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Description of last instar larva and pupa of *Cassida uniorbis* (CHEN et ZIA, 1961) (Coleoptera: Chrysomelidae: Cassidinae)

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ABSTRACT. Last instar larva and pupa of *Cassida uniorbis* (CHEN et ZIA, 1961) are described and figured in detail.

Key words: entomology, taxonomy, Coleoptera, Chrysomelidae, Cassidinae, Cassidini, *Cassida uniorbis*, larva, pupa.

INTRODUCTION

Immatures of Cassidinae have been described for approximately 225 species (BOROWIEC and ŚWIĘTOJAŃSKA 2002). Slightly more than half of these descriptions are devoted to species belonging to the biggest tribe Cassidini (112 species).

The genus *Cassida* comprises 410 species but till now immatures of only 60 species have been described (BOROWIEC and ŚWIĘTOJAŃSKA 2002). From the Oriental Region, including subtropical part of the Eastern Palaearctic, last instar larvae of thirteen *Cassida* species have been described: *Cassida amarantica* MEDVEDEV et EROSHKINA, 1988 (ZAITSEV 1988, 1992), *C. circumdata* HERBST, 1799 (YEUNG 1934 - as *Metriona circumdata*; JOHN GEORGE and VENKATARAMAN 1986; ZAITSEV 1988, 1992; KIMOTO and TAKIZAWA 1994, 1997), *C. conchyliata* (SPAETH, 1914) (ZAITSEV 1988, 1992), *C. enervis* BOHEMAN, 1862 (SINGH et al. 1985), *C. exilis* BOHEMAN, 1854 (TAKIZAWA 1980 - as *Cassida* sp. 2), *C. obtusata* BOHEMAN, 1854 (GRESSITT 1952; GRESSITT and KIMOTO 1963; TAKIZAWA 1980; ZAITSEV 1988; KIMOTO and TAKIZAWA 1997), *C. physodes* (BOHEMAN, 1855) (ZAITSEV 1988, 1992

– as *Cassida expromta*), *C. piperata* HOPE, 1842 (MEDVEDEV and ZAITSEV 1978; KIMOTO and TAKIZAWA 1994, 1997; LEE 1994), *C. rati* MAULIK, 1923 (ZAITSEV 1988, 1992; KIMOTO and TAKIZAWA 1997), *C. solida* SPAETH, 1940 (ZAITSEV 1988, 1992), *C. subtilis* WEISE, 1897 (TAKIZAWA 1980 - as *Cassida* sp. 1), *C. triangulum* (WEISE, 1897) (ZAITSEV 1988), and *C. versicolor* (BOHEMAN, 1855) (GRESSITT and KIMOTO 1963; ZAITSEV 1988, 1992; KIMOTO and TAKIZAWA 1994, 1997; LEE 1994). Unfortunately, the available descriptions are superficial and inadequate thus it is very difficult to compare particular species and prepare proper diagnoses for them.

In the material sent to me by Dr. Jan BEZDĚK (Mendel University, Brno, Czech Republic) I obtained larvae and beetles of an unidentified *Cassida* collected in Laos. Dr. Lech BOROWIEC (University of Wrocław, Wrocław, Poland) identified the beetle as *Cassida uniorbis* (CHAN et ZIA), a rare species hitherto known from China: Yunnan, Thailand, and Laos. Larvae of *C. uniorbis* were unknown and their description with comparative data to larvae of other Oriental *Cassida* is given below.

MATERIAL AND METHODS

Material: Laos, Hua Phan prov., 20°13'N 103°59'E, 6.-18.IV.2004, Ban Saluai, Phu Phan Mt. env., 1300-2000 m, J. Bezděk leg., 2 larvae of last instar and 1 pupa.

Larvae and pupa were killed and preserved in 75 to 80 % ethanol and were mounted on slides with Swan's liquid (aqua distillata 20 g., arabic gum 15 g., chlorhydrate 60 g., glucose 3 g., acetic acid glacial 2 g.) and glycerine.

The photos were made using Nikon COOLPIX MDC Lens camera and Nikon SMZ-10A stereomicroscope.

Slides of larvae were made using Citoval 2 stereomicroscope, figures - using Nikon ECLIPSE 80i microscope with phase contrast.

The description of the last instar is based on the standard description of larva of the tribe Cassidini proposed in my previous paper on *Aethiopocassis rhodesiana* (SPAETH, 1924) (ŚWIĘTOJAŃSKA, 2004).

Prepupal larva

Measurements (n = 2): length: 5.1, 5.9, mm, width: 2.0, 2.3 mm.

Yellow, flattened dorso-ventrally, oval, widest across metanotum, slightly narrowed posteriorly (figs 30, 31).

Body with 16 pairs of long lateral scoli and a pair of supra-anal processes. Lateral scoli of thorax approximately equal in length except for 1st, 5th and 7th which are slightly shorter. Lateral scoli from 9th to 13th pair gradually shortened, then from 14th to 16th gradually longer (figs 8, 9, 30, 31). First two lateral scoli directed anteriorly, next five gradually directed to antero-lateral side, 8th lateral scoli almost perfectly perpendicular to the body axis. Lateral processes 9th to 16th gradually directed posteriorly, 16th pair almost parallel to the body axis. Lateral

branches of scoli numerous and quite short, shortened from base to the top of scoli (figs 4, 5). Each scolus and lateral branch armed apically with one seta (figs 1-6). Supra-anal processes approximately 1.25 times as long as length of 16th lateral processes, bent dorsally, sparsely covered with fine spikes and with a few campaniform sensilla. Apices of supra-anal processes with one or two setae; the second seta smaller than the first one (fig. 7).

Nine pairs of spiracles. Diameter of all spiracles very slightly decreasing posterad. Spiracles on eighth abdominal segment the smallest, distinctly smaller than remaining ones. Close to each spiracle one minute seta and two elongate cauliflower-shaped sensilla placed on low tubercles (figs 13, 29).

Dorsal and ventral side of the body with numerous setae and elongate cauliflower-shaped sensilla (figs 10-18). Medially close to anterior border of each tergite and sternite a pair of minute setae. Tergite with elongate cauliflower-shaped sensilla placed on more or less prominent tubercles. Sensilla in the middle part of tergite on distinctly more prominent tubercles than tubercles of sensilla placed laterally. Sternite mostly with setae, only in posterior part of abdomen few elongate cauliflower-shaped sensilla on low tubercles. Setae on ventral side mostly without tubercles or on low tubercles except setae on prominent tubercles in the middle of second and third abdominal sternites.

Sensilla in the middle of dorsal part of pronotum more numerous and on distinctly higher tubercles than sensilla placed on pronotum laterally (figs 8, 10). Each side of meso- and metanotum in the middle anteriorly with row of 2-4 sensilla on prominent tubercles and in the middle posteriorly with row of 4 sensilla; antero-laterally group of 1-4 sensilla on low tubercles and postero-laterally group of 4-5 sensilla on low tubercles. First abdominal tergite anteriorly with row of 3 sensilla on prominent tubercles and with row of 4 sensilla on prominent tubercles postero-medially. Remaining abdominal tergite with row of 2-4 sensilla anteriorly and row of 2-4 sensilla postero-medially. Chaetotaxy of dorsal side of body as in figure 8.

Ventral side of pronotum medially with two pairs of setae (sometimes some of them doubled). Meso- and metanotum in the middle on each side with a group of setae (4-7) anteriorly and one seta posteriorly. Lateral side of each thoracic sternite with 2-3 stout setae on low tubercles. Setae in the middle of first three abdominal segments most numerous and longest, posteriorly number and size of setae decreases. Chaetotaxy of ventral side of body as in figure 9.

Head hypognathous, retracted into pronotum, hardly visible from above, oval and well sclerotized (figs 19, 20). Median suture complete, connected with fronto-clypeal suture. Clypeus distinct, wider than long, with a pair of setae and a pair of campaniform sensilla.

Ocelli black, five on each side of the head, arranged in constant pattern: four in one row, three of them placed very close, and one at a distance, fifth placed in a gap between group of three and one.

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 single seta, Fe with two setae. In area near rows Fc and Fe, and between these rows a few (3-5) campaniform sensilla occur (fig. 19). Temporal side of head with three setae (T 1-3) and two campaniform sensilla (fig. 20).

Antennae 2- segmented, set in membraneous ring.

Labrum wider than long, with distinctly emarginate anterior margin. Mid part of ventral (epipharyngeal area) surface with a pair of small setae, four campaniform sensilla and two irregular groups of a few sensilla (fig. 21). Central and lateral parts of ventral side of labrum armed with numerous small spines. Emargination on ventral surface with six stout and long setae, and anterior margin on each side ventrally with three setae: two placed very close and one at a distance. On the dorsal surface of margin, close to the gap between the group of two and one seta, there is a single seta. Across the dorsal side of labrum run four setae, and central part of labrum with two pairs of campaniform sensilla (fig. 22).

Mandibles heavily sclerotized, 6-dentate, teeth blunt at apex, teeth 2-4 with crenulate anterior margin (figs 23, 24). Sixth tooth distinctly moved back. At molar part distinct tubercle. At base of dorsal side of the mandible there are two setae and two campaniform sensilla.

Maxillae and labium connate (figs 25-27). Maxillary palp two-segmented, palpiger distinct. Stipes with two long pointed setae. Palpiger ventrally with two setae and three campaniform sensilla; dorso-laterally with a group of short spines which look like spines on ligula and with a group of approximately 12 strong and quite long spines, two times longer than the first one. 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. Galea fused with lacinia. Mala bear six long and pointed setae, one seta shorter and blunt at the apex, one campaniform sensillum and one peg-like sensillum. Labial palp one-segmented, with group of sensilla at apex and one campaniform sensillum below apex. Ligula divided, covered with spines, and with six campaniform sensilla at base. Prementum with two long setae, two short setae and four campaniform sensilla. Postmentum with two long setae and four shorter setae

Legs stout (fig. 28). Tibiotarsus apically with heavily sclerotized, curved, single and simple claw armed basally with a pointed seta. Claw surrounded by a complex of 6 setae which are quite long and straight (five placed close to the claw and one at a distance). Tibiotarsus above claw with two campaniform sensilla and one small seta, and with 4 (sometimes 3) long setae. Femur usually with 15 long setae and one short seta; basally on internal side with a group of five campaniform sensilla and one short, pointed seta, and one campaniform sensillum at a distance. Basally, but on external side of femur, two campaniform sensilla. Coxa on internal side with setae arranged in three groups: first with one very long and four short setae, second group with three setae (one long and two short), and basal group with two setae (one long and one short).

The larva carry shield on the supra anal processes. Thick and triangular in shape, the shield is composed of the previous larval skins along with faecal matter

but at a first glance seems to be made only of faeces (figs 30, 31). Shield is distinctly broader than body width (n = 2; length: 2.0 mm; width: 3.5, 4.0 mm) and covers at most posterior half of body.

Pupa

Measurements (n = 1): length of body: 5.5 mm, width of mesonotum: 2.9 mm, length of pronotum: 2.0 mm, width of pronotum: 3.9 mm.

Body flattened dorso-ventrally, oval (figs 32, 33).

Preserved pupae yellow, only tops of spiracles light brown and dorsal side of abdomen yellowish-brown, lateral scoli yellow.

Pronotum with 60 marginal processes, two pairs in anterior part of the margin distinctly stouter and longer than remainder. Each marginal process armed apically with a short seta.

Meso-and metanotum without any lateral scoli.

Abdominal segments 1-5 with leaf-like scoli which are gradually shortened towards posterior part of body. Each scolus provided with lateral processes. Each scolus and process armed apically with seta. Scoli of 1st abdominal segment with 11-13 lateral processes, scoli of 2nd segment with 9-11 lateral processes, scoli of 3rd segment possess 11-12 lateral processes, scoli of 4th segment with 9-10 lateral processes, scoli of 5th segment with 7-8 lateral processes. Scoli of segments 1-3 directed antero-laterally, those of 4th almost perpendicular to the body axis, those of 5th directed slightly postero-laterally. Abdominal segment 6 narrow, with spine-like process on each side, which is as long as the width of the segment and directed downward. Abdominal segment 7 also with a spine-like process on each side, which is slightly longer than process of 6th segment and directed down and inward. Segment 8 with spine-like process on each sides, as long as the spine of the previous segment but bent down and strongly directed inward. Abdominal segment 9 with two dorsally visible supra-anal processes, put very close to each other at base.

Abdomen with 5 pairs of spiracles. Spiracles of first two segments less elevated and less tubular than of 3-5 segments. Spiracles diameter of first two segments wider than spiracles of 3-5 segments.

Pupa retains larval skin of last instar.

COMPARATIVE DATA

Comparative data are summarized in Table 1. Because previous descriptions are of various standards, some species lack important characters. Comments to the particular descriptions are given below:

Cassida amaranthica: [ZAITSEV 1988] – description is moderate in details. Its larva differs from the larva of *Cassida uniorbis* in the shield composed except exuvia of faeces in form of long filaments whereas in *C. uniorbis* faecal forms one solid mass triangular in shape.

Table 1: Comparative data on larvae of the Oriental species of the genus *Cassida* L.

Species\Characters	**shield of supra-anal processes composed of:**	**anterior margin of labrum**	**mandibulae**	**length of body in mm / width of body in mm**	**general external appearance; ratio: length of scoli to width of body**
Cassida amaranthica	exuvia + faeces in filaments (ZAITSEV 1988)	emarginate (6 setae), on each side ventrally 4 setae (ZAITSEV 1988)	no information	no information	scoli longer than 1/2 body width with the longest 15th and 16th scoli
Cassida circumdata	exuvia (ZAITSEV 1988) or exuvia + feaces attached in small masses to the tips of the supra anal processes (GRESSITT 1952)	shallowly emarginate (6 setae), on each side ventrally 4 setae (ZAITSEV 1988)	no information	4.810 ± 0.558 / 2.522 ± 0.371 (JOHN GEORGE and VENKATARAMAN 1986) or 3.14-5.12 (av. 4.56) / 1.63-3.07 (av. 2.55) (excluding spines) (YEUNG 1934)	scoli shorter than 1/2 body width except scoli 15th and 16th which are the longest and distinctli longer than 1/2 body width
Cassida conchyliata	exuvia + faeces = shield triangular in shape not solid with oval holes in the middle (ZAITSEV 1988)	without emargination (10 setae), on each side ventrally 3 setae (ZAITSEV 1988)	no information	no information	scoli longer than 1/2 body width with the longest 15th and 16th scoli
***Cassida enervis* (?)**	exuvia + faeces (SINGH et al. 1985)	no information	no information	4.63 ± 0.05 mm / 2.3 ± 0.04 mm (SINGH et al. 1985)	scoli longer than 1/2 body width with the longest 15th and 16th scoli
Cassida exilis	exuvia + faeces (TAKIZAWA 1980)	emarginate (TAKIZAWA 1980)	5-dentate (TAKIZAWA 1980)	about 6.0 / 2.5 (TAKIZAWA 1980)	scoli longer than 1/2 body width with the longest 15th and 16th scoli
Cassida obtusata	exuvia + faeces attached in small masses to each previous exuvia (TAKIZAWA 1980; ZAITSEV 1988)	emarginate (8 setae?), on each side ventrally 3 setae (ZAITSEV 1988)	6-dentate (TAKIZAWA 1980)	about 5.5 / 2.5 (TAKIZAWA 1980)	scoli more or less similar in length approximately 1/2 body width
Cassida physodes	exuvia (ZAITSEV 1988)	emarginate (6 setae), on each side ventrally with 4 setae (ZAITSEV 1988)	no information	no information	scoli shorter than 1/2 body width except scoli 15th and 16th which are the longest and distinctly longer than 1/2 body width

Table 1: continuation.

Cassida piperata	exuvia (MEDVEDEV and ZAITSEV 1978)	emarginate (setae?), on each side ventrally with 4 setae (LEE 1994)	7-dentate (LEE 1994)	5.0 / - (LEE 1994)	scoli more or less similar in length approximately 1/2 body width
Cassida rati	exuvia + faeces = create thick trangular structure (ZAITSEV 1988)	emarginate (6 setae), on each side ventrally with 4 setae (ZAITSEV 1988)	no information	no information	scoli longer than 1/2 body width with the longest 15th and 16th scoli
Cassida solida	exuvia (ZAITSEV 1988)	emarginate (setae?), on each side ventrally with 4 setae (3 stout + 1 thin) (ZAITSEV 1988)	no information	no information	no information
Cassida subtilis	exuvia + faeces (TAKIZAWA 1980)	emarginate (TAKIZAWA 1980)	6-dentate (TAKIZAWA 1980)	about 6.0 / 2.5 (TAKIZAWA 1980)	scoli longer than 1/2 body width with the longest 15th and 16th scoli
Cassida triangulum	exuvia (ZAITSEV 1988)	silghtly emarginate (6 setae), on each side ventrally with 4 setae (ZAITSEV1988)	no information	no information	no information
Cassida versicolor	exuvia (ZAITSEV 1988)	shallowly emarginate (in third instar, LEE 1994) or without emargination (ZAITSEV 1988), on each side ventrally with 3 setae	6-dentate (LEE 1994), 4-dentate (ZAITSEV 1988)	5.3 / - length of third instar (LEE 1994)	scoli longer than 1/2 body width with the longest 15th and 16th scoli
Cassida uniorbis	exuvia + faeces = create thick trangular structure	emarginate (6 setae), on each side ventrally 3 setae	6-dentate	5.1, 5.9 / 2.0, 2.3 (n=2) without scoli and supra-anal processes	scoli more or less similar in length approximately 1/2 body width

Cassida circumdata [YEUNG, 1934; JOHN GEORGE and VENKATARAMAN 1986; KIMOTO and TAKIZAWA 1994, 1997]: descriptions and drawings from two older papers distinctly differ from those of KIMOTO and TAKIZAWA. The figures suggested that YEUNG, JOHN GEORGE and VENKATARAMAN studied true *Cassida circumdata* HERBST while the description by KIMOTO and TAKIZAWA has based on a misidentification. Thus, I excluded the information from KIMOTO and TAKIZAWA (1994, 1997) papers. It is difficult to say which species of *Cassida circumdata* group was studied by the Japanese authors. The larva of *Cassida circumdata* distinctly differs from the larva of *Cassida uniorbis* in the shield composed with only skins (sometimes with small remains of faeces) and especially long 15th pair of lateral scoli.

Cassida conchyliata [ZAITSEV 1988]: description is moderate in details. It distinctly differs from the larva of *Cassida uniorbis* in the labrum without median emargination. Faeces at *C. conchyliata* shield are in form of mass but not as solid as in *C. uniorbis* and with oval holes along the middle axis thus it is possible to see the previous larval exuvia.

Cassida enervis [SINGH et al. 1985]: according to description, figures and biological data of adult the description is based on a misidentification and probably concerns *Cassida subtilis* WEISE. The description of the larva is very superficial and offers only few characters with no data differentiating it from *Cassida uniorbis*.

Cassida exilis [TAKIZAWA 1980]: description looks good at a first glance but without the structure of labrum which is diagnostic for many species. According to the general view *Cassida exilis* has lateral scoli slightly longer in relation to body width than *C. uniorbis*, but I do not find clear differences between the two taxa based on description only. My specimens of *Cassida exilis* (sent to me by Dr. Hemant V. GHATE, Pune, India) differ in the shield with faeces forming irregular mass while in *C. uniorbis* they form a more regular plate, triangular, with very broad base.

Cassida obtusata [GRESSITT 1952; GRESSITT and KIMOTO 1963; TAKIZAWA 1980; ZAITSEV 1988; KIMOTO and TAKIZAWA 1997]: descriptions moderate in details. Differs from *C. uniorbis* in the structure of shield composed mostly of skins. Faeces attached in small masses to each previous exuvia. ZAITSEV (1988) on fig. 5.7 presents labrum with 8 setae in anterior emargination while in *C. uniorbis* occur only 6 setae but, in my opinion, this character needs confirmation.

Cassida physodes [ZAITSEV 1988]: description moderate in details. Distinctly differs in the shield composed only of skins without faeces and 15th scoli distinctly longer than preceding ones.

Cassida piperata [MEDVEDEV and ZAITSEV 1978; KIMOTO and TAKIZAWA 1994, 1997; LEE 1994]: descriptions moderate in details. Distinctly differs in the shield composed only with skins without faeces and 16th scoli very short, distinctly shorter than scoli 15th, while in *C. uniorbis* scoli 16th are only slightly shorter than scoli 15th.

Cassida rati [ZAITSEV 1988, 1992; KIMOTO and TAKIZAWA 1997]: descriptions moderate in details. Differs in labrum with 4 marginal setae on each side ventrally, while *C. uniorbis* has only 3 setae.

Cassida solida [ZAITSEV 1988, 1992]: descriptions moderate in details. Like previous species differs in the labrum with 4 marginal setae on each side ventrally. *Cassida solida* has a shield composed of only exuvia without faeces.

Cassida subtilis [TAKIZAWA 1980]: description poor in details. According to the figure it looks stouter than the larva of *C. uniorbis* with slightly longer scoli in relation to body width. Shield in *Cassida subtilis* is composed of both exuvia and faeces but looks more irregular than in *C. uniorbis*.

Cassida triangulum [(ZAITSEV 1988]: descriptions moderate in details. Differs in labrum with 4 marginal setae on each side ventrally, while *C. uniorbis* has only 3 setae, and the shield composed of only exuvia.

Cassida versicolor [GRESSITT and KIMOTO 1963; ZAITSEV 1988, 1992; KIMOTO and TAKIZAWA 1994, 1997; LEE 1994]: the descrption of ZAITSEV (1988) distinctly differs from the description by LEE (1994). Remaining descriptions are very superficial and do not offer diagnostic characters. I think that the differences between descriptions by ZAITSEV and LEE result from different treatment of this taxon by Russian and Korean and Japanese authors. Korean and Japanese authors treated *Cassida versicolor* (BOHEMAN, 1855) and *Cassida crucifera* (KRAATZ, 1879) as colour aberrations while ZAITSEV (1988) treated the two taxa as distinct species according to the study of male genitalia by MEDVEDEV and EROSHKINA (1988). Despite this taxonomical problem larvae of both *C. crucifera* and *C. versicolor* differ in the shield composed with only exuvia without faeces.

Descriptions of pupae of Oriental species of *Cassida* are very superficial and at the moment it is impossible to prepare comparative diagnoses with the pupa of *Cassida uniorbis*.

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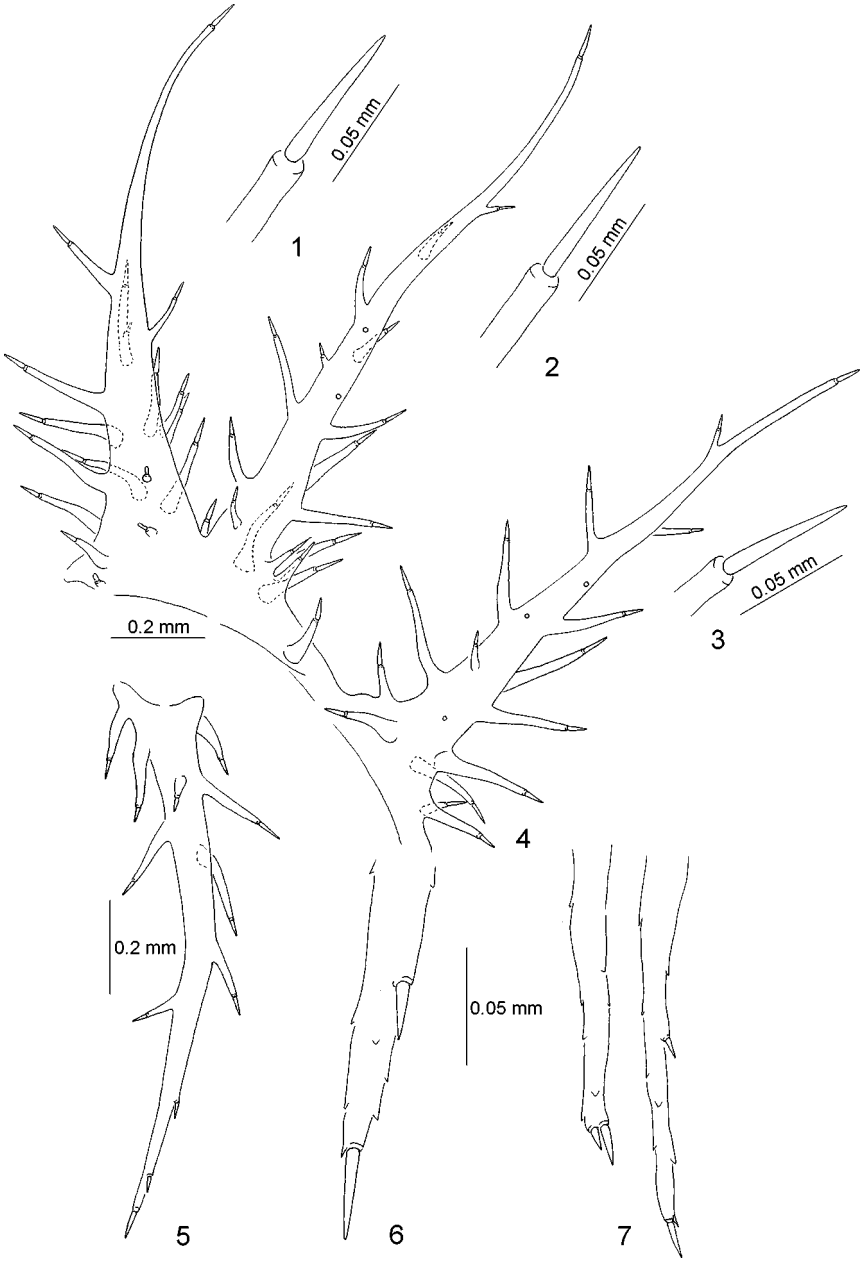
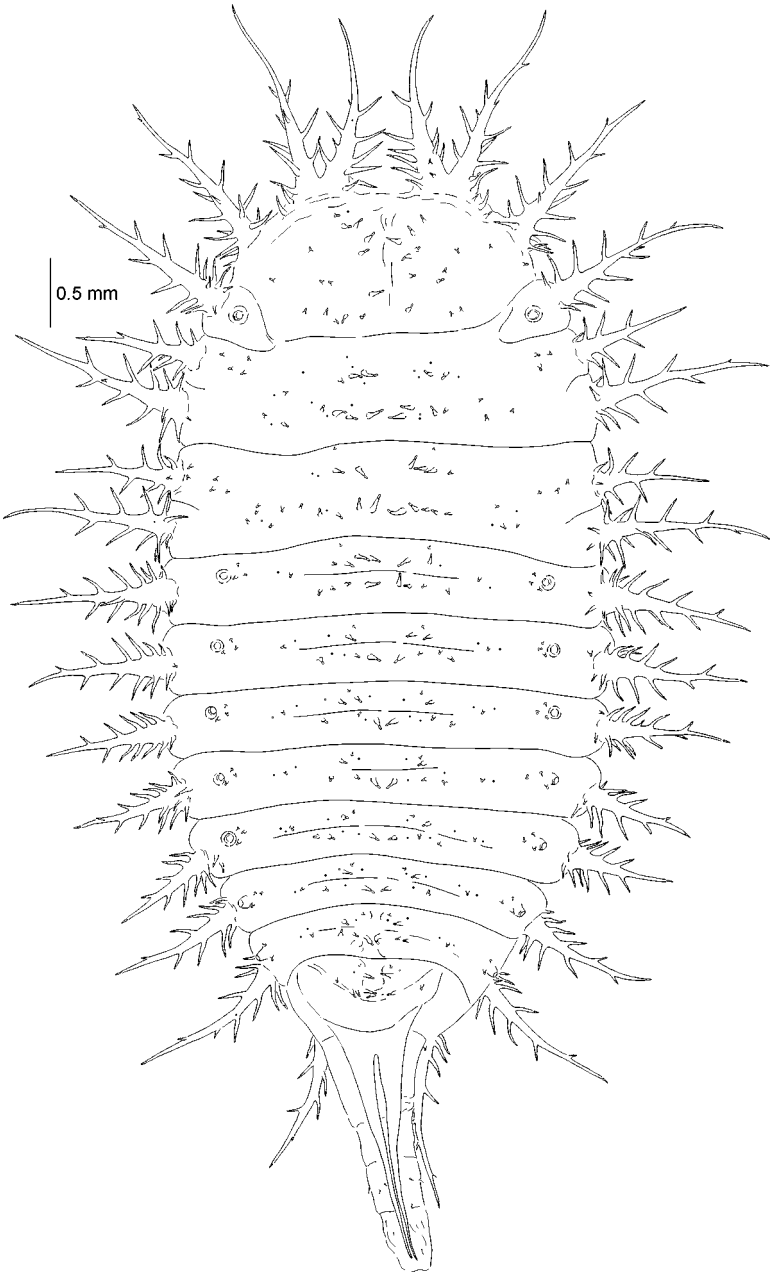
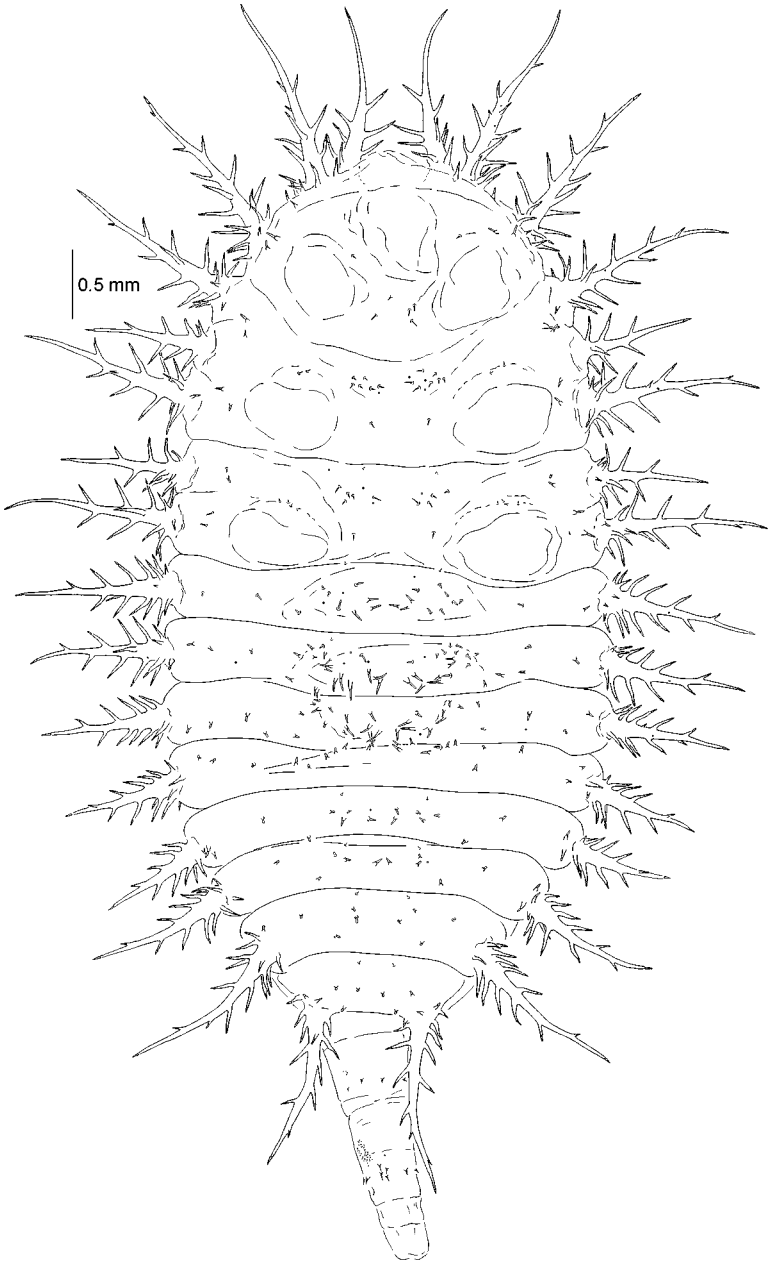


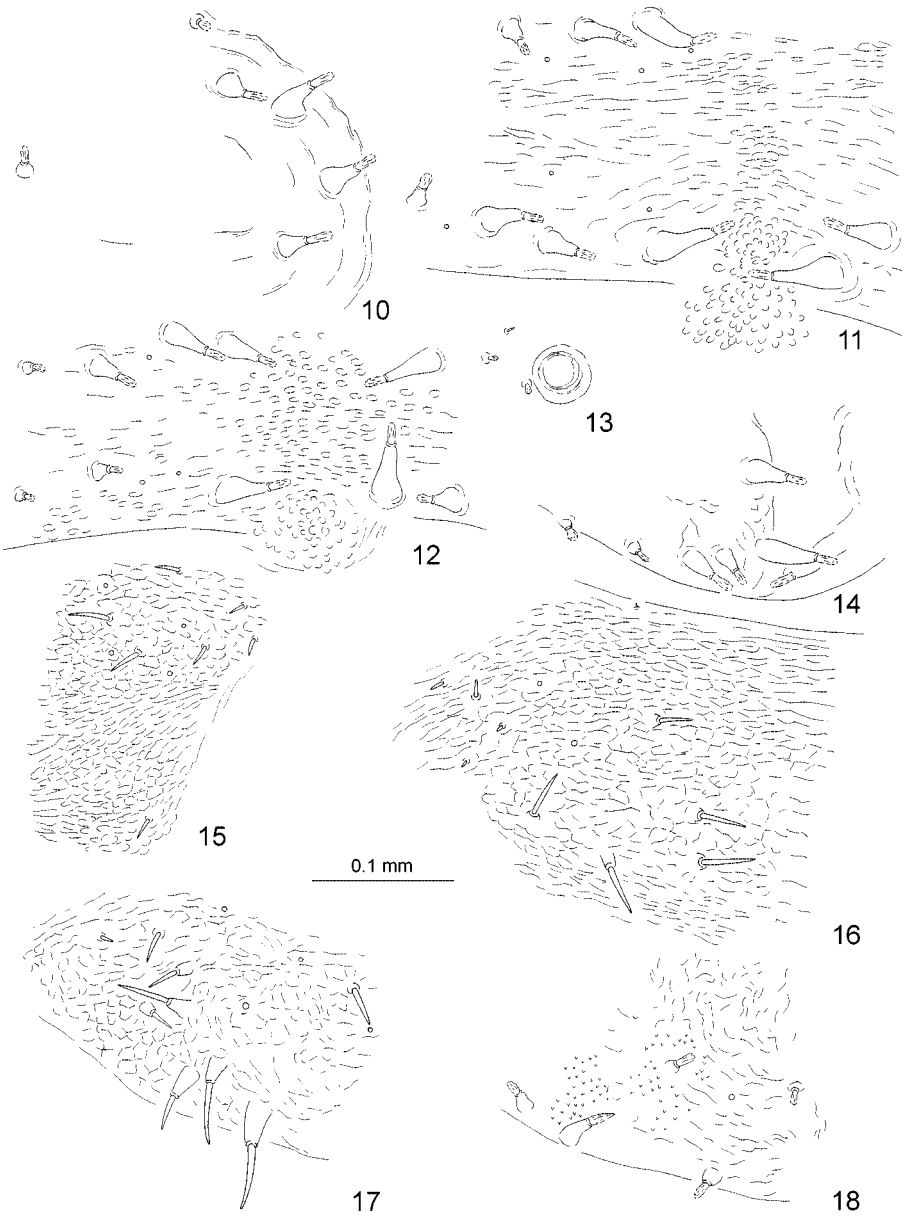
1-7. *Cassida uniorbis*, last instar larva: 1 - top of first lateral scolus; 2 - top of second lateral scolus; 3 - top of third lateral scolus; 4 - first three lateral scoli; 5 - 16th lateral scolus; 6 - top of 16th lateral scolus; 7 - tops of supra–anal processes



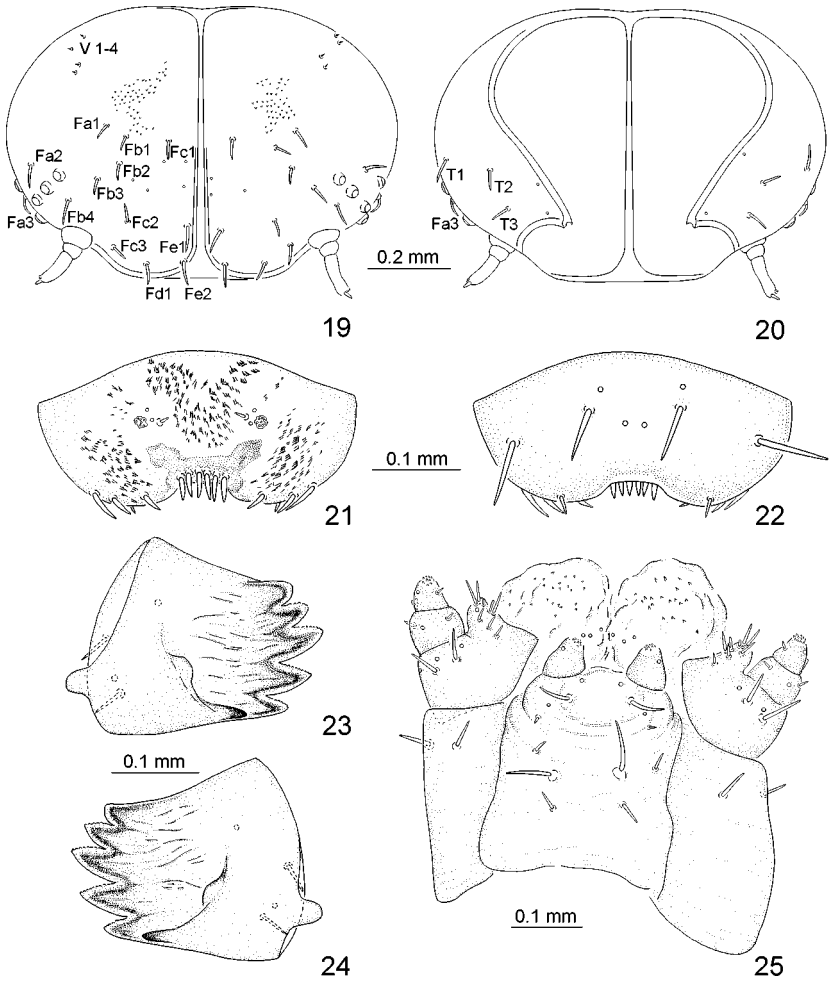
8. *Cassida uniorbis*, last instar larva, dorsal view



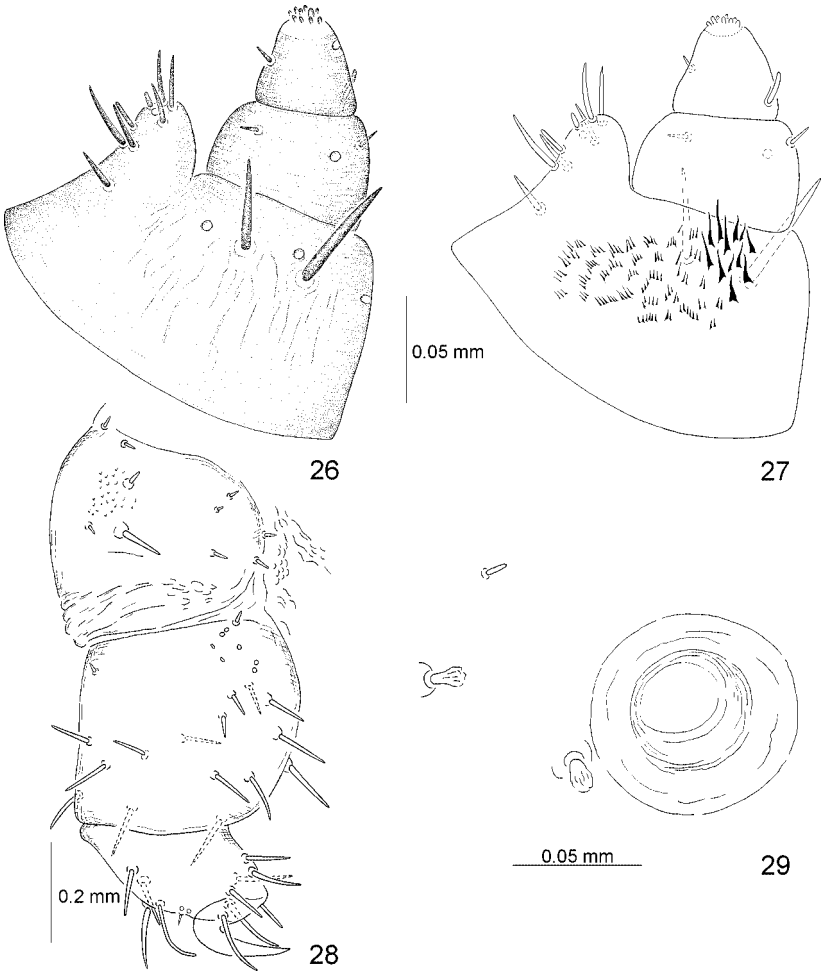
9. *Cassida uniorbis*, last instar larva, ventral view



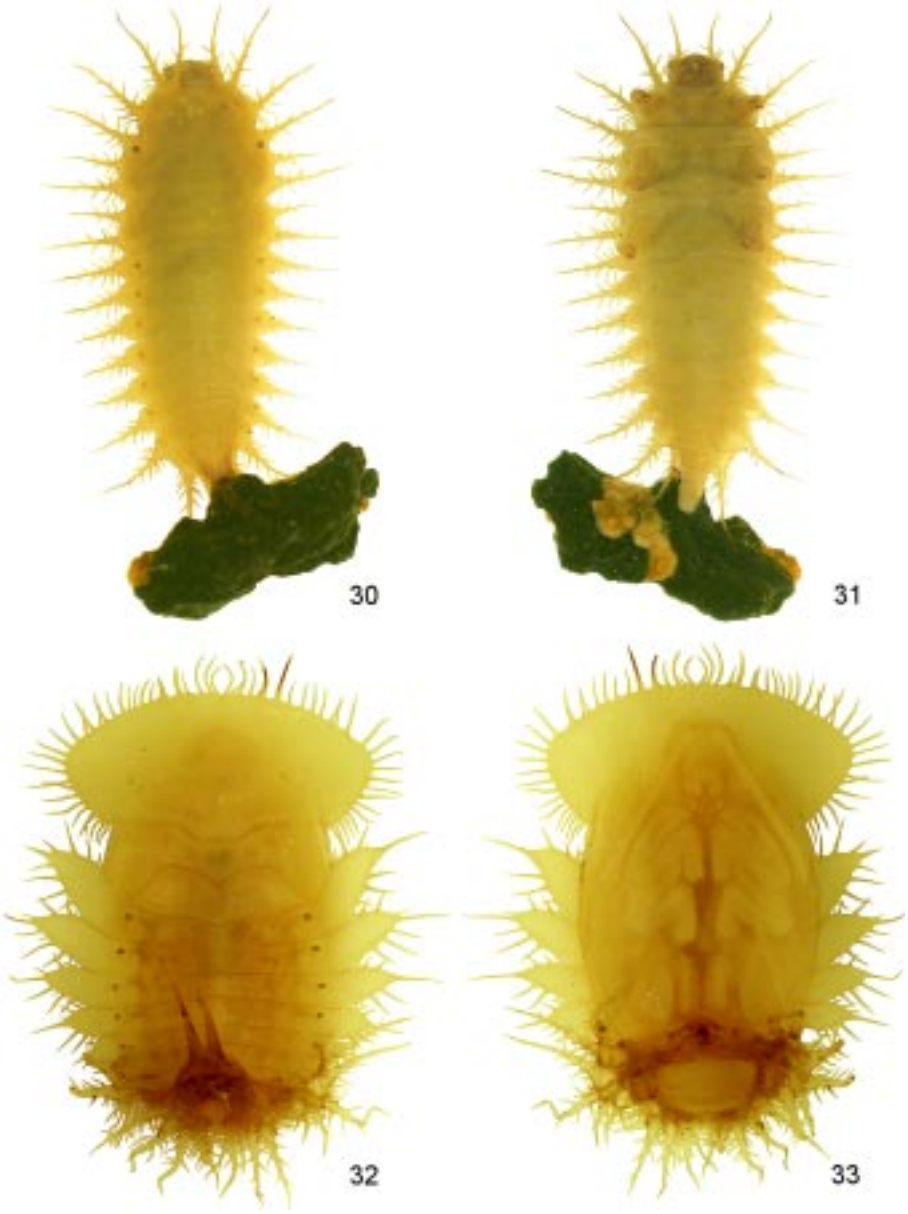
10-18. *Cassida uniorbis*, last instar larva: 10-12, 14 - elongate cauliflower-shaped sensilla on dorsal side in the middle of: 10 - pronotum; 11 - mesonotum; 12 - first abdominal segment; 14 - last abdominal segment; 13 - spiracle of first abdominal segment; 15-18 - setae on ventral side in the middle of: 15 - mesonotum, 16 - first abdominal segment, 17- second abdominal segment, 18 -last abdominal segment



19-25. *Cassida uniorbis*, last instar larva: 19 - frontal side of head; 20 - temporal side of head; 21 - ventral side of labrum; 22 - dorsal side of labrum; 23, 24 - mandibles; 25 - maxillae and labium



26-29. *Cassida uniorbis*, last instar larva: 26 - ventral side of palpiger with mala and maxillary palp; 27 - dorso-lateral side of palpiger with mala and maxillary palp; 28 - leg; 29 - spiracle of first abdominal segment with adjacent setae



30-33. *Cassida uniorbis*: 30 - dorsal view of last instar larva; 31 - ventral view of last instar larva; 32 - dorsal view of pupa; 33 - ventral view of pupa