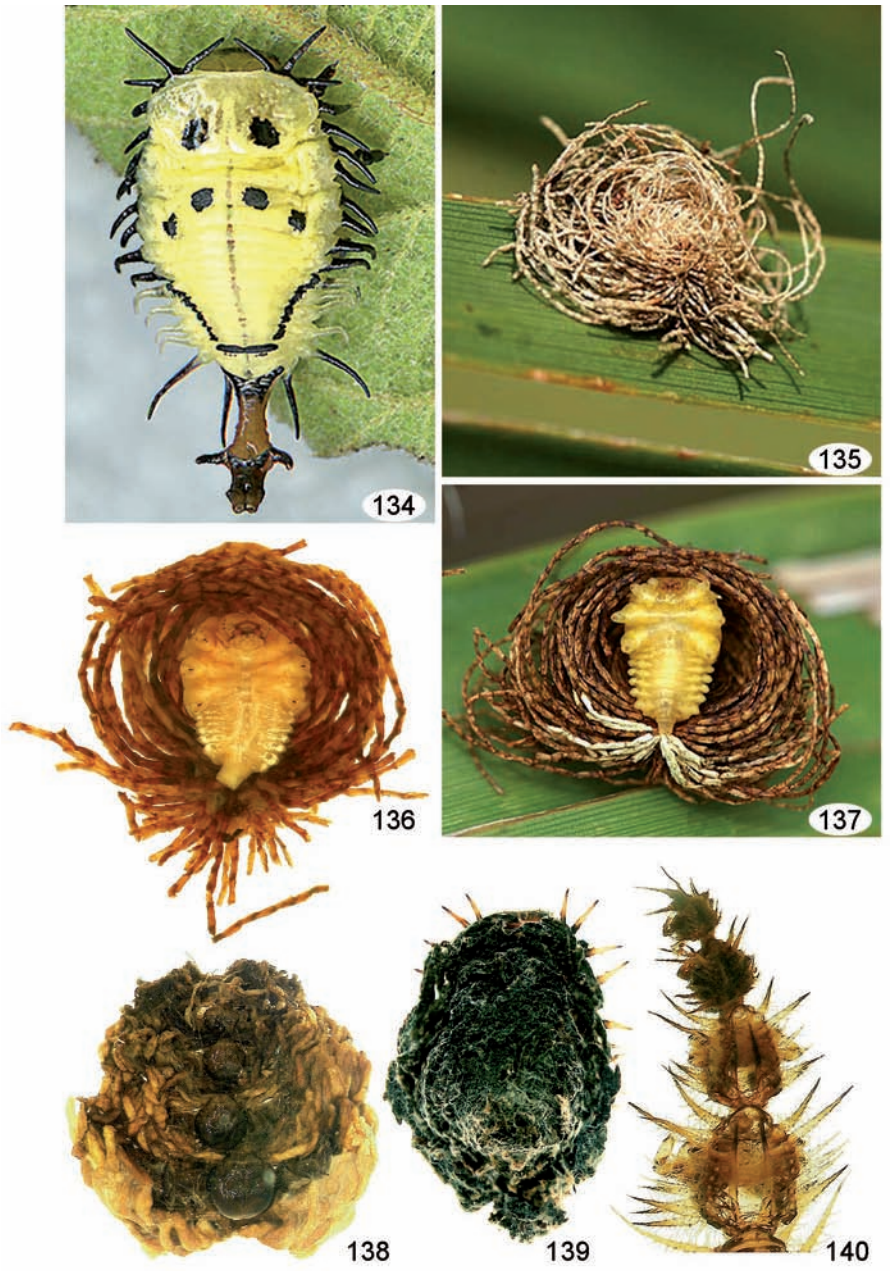




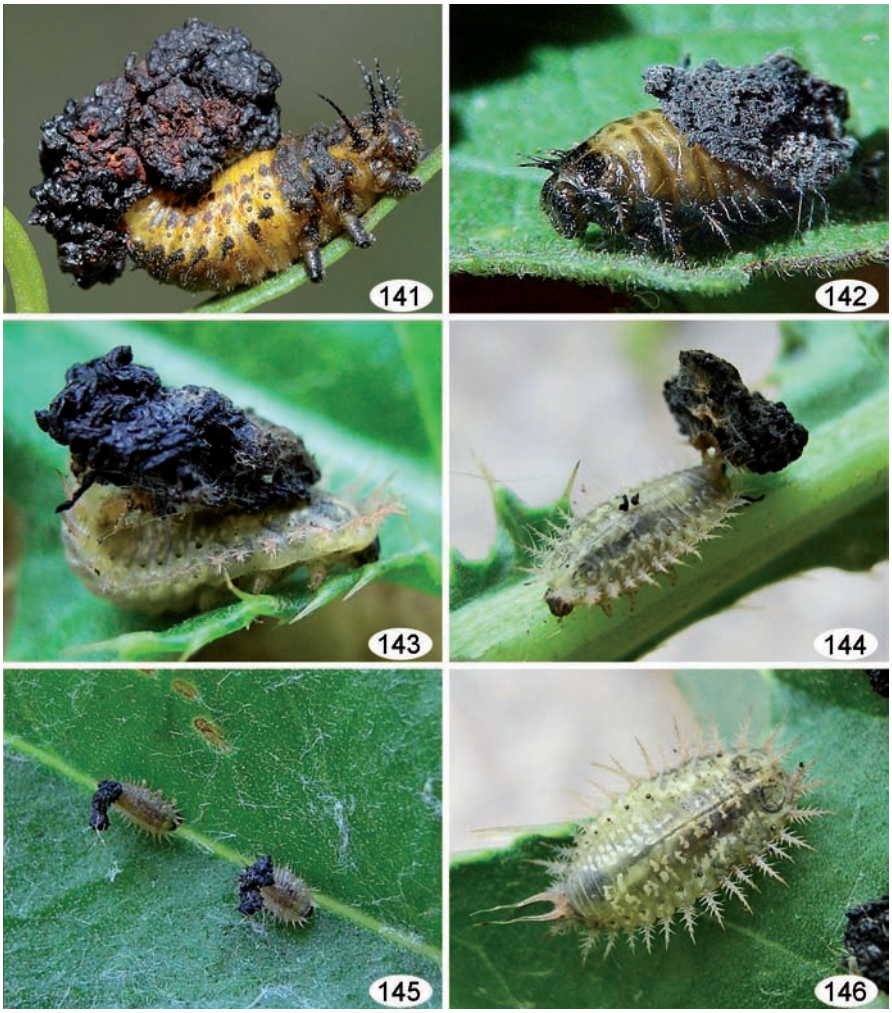
126, 127. (126) *Cassida rubiginosa*, mature larva, top of body, on sides numbers of abdominal segments; (127) faecal shield of *Craspedonta leayana*, after Świętojańska and Ghate 1003



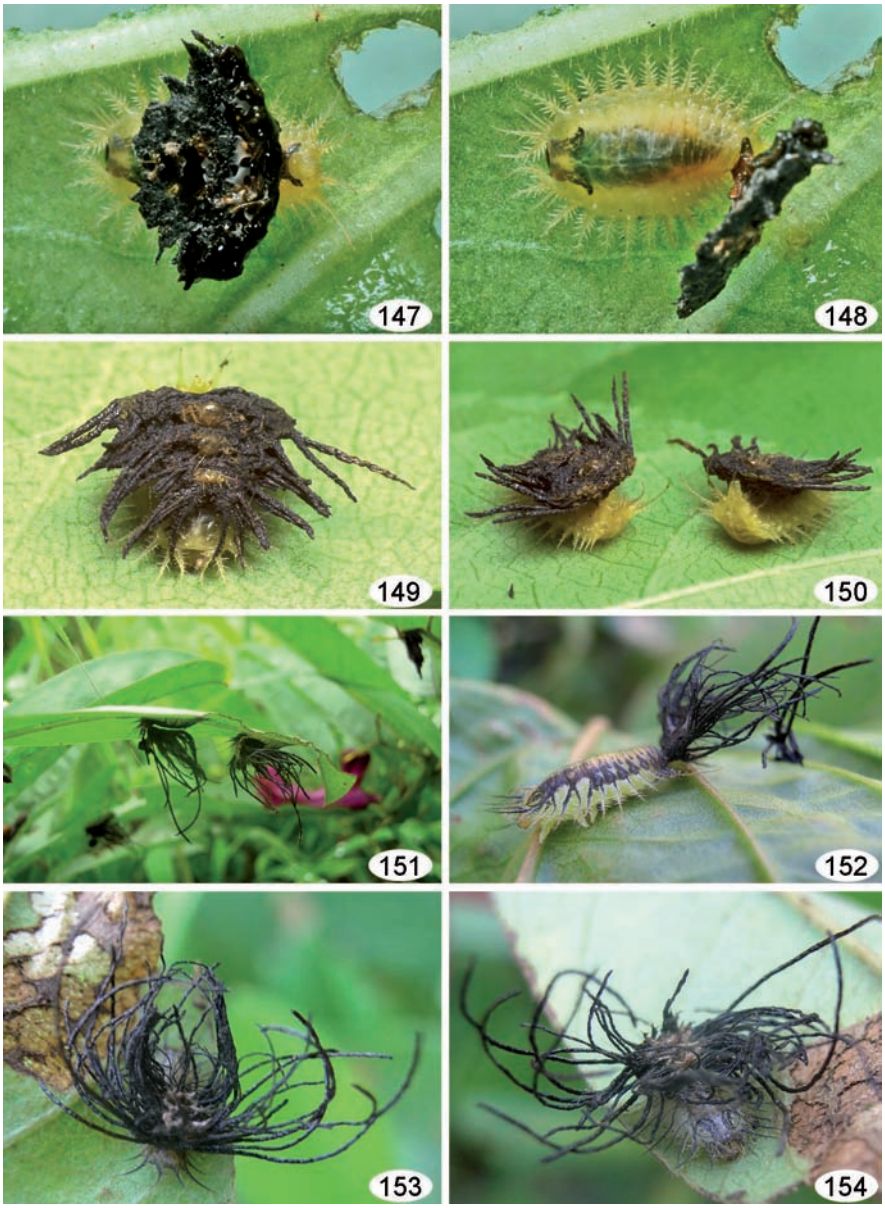
128-133. Shield of mature larvae. (128, 129) *Chiridopsis undecimnotata*, shield composed only of exuvia; (130, 131) *Chiridopsis bistrimaculata*, shield composed of exuvia and faeces; (132, 133) *Chiridopsis bipunctata*, shield composed of exuvia and faeces. After Ghate et al. 2004



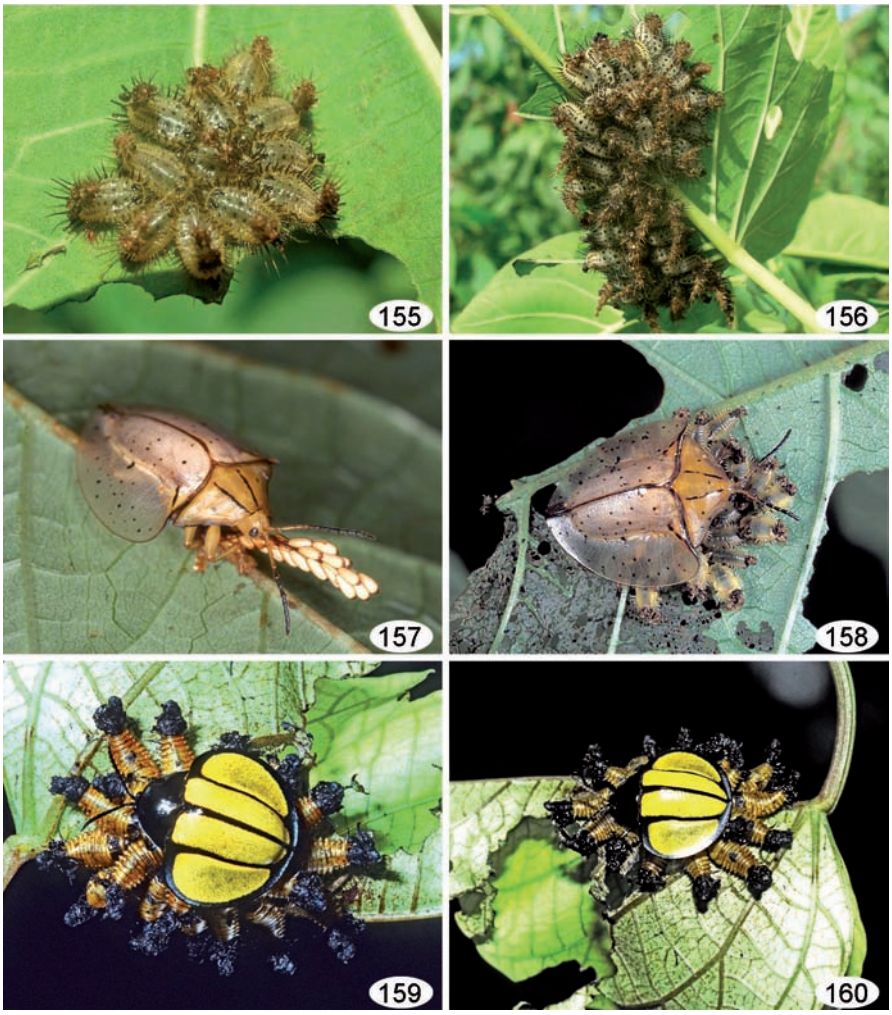
134-140. (134) *Discomorpha nevermanni*, by courtesy of Donald Windsor; (135, 137) *Hemisphaerota cyanea*, (135) faecal shield, (137) ventral view, after Borowiec and Świętojańska 2008; (136) *Hemisphaerota palmarum*, ventral view, larva surrounded by faecal strands of shield; (138) *Aethiopocassis rhodesiana*, faecal shield, after Świętojańska 2004; (139) *Chlamydocassis cribripennis*, faecal shield, after Świętojańska et al. 2005; (140) *Cistudinella obducta*, shield with exuvia, after Świętojańska and Medeiros 2007



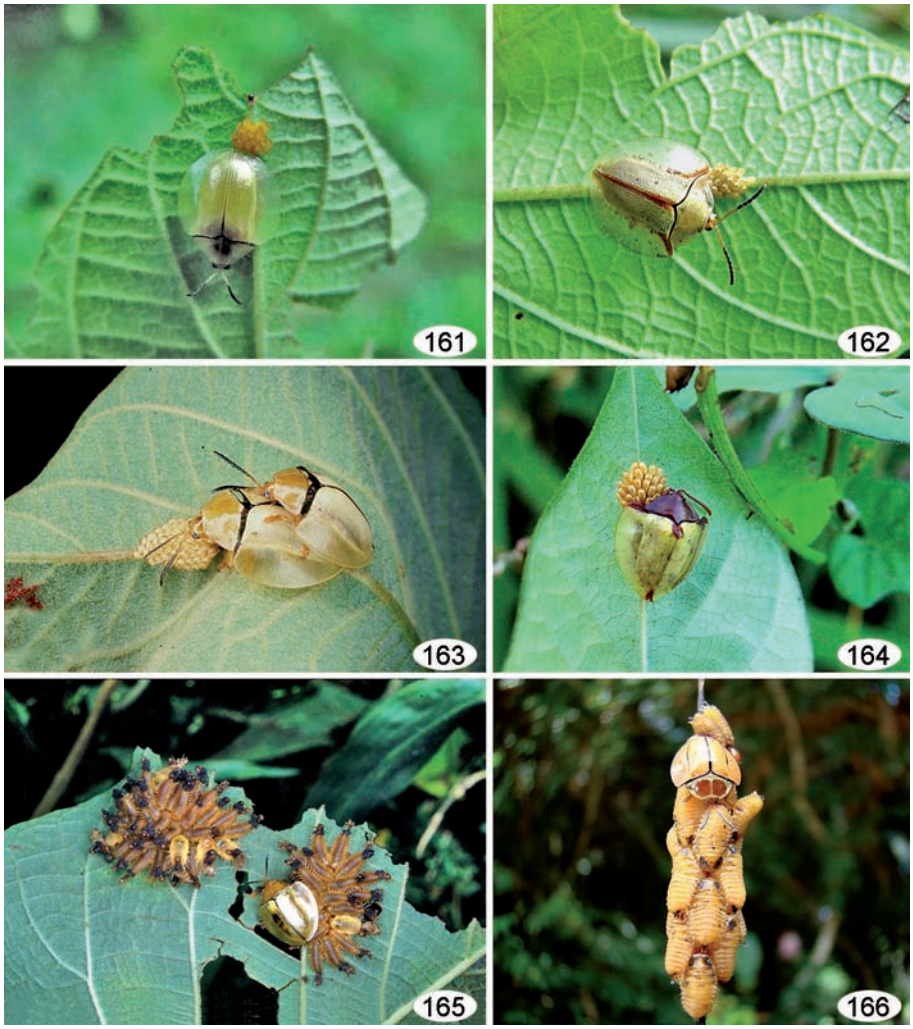
141-146. (141) *Anacassis exarata*, by courtesy of Oz Rittner, after Borowiec and Świętojańska 2008; (142) *Chlamydocassis cribripennis*, photo of Ana Paula Noronha, after Świętojańska et al. 2005; (143-146) *Cassida rubiginosa*: (143, 144) mature larva, (145) first instar larva, (146) prepupa



147-154. (147, 148) *Microctenochira championi*, by courtesy of Donald Windsor; (149, 150) *Thlaspida biramosa*, by courtesy of Paweł Jałoszyński; (151-154) *Aspidimorpha sanctaecrucis*



155-160. (155, 156) Gregarious larvae of *Aspidimorpha miliaris*; (157) *Acromis sparsa* (Boheman, 1854), female with egg, after Borowiec and Świętojańska 2008; (158) *Acromis sparsa*, female with larvae, by courtesy of Greg and Mary Beth Dimijian; (159, 160) *Omaspides bistriata* Boheman 1862, female guarding larvae, by courtesy of Donald Windsor



161-166. Maternal care. (161) *Omaspides pallidipennis* (Boheman, 1854); (162) *Paraselenis decipiens* (Boheman, 1854); (163) *Omaspides tricolorata* (Boheman, 1854); (164) *Paraselenis dichroa* (Germar 1824); (165) *Omaspides tricolorata*; (166) *Omaspides brunneosignata* (Boheman, 1854). (161-166) by courtesy of Fernando Frieiro-Costa