

A Review of Larval Encaustini (Coleoptera: Erotylidae) from Russia

Обзор личинок трибы Encaustini (Coleoptera: Erotylidae) фауны России

A.A. Zaitsev¹, A.V. Kompantsev², A.I. Zaitsev³
 А.А. Зайцев¹, А.В. Компанцев², А.И. Зайцев³

¹ Moscow State Pedagogical University, Institute of Biology and Chemistry, Department of Zoology and Ecology, Kibaltchicha str. 6–3, 129164 Moscow, Russia. E-mail: ztema@mail.ru

¹ Московский Педагогический государственный университет, институт биологии и химии, кафедра зоологии и экологии, ул. Кибальчича, 6–3, 129164 Москва, Россия.

² A.N. Severtsov Institute of Ecology and Evolution, Laboratory for Soil Zoology and General Entomology, Leninskij prosp. 33, 119071, Moscow, Russia. E-mail: beetle-komp@yandex.ru

² Институт проблем экологии и эволюции им. А.Н. Северцова, Лаборатория почвенной зоологии и общей энтомологии, Ленинский просп., 33, 119071, Москва, Россия.

³ Moscow City University, Institute of Mathematics, Informatics and Natural Sciences, Department of Biology, Ecology and Methods of teaching Zoology, 2nd Selskohozyaistvennyi proezd 4–1, 129226 Moscow, Russia. E-mail: azaitzev@mail.ru

³ Московский Городской Университет, Институт математики, информатики и естественных наук, кафедра биологии, экологии и методики обучения зоологии, 2-ой Сельскохозяйственный проезд 4–1, 129226 Москва, Россия.

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КЛЮЧЕВЫЕ СЛОВА: Coleoptera, Erotylidae, Encaustini, личинки, морфология.

ABSTRACT. The late-instar larva of *Episcapha flavofasciata* Reitter, 1879 is described for the first time; larvae of *Aulacochilus luniferus decoratus* Reitter, 1879, *Encaustes cruenta praenobilis* Lewis, 1883, *Episcapha morawitzi* Solsky, 1871 and *Megalodacne bellula* Lewis, 1883 are redescribed. Detailed ecological data and a key to the known larvae of Encaustini from Russia provided.

РЕЗЮМЕ. Впервые описана личинка последнего возраста *Episcapha flavofasciata* Reitter, 1879; переописаны личинки *Aulacochilus luniferus decoratus* Reitter, 1879, *Encaustes cruenta praenobilis* Lewis, 1883, *Episcapha morawitzi* Solsky, 1871 и *Megalodacne bellula* Lewis, 1883. Приводятся подробные данные об их экологии, а также составлен определительный ключ по личинкам Encaustini, известных с территории России.

Introduction

Erotylidae is a family of cucujoid beetles with about 3200 species in 280 genera composed into six subfamilies [Wegrzynowicz, 2002; Leschen, 2003; Leschen, Buckley, 2007; Slipinski, Leschen, Lawrence, 2011]. Five of these subfamilies belong to “languriid” group, thus Erotylidae *sensu stricta* presented by the single subfamily Erotylinae. The level of knowledge of Erotylinae larvae is rather poor. McHugh noted that approximately 97% of erotylid species and 75% of genera lacks larval description [McHugh, 2001]. According to Wegrzynowicz [Wegrzynowicz, 2007] there are 36 gen-

era of Erotylinae recorded for Palaearctic region, of which larvae are known for 15. Unfortunately, the significant part of these contributions is outdated or rather brief, so it is evident that for some Erotylinae taxa it is necessary to provide detailed redescriptions of larvae.

Subfamily Erotylinae consists of 4 tribes: Dacnini, Encaustini, Tritomini, and Erotylini [Wegrzynowicz, 2007]. Encaustini presented by 4 genera and 6 species in Russia [Wegrzynowicz, 2007] and distributed in Far East region exclusively. Larvae are described for all species except *Episcapha flavofasciata* Reitter, 1879: *Aulacochilus luniferus decoratus* Reitter, 1879 [Kompantsev, 1982, as *A. decoratus* Rtt.]; *Aulacochilus sibiricus* Reitter, 1879 [Nobuchi, 1954, as *A. bedeli* Har.]; *Encaustes cruenta praenobilis* Lewis, 1883 [Hayashi, Takenaka, 1965; Morimoto, Hayashi, 1986]; *Episcapha morawitzi* Solsky, 1871 [Kompantsev, 1982]; and *Megalodacne bellula* Lewis, 1883 [Kompantsev, 1982].

Unfortunately, original descriptions are rather brief and written in Japanese [Nobuchi, 1954; Hayashi, Takenaka, 1965; Morimoto, Hayashi, 1986] or in Russian [Kompantsev, 1982], what makes certain difficulties in understanding, moreover the drawings and most descriptions are outdated in comparison with modern standards.

Thus in this paper we provide the first description of late-instar larva of *E. flavofasciata* as well as redescriptions of last-instar larvae of other representatives of Encaustini occurring in Russia with a key to their determination.

Larvae of *E. cruenta praenobilis*, *A. luniferus decoratus* and *E. flavofasciata* were collected and identified by association with adults; larvae of *E. morawitzi* and *M. bellula* were reared to adult stage (Figs 1–5).

Habitus and digital photographs were taken with a Canon 40D camera with a MP-E 65 mm macro lens attached to a Leica MZ6 microscope. Photos of slide mounts were taken with Canon 6D camera attached to a Carl Zeiss AXIO Scope A1 microscope. All photos except those of habitat were processed using Zerene Stacker software. Line drawings were made in Corel Draw 12. The specimens preserved in 70 % ethanol or on slides are deposited in Moscow State Pedagogical University, Moscow, Russia (MSPU).

Results

Description of larval Encaustini

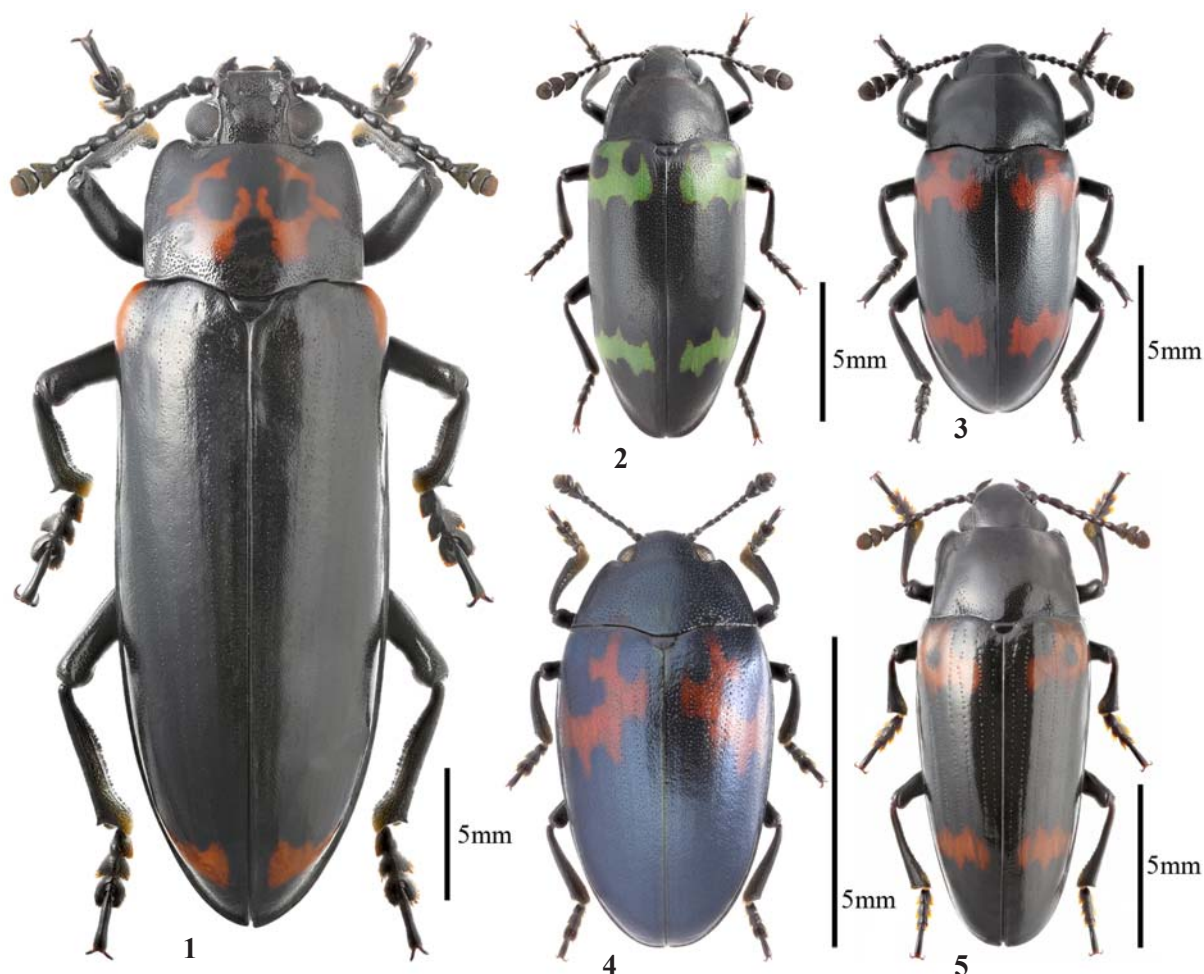
Encaustes cruenta praenobilis Lewis, 1883

Figs 6–22.

MATERIAL. 42 late-instar larvae together with adults: South Kuril Islands, Kunashir, Ozernaya river valley, in rotten wood of *Betula platyphylla* Sukaczew, 43°51'47" N 145°53'42" E, 21–29.VII.2011 leg. & det. A. Zaitsev (MSPU).

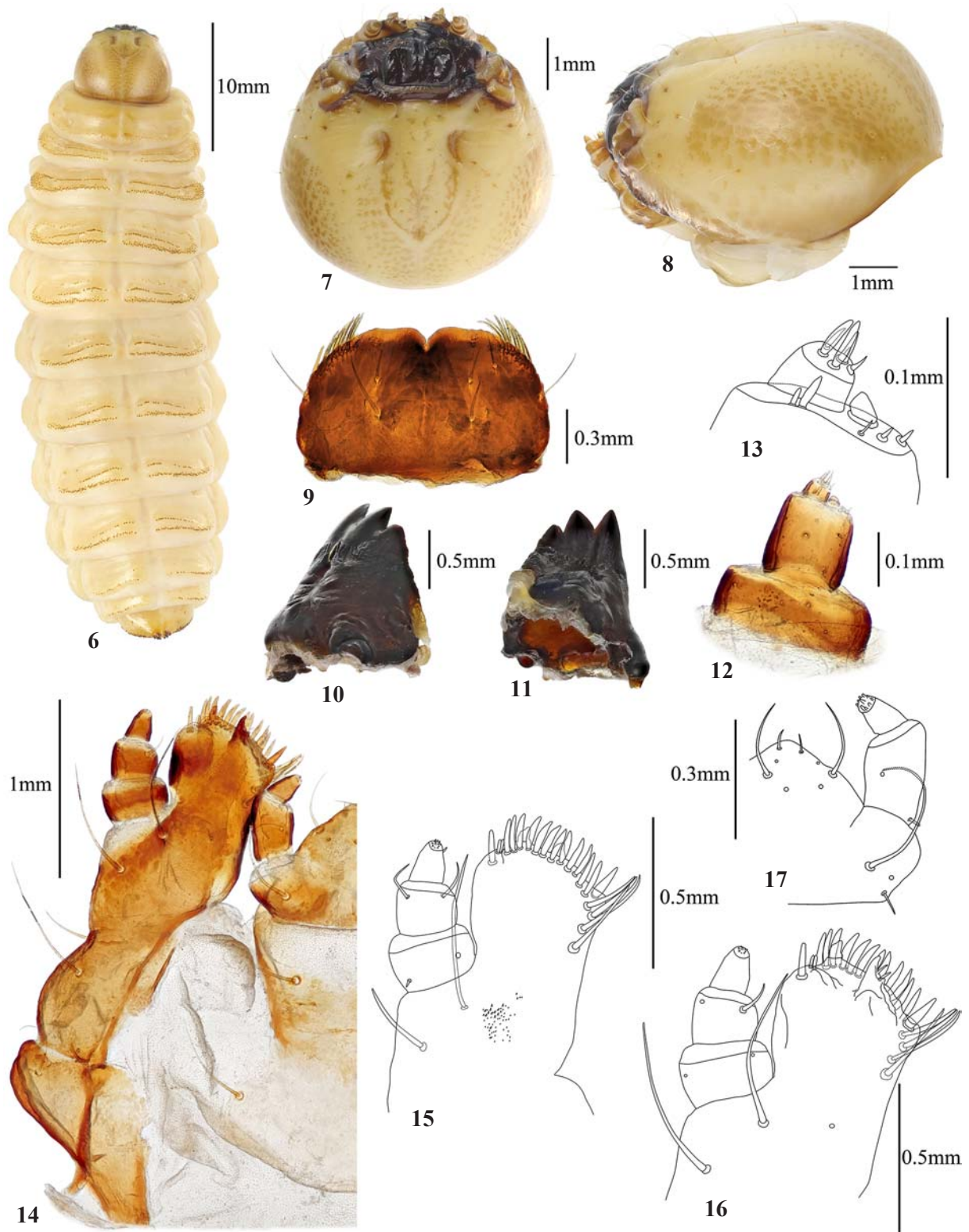
DESCRIPTION. Late-instar larva. Maximum body length about 47 mm; head length 5.5 mm; urogomphi length 0.3 mm; maximum width of thorax 10 mm; maximum width of abdomen 11 mm. Body elongated, cylindrical; widest across abdominal segments I–II, slightly tapering anterad and posterad; urogomphi short, spike-like (Fig. 6). Head light yellow with brown spots, its anterior part from dark-brown to almost black; labrum and mandibles almost black. Sclerotized areas of antennae, maxilla and labium brown. Thoracic and abdominal sclerites pale-yellow, tergites slightly darker than pleurites and ventrites. IX segment yellow; urogomphi heavily darkened apically. Legs light, with claws heavily darkened apically. Dorsal surfaces of all segments except abdominal IX with transverse rows of heavy sclerotized asperities; ventral surfaces membranous, covered with short setae.

Head (Figs 7–8) hypognathous, globular, slightly flattened; dorsally as long as wide and 0.7 as wide as prothorax; with a pair of depressions between antennal bases; dorsally with 11 rather long setae on each side. Epicranial stem long, median endocarina present, frontal arms U-shaped (Fig. 7). Stemmata (Fig. 8) 5 on each side, small, without lens. Hypostomal rods absent. Fronto-clypeal suture present, well-devel-



Figs 1–5. Adults of Encaustini occurring in Russia, dorsal habitus: 1 — *Encaustes cruenta praenobilis*; 2 — *Episcapha flavofasciata*; 3 — *Episcapha morawitzi*; 4 — *Aulacochilus luniferus decoratus*; 5 — *Megalodacne bellula*.

Рис. 1–5. Имаго Энкаустини, известных с территории России, сверху: 1 — *Encaustes cruenta praenobilis*; 2 — *Episcapha flavofasciata*; 3 — *Episcapha morawitzi*; 4 — *Aulacochilus luniferus decoratus*; 5 — *Megalodacne bellula*.



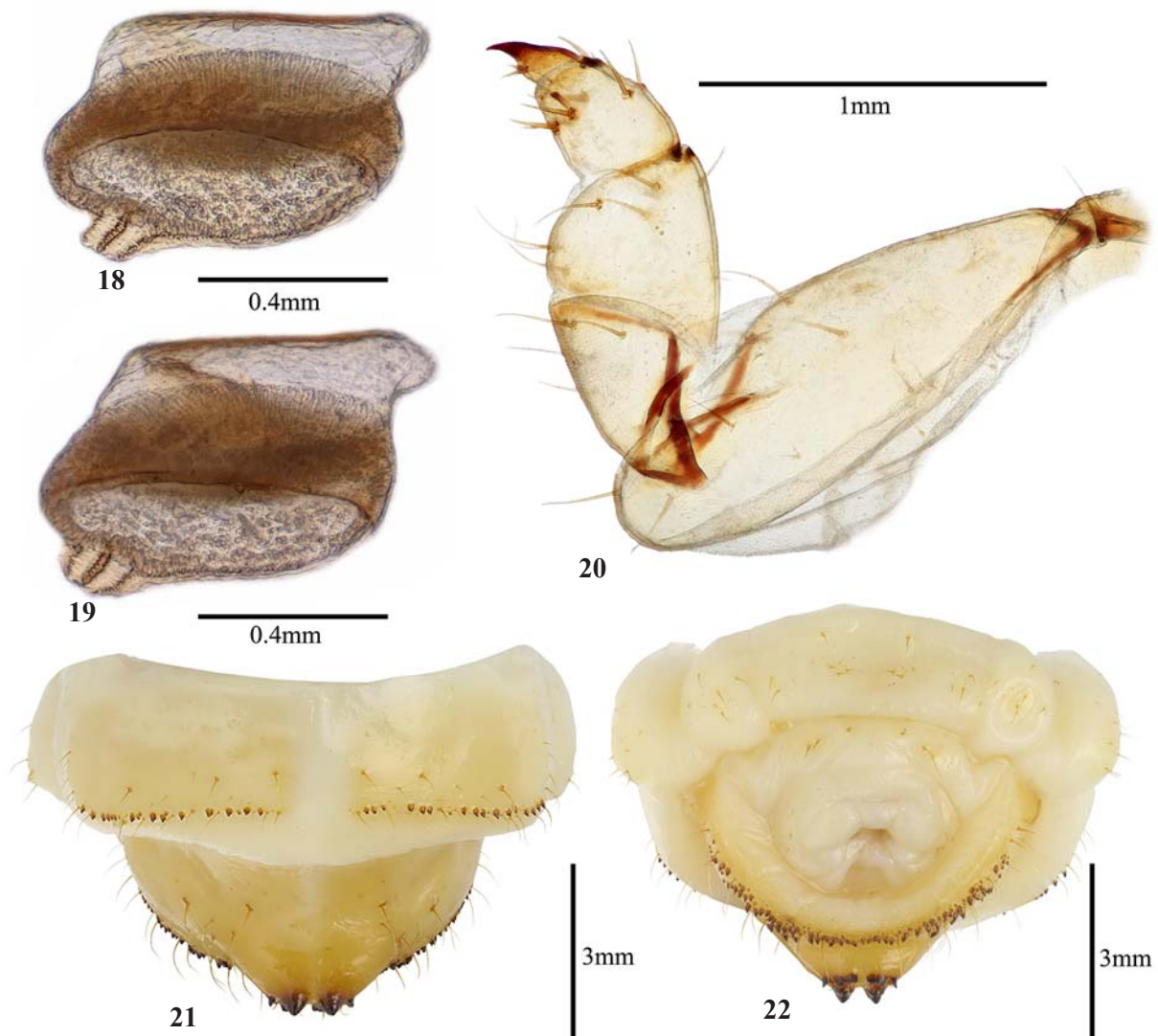
Figs 6–17. *Encaustes cruenta praenobilis*, larva: 6 — dorsal habitus; 7 — head, dorsal; 8 — head, lateral; 9 — labrum, dorsal; 10 — mandible, dorsal; 11 — mandible, ventral; 12 — right antenna, lateral; 13 — right antenna, apex of antennomere II and antennomere III, lateral; 14 — labio-maxillary complex, ventral; 15 — right maxilla, anterior part, dorsal; 16 — right maxilla, anterior part, ventral; 17 — prementum and ligula, ventral.

Рис. 6–17. *Encaustes cruenta praenobilis*, личинка: 6 — габитус, сверху; 7 — голова, сверху; 8 — голова, сбоку; 9 — верхняя губа, сверху; 10 — мандибула, сверху; 11 — мандибула, снизу; 12 — правая антенна, сбоку; 13 — правая антенна, вершина второго и третьего членика, сбоку; 14 — лабио-максиллярный комплекс, снизу; 15 — правая максилла, передняя часть, сверху; 16 — правая максилла, передняя часть, снизу; 17 — прементум и лигула, снизу.

oped (Fig. 7). Clypeus with 2 long lateral and 2 short medial setae, narrow and heavy sclerotised.

Labrum transverse, about 0.6 as long as wide, heavy sclerotized, free, dorsally with 6 long and 2 short setae as well as 6 basiconic sensillae; its anterior margin with distinct notch and with a group of 11 long lateral setae and single long seta on each side (Fig. 9). Antenna 3-segmented, rather short, with well-developed conical sensorium on antennomere II (Figs 12–13). Antennomere I broad, about 0.6 as long as wide, without setae, bears 3 campaniform sensillae; antennomere II 1.2 as long as first and about 1.1 as long as wide, with 1 campaniform sensilla. Apically it bears 5 short setae and conical sensorium, which is about 0.6 as long as antennomere III. Antennomere III is 0.25 as long as antennomere II and about 0.8 as long as wide; apically it bears a group of 3 long and 3 shorter setae (Fig. 13). Mandibles transverse, symmetrical, tridentate with fixed hyaline prosthema; with short seta located dorsally in anterior part (Figs 10–11). Labiomaxillar complex retracted (Fig. 14). Maxilla with well-developed articulating

area, transverse cardo and elongate stipes. Cardio bears 1 long seta mesolaterally, stipes with 3 long setae ventrally and 1 long seta dorsally, at the base with 1 campaniform sensilla. Anterior part of stipes dorsally with medial field of short asperities and 1 campaniform sensilla (Fig. 15). Mala well-developed, broadened apically, ventrally with 2 sclerotized unci, bigger unci with 2 small setae (Fig. 16). Anterior margin of mala dorsally with the row of 16 rather long and stout setae and 2 smaller setae on galeal lobe (Fig. 15). Ventrally anterior margin of mala bears well-developed elongated conical sensorium on the inner side and 1 stout seta on the galeal lobe (Fig. 16). Maxillary palpi 3-segmented; palpomeres I and II transverse. Palpomere I 0.8 as long as wide and bears 1 short lateral seta and 3 campaniform sensillae; palpomere II equal in length and 0.8 as wide as palpomere I, as long as wide, bears 1 campaniform sensilla and 3 long setae apically. Palpomere III slightly shorter and 0.6 as wide as palpomere II and 1.5 as long as wide, slightly tapered, blunt at apex, and bearing 1 short seta and a group of short apical sensory processes (Figs 15–16).



Figs 18–22. *Encaustes cruenta praeobilis*, larva: 18 — thoracic spiracle; 19 — abdominal spiracle; 20 — mesothoracic leg, lateral; 21 — VIII–X abdominal segments, dorsal; 22 — VIII–X abdominal segments, ventral.

Рис 18–22. *Encaustes cruenta praeobilis*, личинка: 18 — грудное дыхальце; 19 — брюшное дыхальце; 20 — нога 2-ой пары, сбоку; 21 — VIII–X сегменты брюшка, сверху; 22 — VIII–X сегменты брюшка, снизу.

Labium with mostly membranous submentum bearing long lateral seta on each side, mentum more sclerotized, also with a pair of long lateral setae (Fig. 14); prementum on the base of each palpiger with 1 small and 1 longer seta as well as 1 campaniform sensilla; ligula broad, with 2 short and 2 long setae as well as 4 campaniform sensillae on the apex. Labial palps 2-segmented, widely separated; palpomere I with short seta on the base, and 1 medial campaniform sensilla; about 2.1 as long as terminal palpomere, and about 2 as long as wide. Terminal palpomere about 1.6 as long as wide, blunt at apex, with a group of short sensory processes (Figs 14, 17).

Thorax about 0.2 as long as total body length, widest across metathorax. Prothoracic tergum on each side with 10 short dorsal setae and 5 short lateral setae, its posterior part with a transverse row of small sclerotized asperities. Meso- and metathoracic terga have similar vestiture: on each side with 3 short dorsal setae and 5 short lateral setae, sclerotized asperities much better developed than on prothorax and compose two transverse rows with clusters on lateral margins (Fig. 6). All thoracic sterna membranous and bear only 2 short setae. Thoracic pleurites with a few short setae. Prothorax is 1.1 and 1.2 as long as meso- and metathorax respectively, and 0.9 and 0.8 as wide. Thoracic spiracles annular-biforous (Fig. 18). Legs 5-segmented, rather short and massive; length ratio of its segments to coxa is 0.3:0.4:0.2:0.1. Coxa with 4 short and 5 long setae; trochanter with 4 long setae; femur with 1 short and 7 long setae; tibiotarsus with 2 short and 6 long stout setae; a single long and sharp claw with 2 short stout setae ventrally (Fig. 20).

Abdomen widest across segments I–II, tapered posteriad; abdominal segments I–III with 3 anterior transverse rows of heavy sclerotized asperities (Fig. 6); segments IV–VI with 2 distinct rows of asperities, and VII–VIII with 1 distinct row. Abdominal terga I–VII with few short setae; and tergum VIII with 16 short dorsal and 8 lateral setae on each side. Tergum IX with 5 dorsal setae and with about 20 setae on its posterior margin, which also bears numerous heavy sclerotized granules (Fig. 21). Abdominal sterna I–IX membranous and have similar vestiture, consisting of several short setae on each segment. Abdominal pleurites also bear short setae, about 10 on each segment. Abdominal spiracles similar to those on thorax, annual-biforous (Fig. 19). Urogomphi short, spike-like, heavy sclerotized, surrounded posteriorly by 4 granules (Fig. 21). Abdominal segment X short, considerably retracted and directed posteroventrally, with 4 short lateral setae on each side (Fig. 22).

Episcapha morawitzi Solsky, 1871
Figs 23–39.

MATERIAL. 3 late-instar larvae: Primorskyi krai, Lazovskyi zapovednik, kordon Korpad, valley forest, on fallen *Betula* sp., near fungi, 43°14.6705' N 134°07.7580' E, 8.VIII.2007 leg. A. Zaitsev, K. Makarov; det. A. Zaitsev (MSPU)

DESCRIPTION. **Late-instar larva.** Maximum body length about 17 mm; head length 1.7 mm; urogomphi length 1.5 mm; maximum width of thorax 6.2 mm; maximum width of abdomen 6 mm. Body elongated, subcylindrical; widest across thoracic segments II–III, slightly tapering posterad; urogomphi long, stout. (Fig. 23). Head mostly reddish-yellow; basal half of frons and area near stemmata brown. Ventrad to the base of the antennae cuticle darkened, with heavily pigmented bases of setae. Labrum and mandibles yellowish-brown; mandibles heavily darkened apically. Sclerotized areas of maxilla and labium from brown to light-yellow. Thoracic and abdominal terga with contrastive staining: dark brown medial trapezoidal spots, distinctly short-

ened posteriad, on yellowish-red background. Anterior corners of prothorax dark-brown, on meso- and metathorax dark color prevails and covers almost all lateral part of tergite; on abdominal segments lateral third and each lobe dark-brown. Urogomphi light colored, with slightly darkened base. Thoracic pleura yellowish-brown with distinct pigmented spots. Abdominal pleura (except VIII) heavily pigmented and colored dark-brown. Abdominal ventrites pale-yellow, with distinct pigmentation only on the bases of setae. Legs mostly yellowish, outer part of coxa, dorsal surface of femur and tibiotarsus from brown to dark-brown. Dorsal surfaces of all segments with numerous tubercles; broad, finger-like (except on the prothorax) lobes arises from lateral parts of the tergite of each segment (Fig. 23); ventral surfaces membranous, covered with short setae.

Head (Figs 24–25) hypognathous, globular, slightly flattened; dorsally 0.8 as long as wide and 0.5 as wide as prothorax; with a pair of depressions between antennal bases; dorsally with 11 rather long and 27 short setae on each side. Almost all surface of the head capsule, except the anterior part, covered by numerous granulae, forming a characteristic pattern. Epicranial stem long, median endocarina present, frontal arms U-shaped (Fig. 24). Stemmata 5 on each side, large, with lens; 4 compose a group behind the antennal base and 1 shifted anteriorly (Fig. 25). Hypostomal rods absent. Fronto-clypeal suture present, well-developed (Fig. 24). Clypeus with 2 long lateral setae on each side, narrow and sclerotised as the rest of head capsule.

Labrum transverse, about 0.6 as long as wide, moderately sclerotized, free, with 2 long medial setae, 2 setae located laterally and 4 campaniform sensillae. Its anterior part with 4 shorter stout setae and 2 basiconical sensillae. Anterior margin of labrum without notch and bears a group of 8 long lateral setae on each side, and numerous short setae between them (Fig. 26). Antenna 3-segmented, rather long, with well-developed elongated conical sensorium on antennomere II (Figs 29–30). Antennomere I broad, about 0.6 as long as wide, without setae, bears 3 campaniform sensillae; antennomere II elongated, slightly tapered apically, about 2.5 as long as first and about 2 as long as wide, with campaniform sensilla. Apically it bears 6 short setae and elongated conical sensorium, which is about 0.4 as long as antennomere III. Antennomere III is 0.3 as long as antennomere II and about 1.8 as long as wide; apically it bears a group of 5 short setae and 1 long medial seta (Fig. 30). Mandibles transverse, symmetrical, tridentate, with 1 seta located dorsally in anterior part and 1 seta near the base as well as 3 campaniform sensillae; protheca bilobed, setose (Figs 27–28). Labiomaxillary complex retracted (Fig. 31). Maxilla with well-developed articulating area, transverse cardo and elongate stipes. Cardo bears 1 long seta mesolaterally, stipes with 3 long setae ventrally and 2 long seta dorsally, and 1 campaniform sensilla near the base (Fig. 31). Anterior part of stipes dorsally with medial field of about 25 short asperities and 1 campaniform sensilla (Figs 31–32). Mala well-developed, broad, slightly tapered apically, with a dorsal field of about 20 asperities, which are significantly larger than those on anterior part of stipes (Fig. 32). Mala bears 1 dorsal and 2 ventral sclerotized unci, bigger ventral unci with 1 small seta near the base. Anterior margin of mala dorsally with the row of 12 rather long and stout setae, 1 seta on galeal lobe, 1 long seta arising from the anterior part of the field with asperities. Ventrally anterior margin of mala bears well-developed elongated conical sensorium on the inner side, 2 short setae on the galeal lobe and 1 short seta posterior to the field of asperities. Inner side of mala ventrally with about 20 heavy sclerotized asper-

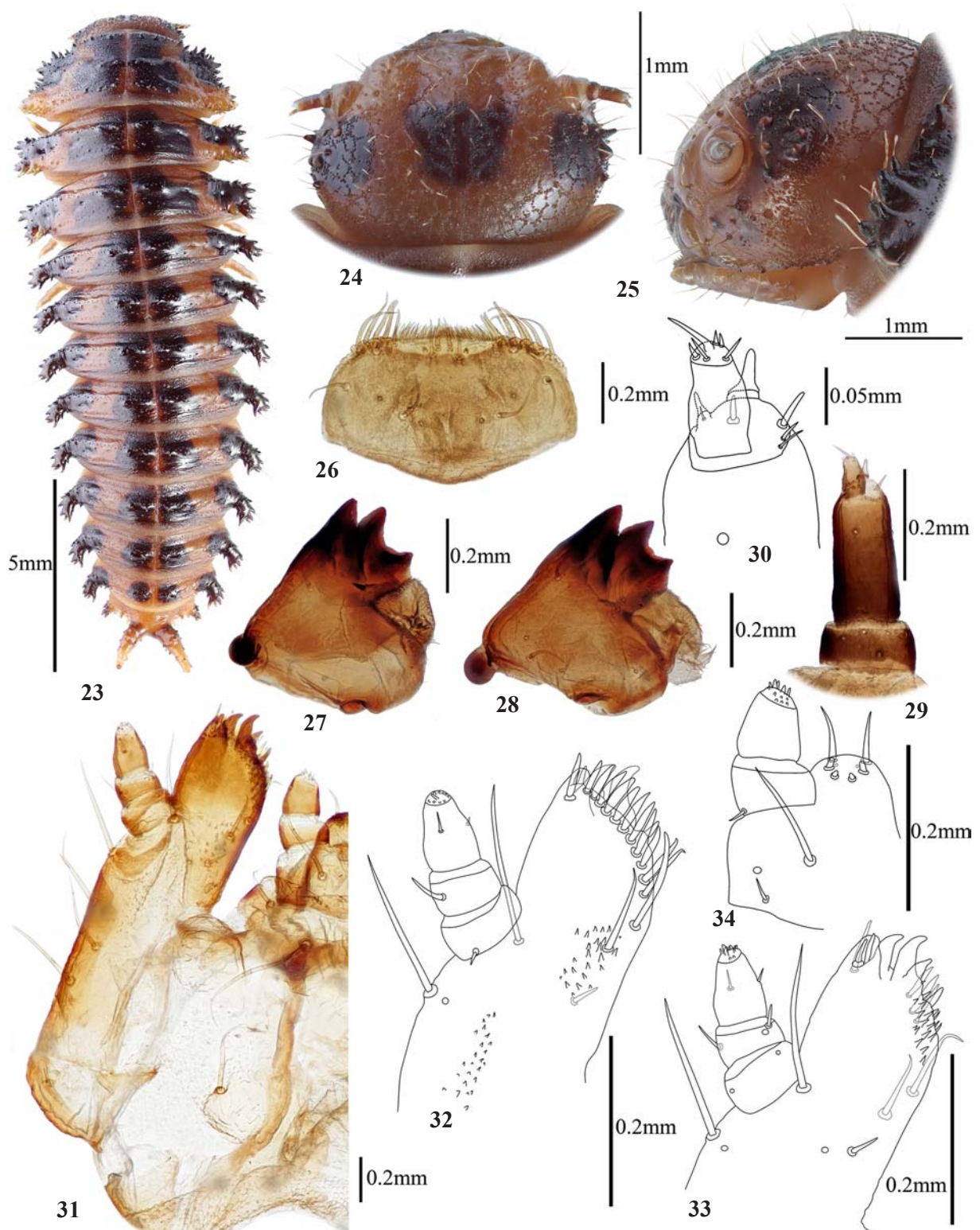


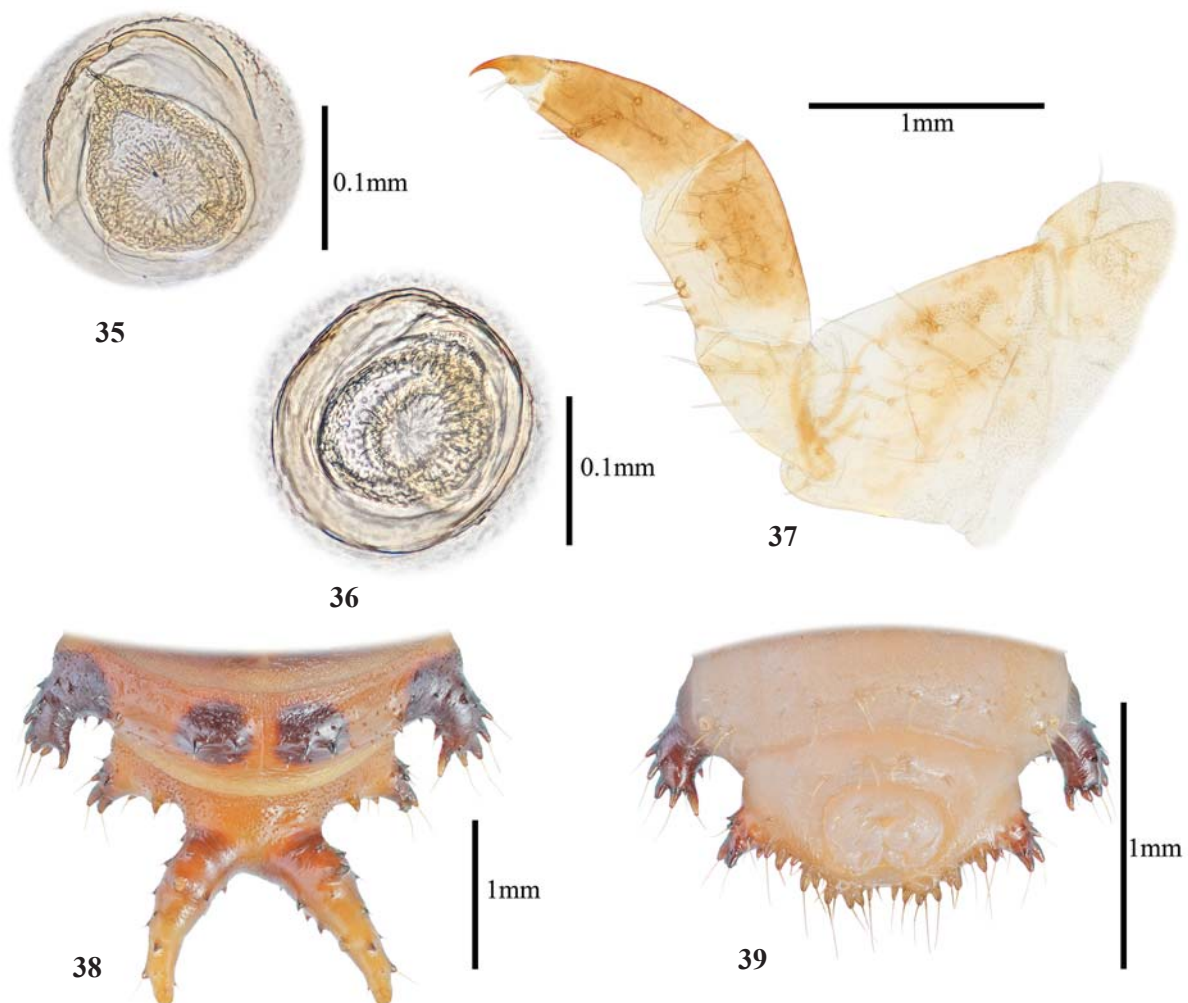
Рис. 23–34. *Episcapha morawitzi*, larva: 23 — dorsal habitus; 24 — head, dorsal; 25 — head, lateral; 26 — labrum, dorsal; 27 — mandible, dorsal; 28 — mandible, ventral; 29 — right antenna, dorsal; 30 — right antenna, apex of antennomere II and antennomere III, dorsal; 31 — labio-maxillar complex, ventral. 32 — right maxilla, anterior part, dorsal; 33 — right maxilla, anterior part, ventral; 34 — prementum and ligula, ventral.

Рис. 23–34. *Episcapha morawitzi*, личинка: 23 — габитус, сверху; 24 — голова, сверху; 25 — голова, сбоку; 26 — верхняя губа, сверху; 27 — мандибула, сверху; 28 — мандибула, снизу; 29 — правая антенна, сверху; 30 — правая антенна, вершина второго и третьего членика, сверху; 31 — лабио-максиллярный комплекс, снизу; 32 — правая максилла, передняя часть, сверху; 33 — правая максилла, передняя часть, снизу; 34 — прементум и лигула, снизу.

ities (Fig. 33). Maxillary palpi 3-segmented; palpomeres I and II transverse. Palpomere I 0.6 as long as wide and bears 1 short lateral seta near the base and 2 campaniform sensillae; palpomere II equal in length and 0.7 as wide as palpomere I, about 0.8 as long as wide, bears 2 setae and 1 campaniform sensilla. Palpomere III about 1.6 as long and 0.8 as wide as palpomere II and 1.6 as long as wide, slightly tapered, blunt at apex, and bearing 2 medial setae and a group of short apical sensory processes with longer medial one (Figs 32–33).

Labium with membranous submentum bearing long lateral seta on each side, mentum also mostly membranous, on each side with 2 long medial and 1 very short lateral setae near the base and 1 campaniform sensilla (Fig. 31); prementum on each side with 1 small and 1 long seta on the base of palpiger; ligula broad, rounded apically, with 4 conical and 2 campaniform sensillae and 2 long setae on the apex. Labial palps 2-segmented, widely separated; palpomere I with short seta on the base, about 0.8 as long as terminal palpomere, and about 0.8 as long as wide. Terminal palpomere about 1.3 as long as wide, blunt at apex, with a group of short sensory processes with longer medial one (Figs 31, 34).

Thorax about 0.3 as long as total body length, widest across metathorax. Prothoracic tergum with numerous tubercles dorsally; its anterior margin and medial part with several heavily-sclerotized larger tubercles, bearing 1 seta each. Lateral margins of prothorax extended and bear numerous projections (Fig. 23). There are 12 dorsal brush-like setae originated from the tubercles on the anterior part of the segment; lateral margins with about 15 longer simple setae on each side. Meso- and metathoracic terga tuberculate, with 4 large heavily-sclerotized medial tubercles with 1 setae each; lateral margins with broad, finger-like lobes with about 10 longer setae on each. All thoracic sterna membranous and bear a few short setae. Thoracic pleurites II–III with sclerotized convex protuberances bearing 1 long and several shorter setae each. Prothorax is 1.2 as long as meso- and metathorax individually, and about 0.9 as wide. Thoracic spiracles annular, without chambers (Fig. 35). Legs 5-segmented, rather slender; length ratio of its segments to coxa is 0.7:0.8:0.8:0.3. Coxa with 10 short and 10 longer setae and has a field of short spike-like asperities in the medial part; trochanter with 6 long and 1 shorter setae; femur with 5 short and 12 longer setae; tibiotsarsus with 1 short and 11 long setae; a single long and sharp claw with 2 rather long setae ventrally (Fig. 37).



Figs 35–39. *Episcapha morawitzi*, larva: 35 — thoracic spiracle; 36 — abdominal spiracle; 37 — mesothoracic leg, lateral; 38 — VIII–X abdominal segments, dorsal; 39 — VIII–X abdominal segments, ventral.

Рис. 35–39. *Episcapha morawitzi*, личинка: 35 — грудное дыхальце; 36 — брюшное дыхальце; 37 — нога 2-ой пары, сбоку; 38 — VIII–X сегменты брюшка, сверху; 39 — VIII–X сегменты брюшка, снизу.

Abdomen widest across segments I–II, tapered posteriorly; abdominal segments I–VIII covered in numerous small tubercles, dorsally with 4 larger ones; its lateral margins with finger-like lobes, which are narrower than those on thorax (Fig. 23). Abdominal terga I–VIII with few short setae dorsally and 5 longer setae on each lateral lobe. Tergum IX covered in small tubercles, with lateral lobe on each side, bearing 2 short and 4 longer setae; proximal to each lobe there is a distinct triangular uncus, with 1 apical seta. Posterior margin of abdominal tergum IX with transverse row of numerous triangular processes, each with 1 short or longer seta (Fig. 38). Abdominal sterna I–VIII membranous; sternite I with few short dorsal setae; sternites II–VIII with numerous small setae and several large tubercles arranged in a transverse row bearing 1 longer setae each. Abdominal sternite IX with 8 medial setae and 1 small lateral seta on each side (Fig. 39). Abdominal pleurites I–VIII with heavy sclerotized (except pleurite VIII) protuberances bearing several long and shorter setae each. Abdominal spiracles similar to those on thorax, annular (Fig. 36). Urogomphi long, stout, have common base, about 2 as long as the rest of abdominal segment IX, and about 2.6 as long as wide. Each urogomphi with 5 processes on outer margin, 5 medial processes and 6 processes on inner margin, each bearing 1 seta (Fig. 38). Abdominal segment X short, directed posteroventrally, on each side with 4 setae on anterior part and 5 longer setae on the posterior margin (Fig. 39).

Episcapha flavofasciata Reitter, 1879
Figs 40–56.

MATERIAL. 17 late-instar larvae together with adults: Khabarovskiy krai, Amurskaya oblast, Kundur village, on *Betula* sp., near fungi, 20.VII.1975, leg. & det. A. Kompantsev (IPEE RAS).

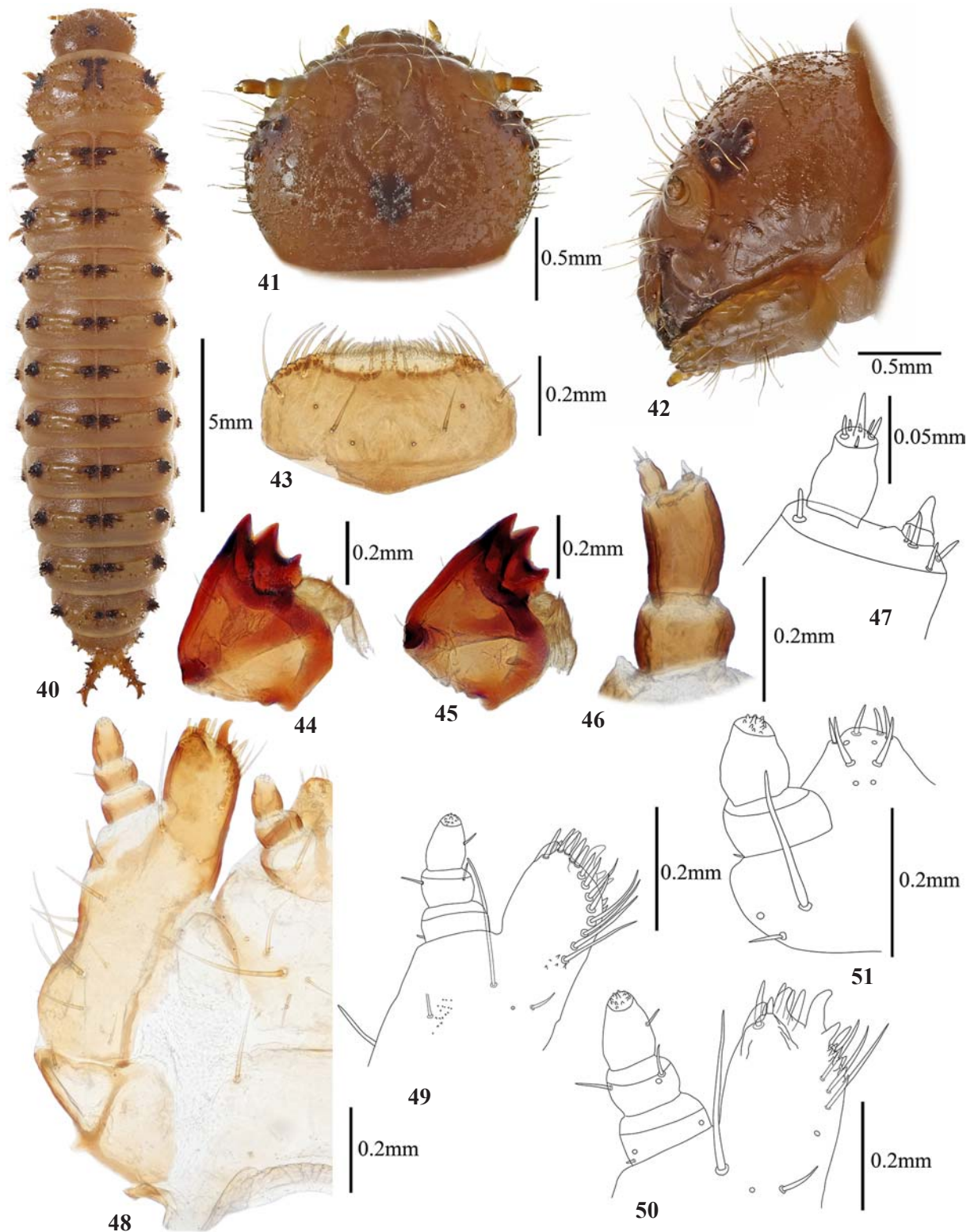
DESCRIPTION. Late-instar larva. Maximum body length about 19 mm; head length 1.5 mm; urogomphi length 1.4 mm; maximum width of thorax 4.3 mm; maximum width of abdomen 4.5 mm. Body elongated, subcylindrical; widest across thoracic segments II–III, slightly tapering posterad; urogomphi long, stout. (Fig. 40). Head yellowish, with small triangular brownish-black spot on the base of frons; area near stemmata dark brown. Labrum brownish-yellow, mandibles light brown, darkened apically. Sclerotized areas of maxilla and labium from yellowish to light brown; antennae dark brown. Thoracic and abdominal terga bicolored; major color light yellow, on both sides from medial suture lies rather small trapezoidal dark brown spot, larger on prothorax and gradually decreasing posteriad. Anterior corners of thoracic terga with dark brown spots, surrounded by dark yellow area. Lateral parts of abdominal terga dark brown. Urogomphi with light-colored bases and darkened apically. Thoracic and abdominal pleura and distal half of episterna brown; ventrites light-colored, with darkened bases of larger setae. Legs bicolored, outer part of coxa, dorsal surface of femur and tibiotarsus dark brown, claws brownish-yellow. Dorsal surfaces of all segments with numerous tubercles; broad and short finger-like lobes arises from lateral parts of the tergite of each segment; ventral surfaces membranous, covered with short setae (Fig. 40).

Head (Figs 41–42) hypognathous, globular, slightly flattened; dorsally 1.1 as long as wide and 0.6 as wide as prothorax; with pair of depressions between antennal bases; dorsally with 11 rather long and 27 short setae on each side. Almost all surface of the head capsule, except the anterior part, covered by numerous granulae, forming a characteristic pattern, similar to those in *E. morawitzi*. Epicranial stem

long, median endocarina present, frontal arms U-shaped (Fig. 41). Stemmata (Fig. 42) 5 on each side, large, with lens; 4 compose a group behind the antennal base and 1 shifted anteriorly. Hypostomal rods absent. Fronto-clypeal suture present, well-developed (Fig. 42). Clypeus with 2 medial setae and 2 longer lateral setae on each side, narrow and sclerotized as the rest of head capsule.

Labrum transverse, about 0.6 as long as wide, moderately sclerotized, free, with 2 long medial setae, 2 setae located laterally and 4 campaniform sensillae as well as a group of 4 shorter stout setae in anterior part, with 1 basiconical sensilla on each side. Its anterior margin without notch and bears a group of 8 long lateral setae on each side, and numerous short setae between them (Fig. 43). Antenna 3-segmented, rather long, with well-developed conical sensorium on antennomere II, which is not as elongated as in *E. morawitzi* (Figs 46–47). Antennomere I broad, square, almost as long as wide; antennomere II broadened apically, about 1.5 as long as first and about 1.7 as long as wide. Apically it bears 5 short setae and conical sensorium, which is about 0.4 as long as antennomere III. Antennomere III is 0.3 as long as antennomere II and about 1.8 as long as wide; apically it bears a group of 6 rather short setae and 1 longer medial seta (Fig. 47). Mandibles transverse, symmetrical, tridentate, with 1 seta located dorsally in anterior part and 2 setae near the base; prosthema bilobed, setose (Figs 44–45). Labiomaxillar complex retracted (Fig. 48). Maxilla with well-developed articulating area, transverse cardo and elongate stipes. Cardo bears 1 long seta mesolaterally, stipes with 3 long setae ventrally and 3 long setae dorsally, and 1 campaniform sensilla near the base (Fig. 48). Anterior part of stipes dorsally with medial field of about 15 asperities, which are considerably shorter than those in *E. morawitzi*, and 1 campaniform sensilla (Fig. 49). Mala well-developed, broad, slightly tapered apically, with a dorsal field consisting only of 5 asperities. Mala bears 3 sclerotized unci, bigger ventral uncus without setae. Anterior margin of mala dorsally with the row of 11 rather long and stout setae, 1 seta on galeal lobe and 1 long seta arising from the anterior part of the field with asperities (Fig. 49). Ventrally anterior margin of mala bears well-developed elongated conical sensorium on the inner side, 2 short setae on the galeal lobe and 1 short seta posterior to the field of asperities. Inner side of mala ventrally with about 10 heavy sclerotized asperities (Fig. 50). Maxillary palpi 3-segmented; palpomeres I and II transverse. Palpomere I 0.6 as long as wide and bears 1 short lateral seta near the base and 2 campaniform sensillae; palpomere II equal in length and 0.7 as wide as palpomere I, about 0.7 as long as wide, bears 2 setae and 1 campaniform sensilla. Palpomere III about 1.5 as long and 0.8 as wide as palpomere II and 1.4 as long as wide, slightly tapered, blunt at apex, and bearing 1 seta and a group of short apical sensory processes with longer medial one (Figs 49–50).

Labium with membranous submentum bearing long lateral seta on each side, mentum also mostly membranous, each side with 4 long medial setae, 1 very short lateral seta near the base, and 1 campaniform sensilla (Fig. 48); prementum on each side with 1 small and 1 longer seta as well as 1 campaniform sensilla on the base of palpigiger; ligula broad, distinctly tapered and rounded apically with 6 rather long setae and 4 campaniform sensillae. Labial palps 2-segmented, widely separated; palpomere I with short seta on the base, about 0.7 as long as terminal palpomere, and about 0.6 as long as wide. Terminal palpomere about 1.3 as long as wide, blunt at apex, with a group of apical sensory processes with longer medial one (Figs 48, 51).



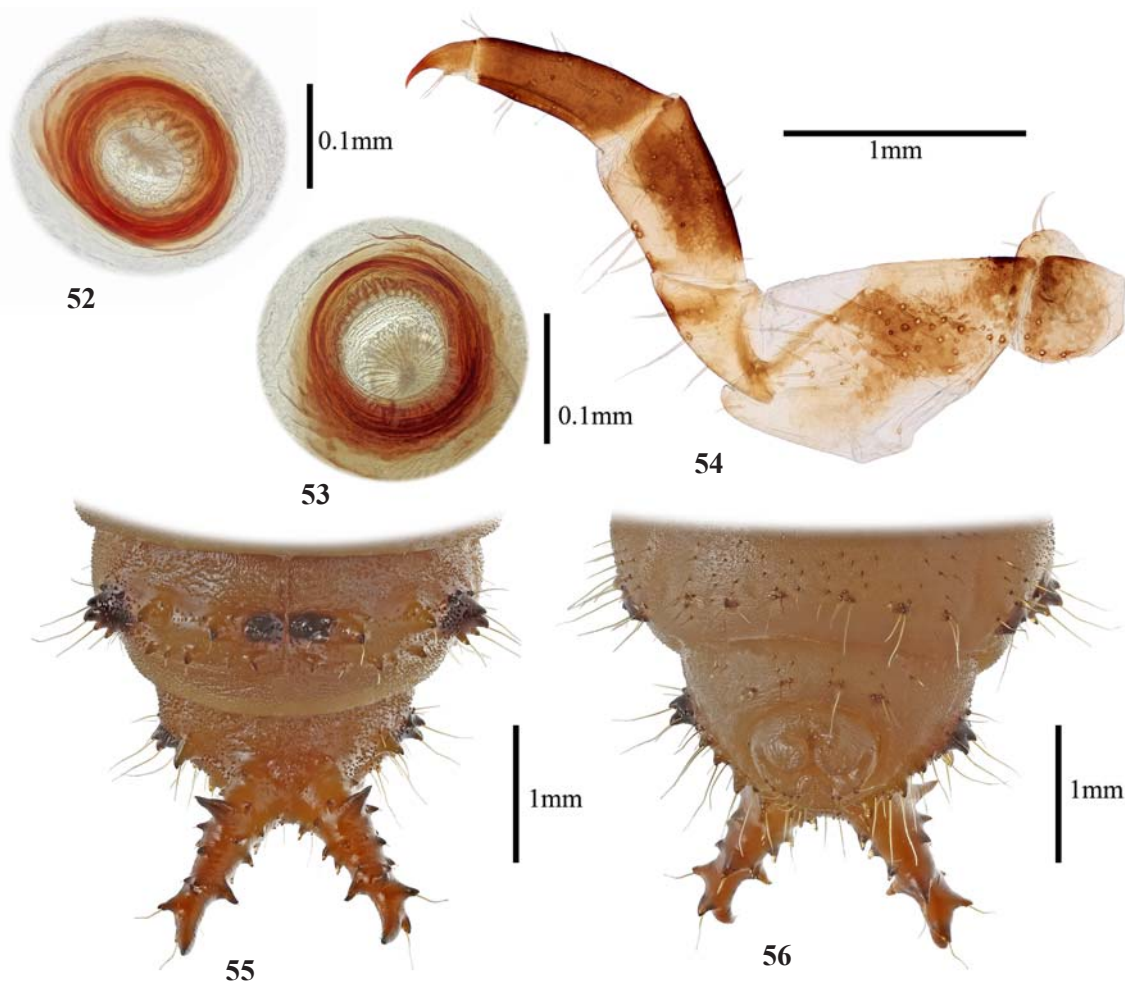
Figs 40–51. *Episcapha flavofasciata*, larva: 40 — dorsal habitus; 41 — head, dorsal; 42 — head, lateral; 43 — labrum, dorsal; 44 — mandible, dorsal; 45 — mandible, ventral; 46 — right antenna, lateral; 47 — right antenna, apex of antennomere II and antennomere III, lateral; 48 — labio-maxillary complex, ventral; 49 — right maxilla, anterior part, dorsal; 50 — right maxilla, anterior part, ventral; 51 — prementum and ligula, ventral.

Рис. 40–51. *Episcapha flavofasciata*, личинка: 40 — габитус, сверху; 41 — голова, сверху; 42 — голова, сбоку; 43 — верхняя губа, сверху; 44 — мандибула, сверху; 45 — мандибула, снизу; 46 — правая антенна, сбоку; 47 — правая антенна, вершина второго и третий членик, сбоку; 48 — лабио-максиллярный комплекс, снизу; 49 — правая максилла, передняя часть, сверху; 50 — правая максилла, передняя часть, снизу; 51 — прементум и лигула, снизу.

Thorax about 0.3 as long as total body length, widest across metathorax. Prothoracic tergum dorsally with numerous tubercles; 8 medial heavy-sclerotized ones bear 1 seta each (Fig. 40). Numerous rather short setae arise from less-sclerotized tubercles, situated laterally, which are arranged in 4 rows. Lateral margins of prothorax a bit extended and bear about 10 projections; each lateral projection bears 1 long seta. Meso- and metathoracic terga anteriorly with medial field of small heavy sclerotized tubercles on both sides of medial suture, and with 6 large heavy-sclerotized tubercles bearing 1 seta each. Lateral margins with broad but short finger-like lobes with about 7 projections, each bearing 1 long seta. All thoracic sterna membranous, with tubercles in anterior part and bear a few short setae. Thoracic pleurites II–III with paired sclerotized spot-like protuberances bearing 2 long and several shorter setae each. Prothorax is 1.3 as long as meso- and metathorax individually, and about 0.9 as wide. Thoracic spiracles annular, without chambers (Fig. 52). Legs 5-segmented, slender; length ratio of its segments to coxa is 0.6:0.7:0.7:0.3. Coxa with 10 short and 25 longer setae and has 2 fields of short spike-like asperities: one in the medial part and other near the base; trochanter with 6 long and 1 shorter setae; femur with 5 short and 12 longer setae; tibia with

1 short and 11 long setae; a single long and sharp claw with 2 rather long setae ventrally (Fig. 54).

Abdomen widest across segment III, tapered posteriorly; abdominal segments I–VIII covered in numerous small tubercles, dorsally with 6 larger heavy-sclerotized ones; its lateral margins with finger-like lobes, which are a little narrower than those on thorax and bear 5 long setae each (Fig. 40). Tergum IX covered in small tubercles, with small lateral lobe on each side, bearing 2 short and 4 longer setae; proximal to each lobe there is a distinct triangular uncus, with 1 apical seta. Posterior margin of abdominal tergum IX with transverse row of 10 triangular processes, each with 1 long seta (Fig. 55). Abdominal sterna I–VIII membranous; sternite I with few short dorsal setae; sternites II–VIII with numerous small setae and several large tubercles arranged in a transverse row bearing 1 longer seta each. Abdominal sternite IX with about 20 medial setae. Abdominal pleurites I–VIII with heavy sclerotized spot-like protuberances bearing several long and shorter setae each. Abdominal spiracles similar to those on thorax, annular (Fig. 53). Urogomphi long, stout, have common base, about 2 as long as the rest of abdominal segment IX, and about 3 as long as wide. Each urogomphi with 6 processes on outer margin, 7 medial processes and 5 processes on inner margin, each bear-



Figs 52–56. *Episcapha flavofasciata*, larva: 52—thoracic spiracle; 53—abdominal spiracle; 54—mesothoracic leg, lateral; 55—VIII–X abdominal segments, dorsal; 56—VIII–X abdominal segments, ventral.

Рис. 52–56. *Episcapha flavofasciata*, личинка: 52—грудное дыхальце; 53—брюшное дыхальце; 54—нога 2-ой пары, сбоку; 55—VIII–X сегменты брюшка, сверху; 56—VIII–X сегменты брюшка, снизу.

ing 1 seta (Figs 55–56). Abdominal segment X short, directed posteroventrally, on each side with 4 setae on anterior part and 5 longer setae on the posterior margin (Fig. 56).

The larvae of *E. morawitzi* and *E. flavofasciata* can be well distinguished by the complex of characters, most important are represented below:

Characters	<i>E. morawitzi</i>	<i>E. flavofasciata</i>
Lateral finger-like lobes of tergites II–VIII	elongated	short
Antennomere II	slightly tapered apically	broadened apically
Anterior part of stipes	with about 25 asperities	with about 15 asperities
Dorsal field of asperities on mala	with 20 larger asperities	with 5 asperities
Inner side of mala	with 20 asperities	with 10 asperities
Anterior margin of mala	with 12 setae	with 11 setae
Urogomphi, outer margin	5 processes	6 processes
Urogomphi, medial area	5 processes	7 processes
Urogomphi, inner margin	6 processes	5 processes

Aulacochilus luniferus decoratus Reitter, 1879
Figs 57–73.

MATERIAL. 8 late-instar larvae together with adults: Primorskyi krai, Lazovskiy zapovednik, kordon Prosyolochnyi, stump with fungi 43°01'53" N 134°08'44" E, 20.VIII.2007, leg. & det. A. Zaitsev (MSPU); 3 late-instar larvae together with adults: Primorskyi krai, Lazovskiy zapovednik, kordon Korpad, valley of river Kedrovaya, in bracket fungi 43°15'17" N 134°07'59" E, 14.VII.2005, leg. K. Makarov; det. A. Zaitsev (MSPU).

DESCRIPTION. Late-instar larva. Maximum body length about 11 mm; head length 1 mm; urogomphi length 0.6 mm; maximum width of thorax 2 mm; maximum width of abdomen 2.3 mm. Body elongated, subcylindrical; widest across abdominal segment III, slightly tapering anteriorly and posteriorly; urogomphi rather short, stout (Fig. 57). Head brownish-yellow, with darkened frons. Labrum yellowish-brown, mandibles brownish-yellow, heavily darkened apically. Sclerotized areas of maxilla and labium yellowish-brown; antennae weakly pigmented, yellowish. Thoracic and abdominal terga brownish-yellow, VIII and IX terga slightly darker. Distal half of urogomphi dark brown. Thoracic and abdominal pleurites pale, slightly yellowish, ventrites pale. Legs pale, low-sclerotized except claws. Dorsal surfaces of all segments except prothorax and abdominal segment IX with 1 or 2 transverse rows of small heavy-sclerotized asperities; ventral surfaces membranous, covered with short and longer setae. (Fig. 57).

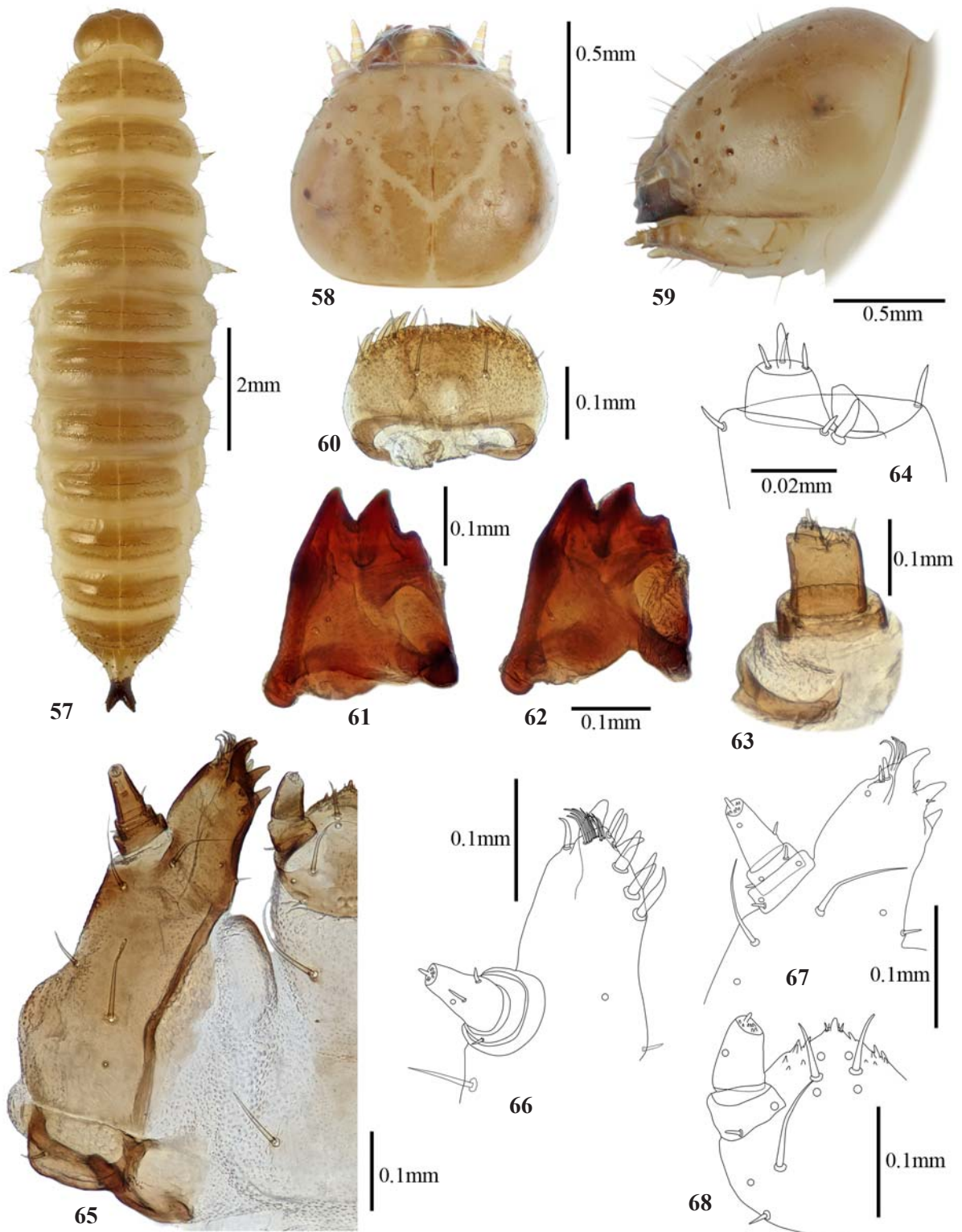
Head (Figs 58–59) hypognathous, globular, slightly flattened; dorsally almost as long as wide and 0.7 as wide as prothorax; with a pair of depressions between antennal bases; dorsally with 12 rather long and 5 short setae on each side. Almost all surface of the head capsule covered by numerous microgranulae. Epicranial stem long, median endocarina present, frontal arms U-shaped (Fig. 58). Stemmata (Fig. 59) 5 on each side, large, with lens; 4 compose a group behind the antennal base and 1 shifted anteriorly. Hypostomal rods absent. Fronto-clypeal suture present, well-developed (Fig. 58). Clypeus with 2 small medial setae and 1 long and 1 shorter lateral setae on each side, narrow and sclerotized as the rest of head capsule.

Labrum transverse, about 0.7 as long as wide, moderately sclerotized, free, with 2 long medial setae, 2 setae located laterally and 4 basiconic sensillae as well as 2 long setae in anterior part. Its anterior margin without notch and bears a group of 10 long lateral setae on each side, and 2 short setae between them (Fig. 60). Antenna 3-segmented, rather short, with well-developed conical sensorium on antennomere II (Figs 63–64). Antennomere I broad, about 0.6 as long as wide, with 2 campaniform sensillae; antennomere II about 1.4 as long as first and about 1.2 as long as wide. Apically it bears 4 setae and conical sensorium, which is about 0.7 as

long as antennomere III. Antennomere III is 0.3 as long as antennomere II and about 0.7 as long as wide; apically it bears 3 rather short setae and 1 longer medial seta (Fig. 64). Mandibles transverse, symmetrical, tridentate, dorsally with 1 medial seta and 1 seta near the base; prostheca with asperities in anterior part and setose in posterior part (Figs 61–62). Labiomaxillar complex retracted (Fig. 65). Maxilla with well-developed articulating area, transverse cardo and elongate stipes. Cardo bears 1 seta mesolaterally, stipes with 4 long setae and 3 campaniform sensillae ventrally (Fig. 65). Anterior part of stipes without field of asperities. Mala well-developed, broad, slightly tapered apically, bears 1 dorsal and 2 ventral sclerotized unci, bigger ventral unci with 1 short seta near the base. Anterior margin of mala dorsally with the row of 5 rather long and stout setae and with group of about 10 medial thinner setae arising near the base of dorsal unci; 1 long seta on galeal lobe (Fig. 66). Ventrally anterior margin of mala bears well-developed elongated conical sensorium on the inner side, 2 short setae on the galeal lobe and 1 short seta and 1 campaniform sensilla near the base of mala. Inner side of mala without asperities (Fig. 67). Maxillary palpi 3-segmented; palpomeres I and II transverse. Palpomere I 0.5 as long as wide and bears 1 short seta near the base and 2 campaniform sensillae; palpomere II equal in length and 0.8 as wide as palpomere I, about 0.6 as long as wide, bears 1 seta on outer margin, 1 medial seta and 1 campaniform sensilla. Palpomere III about 2 times longer and 0.8 as wide as palpomere II and 1.6 as long as wide, tapered apically, blunt at apex, and bears 2 setae dorsally, 1 campaniform sensilla and a group of short apical sensory processes with longer medial one (Figs 66–67).

Labium with membranous submentum bearing long lateral seta on each side, mentum also mostly membranous, on each side with 1 long medial seta and 1 short seta near the base (Fig. 65); prementum with 1 small and 1 longer seta as well as 1 campaniform sensilla on each side of the base of palpiger; ligula broad, triangular, anterior part dentate; bears 2 long and 2 short setae as well as 4 campaniform sensillae (Fig. 68). Labial palps 2-segmented, widely separated; palpomere I with short seta and 1 campaniform sensilla on the base, about 0.6 as long as terminal palpomere, and about 0.7 as long as wide. Terminal palpomere about 1.4 as long as wide, blunt at apex, with 1 campaniform sensilla and a group of short apical sensory processes with longer medial one (Figs 65–68).

Thorax about 0.3 as long as total body length, widest across metathorax. Prothoracic tergum dorsally with numerous rather long setae arranged in 3 transverse rows, and several shorter setae between them. Mesothoracic terga with medial transverse row of small heavy sclerotized asperities and with about 30 setae arranged in 2 transverse rows.



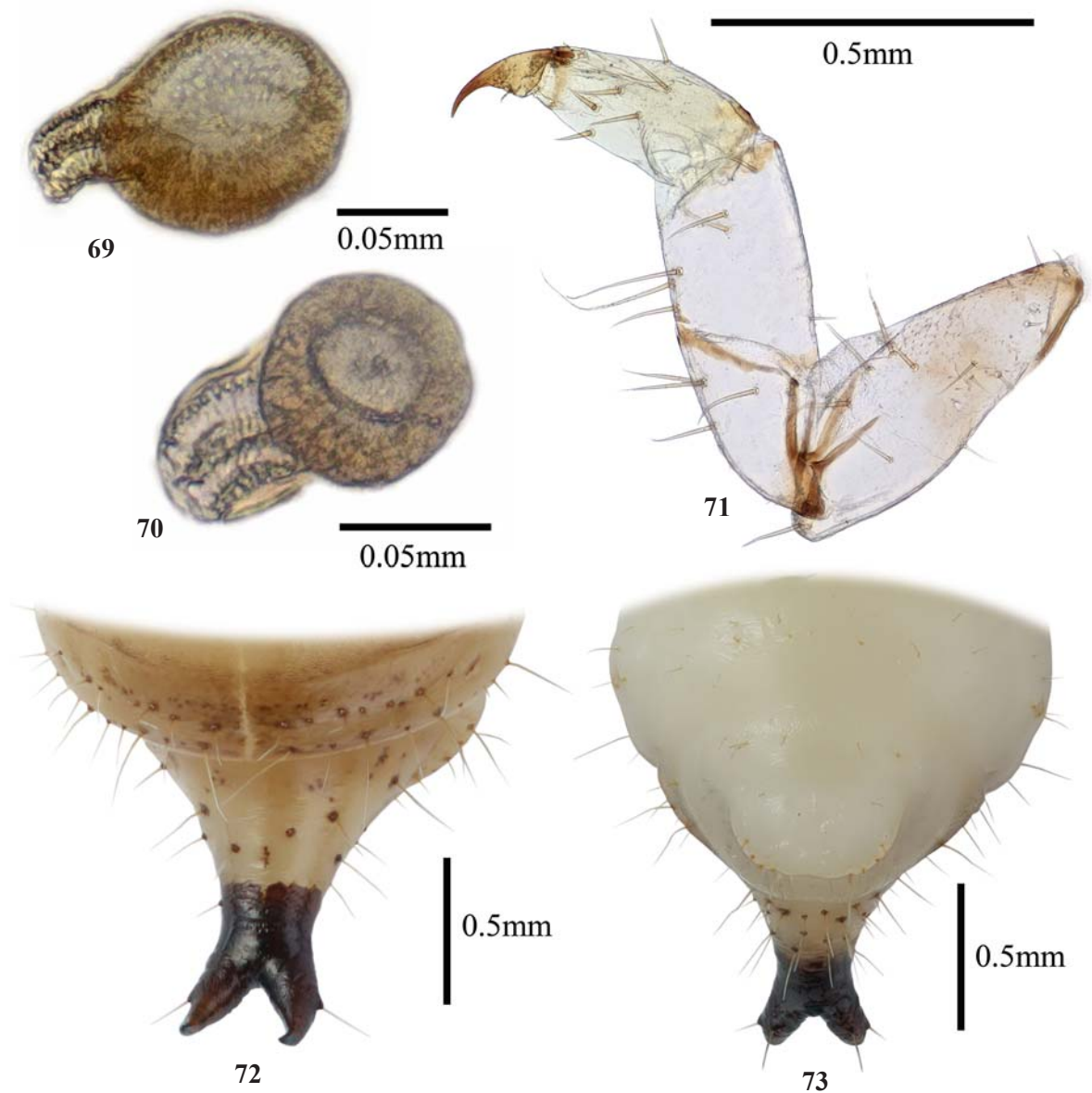
Figs 57–68. *Aulacochilus luniferus decoratus*, larva: 57 — dorsal habitus; 58 — head, dorsal; 59 — head, lateral; 60 — labrum, dorsal; 61 — mandible, dorsal; 62 — mandible, ventral; 63 — right antenna, lateral; 64 — right antenna, apex of antennomere II and antennomere III, lateral; 65 — labio-maxillar complex, ventral; 66 — right maxilla, anterior part, dorsal; 67 — right maxilla, anterior part, ventral; 68 — prementum and ligula, ventral.

Рис. 57–68. *Aulacochilus luniferus decoratus*, личинка: 57 — габитус, сверху; 58 — голова, сверху; 59 — голова, сбоку; 60 — верхняя губа, сверху; 61 — мандибула, сверху; 62 — мандибула, снизу; 63 — правая антенна, сбоку; 64 — правая антенна, вершина второго и третий членик, сбоку; 65 — лабио-максиллярный комплекс, снизу; 66 — правая максилла, передняя часть, сверху; 67 — правая максилла, передняя часть, снизу; 68 — прементум и лигула, снизу.

Vestiture of metathoracic tergum similar to those on mesothorax, except asperities forming 2 transverse rows (Fig. 57). All thoracic sterna membranous, with 4 short setae. Thoracic pleurites with few short setae, without heavy-sclerotized areas. Prothorax is almost as long as meso- and metathorax individually, and about 0.8 as wide. Thoracic spiracles annular-biforous (Fig. 69). Legs 5-segmented; length ratio of its segments to coxa is 0.7:0.9:0.8:0.4. Coxa with 2 short and 12 longer setae, without fields of spike-like asperities; trochanter with 4 long setae; femur with 1 short and 6 longer setae; tibiotarsus with 1 short and 7 longer setae; a single long and sharp claw with 2 rather short setae ventrally (Fig. 71).

Abdomen widest across segment III, tapered posteriad; abdominal segments I–VII each dorsally with 2 transverse rows of heavy-sclerotized asperities (posterior row poorly

developed on abdominal tergum VII), and with about 40 short and longer setae also arranged in 2 transverse rows (Fig. 57). Abdominal tergum VIII has similar vestiture, but lacks transverse rows of asperities. Tergum IX without tubercles, dorsally with 8 long setae, and several small sclerotized spots in anterior part, ventrally with 16 rather long setae. Posterior margin of abdominal tergum IX without any processes (Fig. 72). Abdominal sternites I–VIII membranous, without tubercles; with 12 short dorsal setae on each side. Abdominal sternite IX with 6 medial setae. Abdominal pleurites I–VIII without sclerotized areas and bear several long and shorter setae each. Abdominal spiracles similar to those on thorax, annular-biforous (Fig. 70). Urogomphi stout, have long common base, heavily sclerotized, distinctly pointed, about 2 as long as the rest of abdominal segment IX, and about 2 as long



Figs 69–73. *Aulacochilus luniferus decoratus*, larva: 69 — thoracic spiracle; 70 — abdominal spiracle; 71 — mesothoracic leg, lateral; 72 — VIII–X abdominal segments, dorsal; 73 — VIII–X abdominal segments, ventral.

Рис. 69–73. *Aulacochilus luniferus decoratus*, личинка: 69 — грудное дыхальце; 70 — брюшное дыхальце; 71 — нога 2-ой пары, сбоку; 72 — VIII–X сегменты брюшка, сверху; 73 — VIII–X сегменты брюшка, снизу.

as wide; each urogomph with 1 lateral and 1 ventral setae (Figs 72–73). Abdominal segment X short, directed posteroventrally, on each side with 1 seta in anterior part and 5 setae on the posterior margin (Fig. 73).

Megalodacne bellula Lewis, 1883
Figs 74–90.

MATERIAL. 25 late-instar larvae: South Kuril Islands, Kunashir, Mendelevo, 14.IX.1976, leg. & det. A. Kompantsev (IPEE RAS)

DESCRIPTION. **Late-instar larva.** Maximum body length about 17 mm; head length 1.5 mm; urogomphi length 0.3 mm; maximum width of thorax 3.9 mm; maximum width of abdomen 4.5 mm. Body elongated, subcylindrical; widest across thoracic segment III, slightly tapering posterad; urogomphi short, stout. (Fig. 74). Head light yellow, without contrastive staining, only tubercles of frons and occiput rather darker. Labrum dark yellow with anterior margin brown; mandibles brown, heavily darkened apically. Sclerotized areas of antennae, maxilla and labium yellow. Thoracic and abdominal terga yellowish-brown with brown tubercles, which are more darker on prothorax and VIII–IX abdominal segments. Urogomphi yellowish-brown. Abdominal pleurites pale-yellow. Ventrites mostly pale, except brown bases of setae. Legs yellowish. Dorsal surfaces of all segments with numerous convex tubercles; ventral surfaces membranous, covered with short setae (Fig. 74).

Head (Figs 75–76) hypognathous, globular, slightly flattened; dorsally almost as long as wide and 0.4 as wide as prothorax; with pair of depressions between antennal bases; dorsally with 26 rather long and 14 shorter setae on each side. Head capsule with rows of rounded convex tubercles on inner margins of paired depressions, in posterior part and on lateral side. Epicranial stem long, median endocarina present, frontal arms U-shaped (Fig. 75). Stemmata (Fig. 76) 5 on each side, large, with lens; 4 compose a group behind the antennal base and 1 shifted anteriorly. Hypostomal rods absent. Frontoclypeal suture present, well-developed (Fig. 75). Clypeus with 1 medial and 2 lateral setae on each side, narrow and slightly more sclerotized than the rest of head capsule.

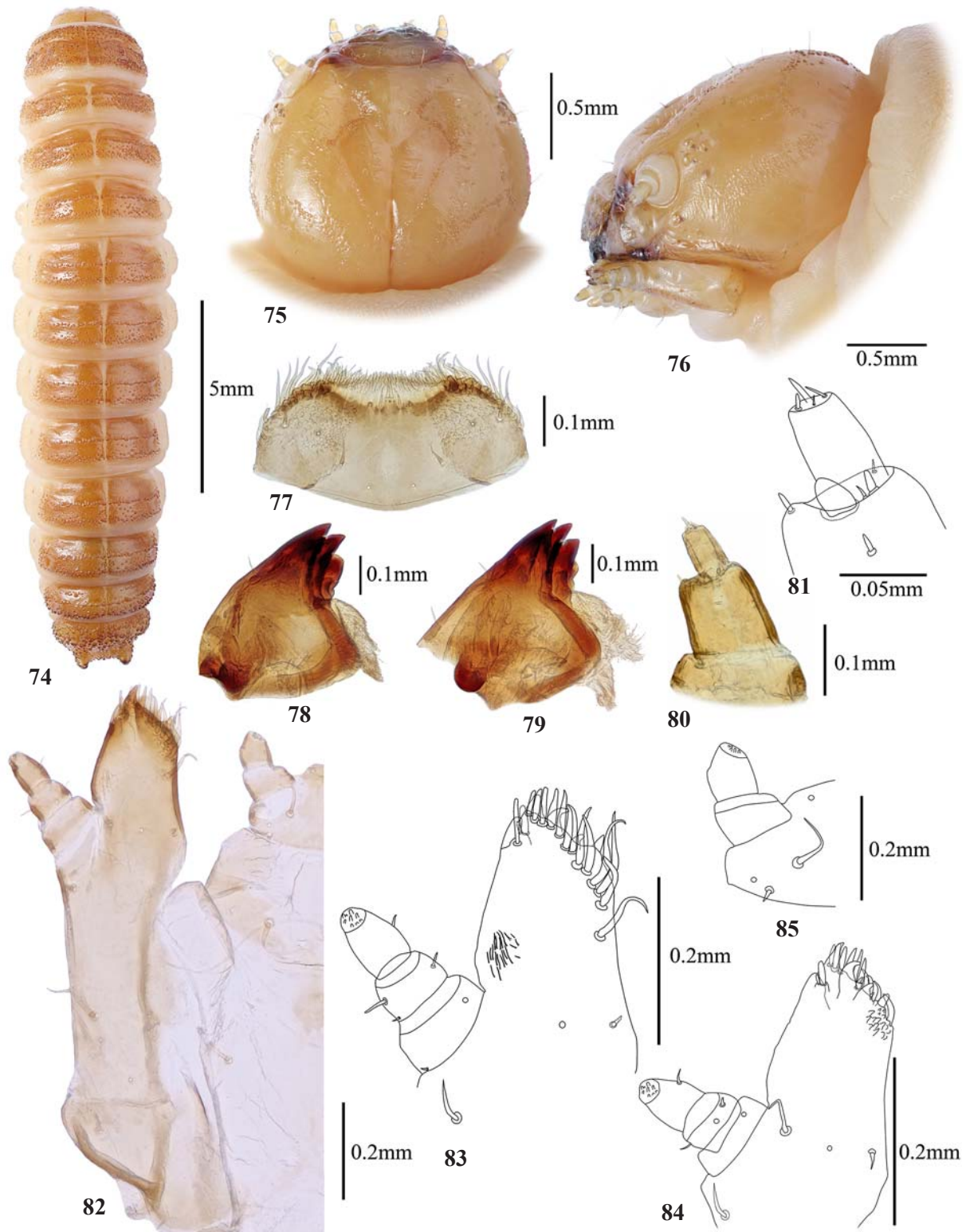
Labrum transverse, about 0.5 as long as wide, moderately sclerotized, free, with 2 long medial setae, 2 setae located laterally and 4 campaniform sensillae as well as a group of 4 stout setae in anterior part, with 1 basiconical sensilla on each side. Its anterior margin without notch and bears a group of 13 long lateral setae on each side, and numerous short setae between them (Fig. 77). Antenna 3-segmented, rather short, with well-developed conical sensorium on antennomere II (Figs 80–81). Antennomere I broad, about 0.5 as long as wide; antennomere II about 1.6 as long as first and about 1.4 as long as wide. Apically it bears 5 short setae and conical sensorium, which is about 0.4 as long as antennomere III. Antennomere III is 0.5 as long as antennomere II and about 1.8 as long as wide; apically it bears a group of 3 rather short setae and 1 longer medial seta (Fig. 81). Mandibles transverse, symmetrical, tridentate, with 1 seta located dorsally in anterior part and 1 seta near the base; protheca bilobed, setose (Figs 78–79). Labiomaxillar complex retracted (Fig. 82). Maxilla with well-developed articulating area, transverse cardo and elongate stipes. Cardo bears 1 long seta mesolaterally, stipes dorsally with 3 setae and 2 campaniform sensillae, ventrally with 1 seta (Fig. 82). Mala well-developed, broad, slightly tapered apically, bears 1 dorsal and 2 ventral sclerotized unci, each ventral uncus with 1 short seta near the base. Anterior margin of mala dorsally with the row of 13 rather long and stout setae, 1 seta on galeal lobe; near the outer margin of mala, anteriorly to maxillary palpi located

a group of about 20 microtrichia (Fig. 83). Ventrally anterior margin of mala bears well-developed elongated conical sensorium on the inner side, 2 setae on the galeal lobe and 1 short seta and 1 campaniform sensilla near the base. Inner side of mala in anterior part ventrally with about 15 heavy sclerotized asperities (Fig. 84). Maxillary palpi 3-segmented; palpomeres I and II transverse. Palpomere I 0.6 as long as wide and bears 1 short lateral seta near the base and 1 campaniform sensilla; palpomere II 0.9 as long and 0.7 as wide as palpomere I, about 0.8 as long as wide, bears 2 dorsal and 1 ventral setae as well as 1 campaniform sensilla. Palpomere III about 1.4 as long and 0.7 as wide as palpomere II and 1.6 as long as wide, slightly tapered, blunt at apex, and bears 1 seta and a group of short apical sensory processes (Figs 83–84).

Labium with mostly membranous submentum with 1 long lateral seta on each side; mentum also mostly membranous, with small sclerotized area in posterior part, on each side with 1 long medial seta, 1 short seta near the base and 1 campaniform sensilla (Fig. 82); prementum with 1 short and 1 long seta as well as 1 campaniform sensilla on the base of each palpiger; ligula broad, considerably smaller than in other *Encaustini* larvae, with rounded margin; bears 2 campaniform sensillae. Labial palps 2-segmented, widely separated; palpomere I about 0.8 as long as terminal palpomere, and about 0.7 as long as wide. Terminal palpomere about 1.2 as long as wide, blunt at apex, with a group of short apical sensory processes (Figs 82, 85).

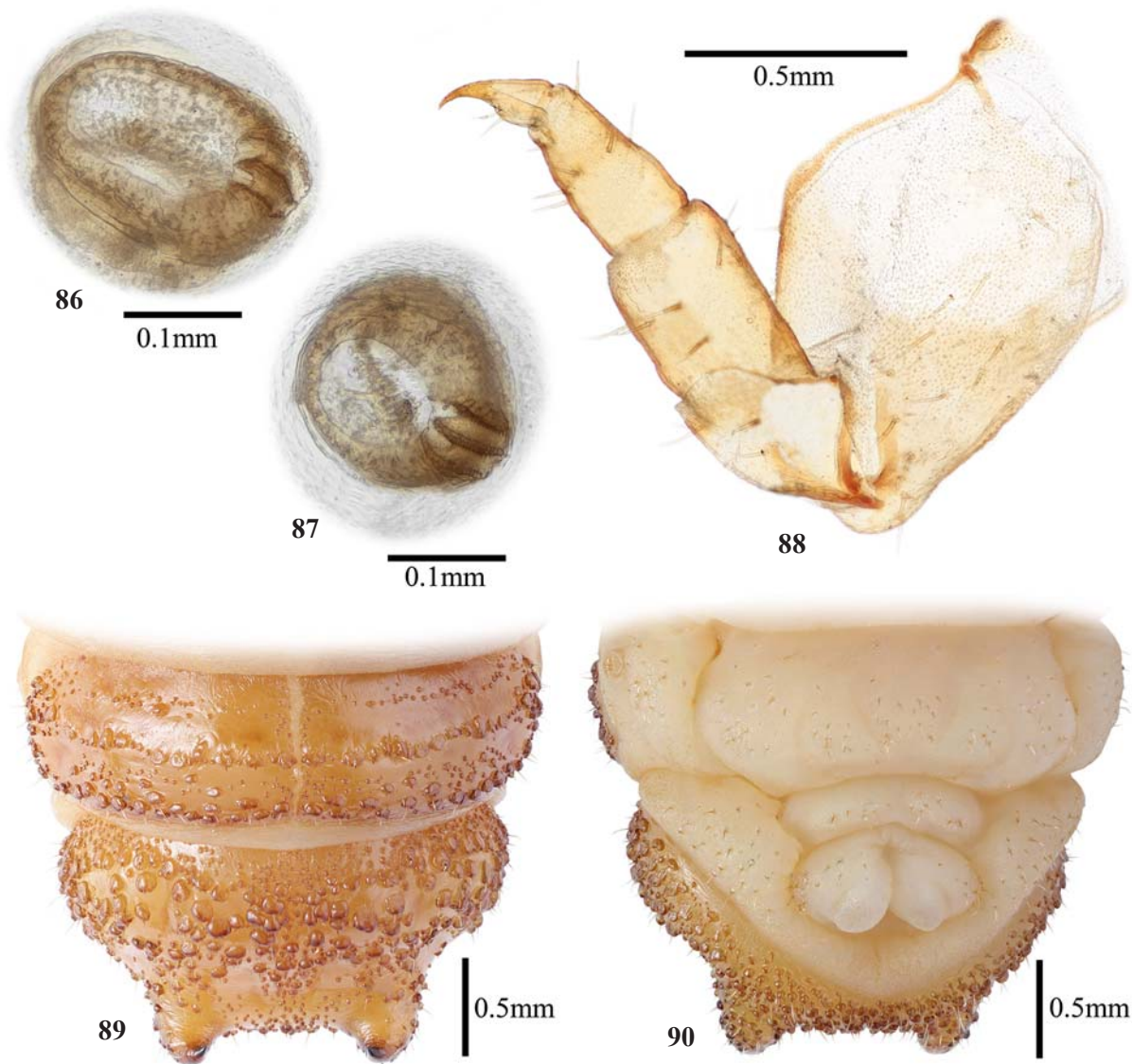
Thorax about 0.25 as long as total body length, widest across metathorax. Prothoracic tergum covered in numerous large and smaller rounded convex tubercles; each large tubercle bears short seta. Meso- and metathoracic terga with similar vestiture, except tubercles absent in anterior part and medial tubercles forming distinct transverse row (Fig. 74). All thoracic sterna membranous, prothoracic sternum with only 2 short dorsal setae; meso- and metathoracic sterna with about 20 short dorsal setae. Prothoracic pleurite membranous, with only 3 setae, meso- and metathoracic pleurites also membranous and bear about 10 setae each. Prothorax is about 1.3 as long as meso- and metathorax individually, and about 0.9 as wide. Thoracic spiracles annular-biforous (Fig. 86). Legs 5-segmented, rather short and massive; length ratio of its segments to coxa is 0.6:0.6:0.5:0.3. Coxa with 5 short and 15 longer setae; trochanter with 4 long and 1 shorter setae; femur with 1 short and 7 longer setae; tibiotarsus with 1 short and 6 long setae; a single long and sharp claw with 2 rather long setae ventrally (Fig. 88).

Abdomen widest across segment III, slightly tapered posteriorly; abdominal terga I–VIII have similar vestiture as on meso- and metathorax, but have significantly less smaller tubercles (Fig. 74). Tergum IX covered in numerous large and smaller tubercles (Fig. 89). Abdominal sternites I–VIII membranous with numerous small setae. Abdominal sternite IX with about 14 medial setae. Abdominal pleurites I–VIII with slightly sclerotized area on each side bearing 15 setae; abdominal pleurite IX with about 25 setae. Abdominal spiracles similar to those on thorax, annular-biforous (Fig. 87). Urogomphi short, stout, pointed apically, slightly curved inwards, their bases widely separated; about 0.3 as long as the rest of abdominal segment IX, and about 1.1 as long as wide. Dorsally each urogomph, except apical part, sclerotized as the rest of abdominal segment IX and lack tubercles (Fig. 89). Ventrally and laterally they covered in large tubercles bearing 1 seta each (also except apical part). Apex of urogomphi sharpened and heavily sclerotized. Abdominal segment X short, directed posteroventrally, on each side with 5 setae on anterior part and 7 longer setae on the posterior margin (Fig. 90).



Figs 74–85. *Megalodacne bellula*, larva: 74 — dorsal habitus; 75 — head, dorsal; 76 — head, lateral. Scale bars = 0.5 mm; 77 — labrum, dorsal; 78 — mandible, dorsal; 79 — mandible, ventral; 80 — right antenna, lateral; 81 — right antenna, apex of antennomere II and antennomere III, lateral; 82 — labio-maxillary complex, ventral; 83 — right maxilla, anterior part, dorsal; 84 — right maxilla, anterior part, ventral; 85 — prementum and ligula, ventral.

Рис. 74–85. *Megalodacne bellula*, личинка: 74 — габитус, сверху; 75 — голова, сверху; 76 — голова, сбоку; 77 — верхняя губа, сверху; 78 — мандибула, сверху; 79 — мандибула, снизу; 80 — правая антенна, сбоку; 81 — правая антенна, вершина второго и третий членик, сбоку; 82 — лабио-максиллярный комплекс, снизу; 83 — правая максилла, передняя часть, сверху; 84 — правая максилла, передняя часть, снизу; 85 — прементум и лигула, снизу.



Figs 86–90. *Megalodacne bellula*, larva: 86— thoracic spiracle; 87 — abdominal spiracle; 88 — mesothoracic leg, lateral; 89 — VIII–X abdominal segments, dorsal; 90 — VIII–X abdominal segments, ventral.

Рис. 86–90. *Megalodacne bellula*, личинка: 86 — грудное дыхальце; 87 — брюшное дыхальце; 88 — нога 2-ой пары, сбоку; 89 — VIII–X сегменты брюшка, сверху; 90 — VIII–X сегменты брюшка, снизу.

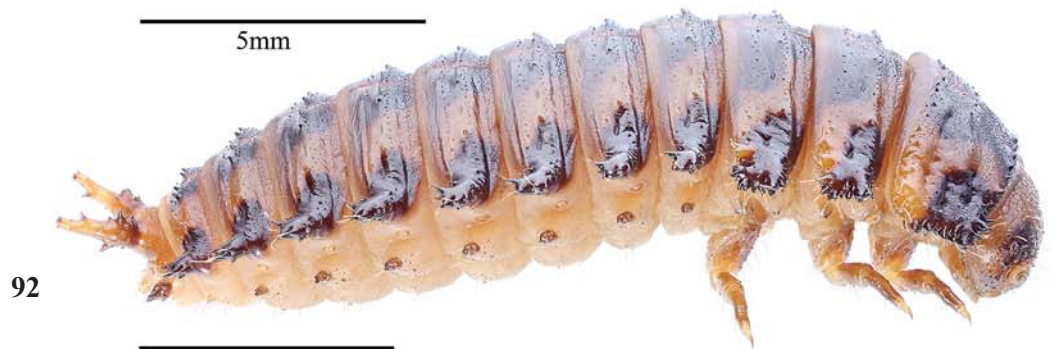
THE KEY TO THE LATE-INSTAR LARVAE OF GENERA OF ENCAUSTINI OCCURRING IN RUSSIA

1. Larvae large (length more than 2 cm), lightly pigmented, with 1 or 2 dorsal transverse rows of heavy-sclerotized asperities; legs short; urogomphi short, spike-like; stemmata without lens (Figs 6, 91). In rotten *Betula platyphylla* wood (S. Kurils, Kunashir Isl.)
..... *Encaustes* Lacordaire, 1842 (*E. cruenta praeenobilis*)
— Larvae significantly smaller (length less than 2 cm), with pigmented tergites, covered in tubercles or asperities of various size; legs longer; urogomphi of various shape,

- often large and elongated; stemmata with lens. In bracket fungi 2
2. Lateral parts of tergites bear finger-like lobes of various size, spiracles annular. Maximal length about 1.9 cm ...
..... *Episcapha* Dejean, 1837
— Lateral parts of tergites without finger-like lobes, spiracles annular-biforous 3
3. Dorsal surfaces of all segments except prothorax and abdominal segment IX with 1 or 2 transverse rows of small heavy-sclerotized asperities, urogomphi with long common base, distinctly upturned, heavy sclerotized api-

Figs 91–95. Larvae of Encaustini, habitus, lateral: 91 — *Encaustes cruenta praeenobilis*; 92 — *Episcapha morawitzi*; 93 — *Episcapha flavofasciata*; 94 — *Aulacochilus luniferus decoratus*; 95 — *Megalodacne bellula*.

Рис. 91–95. Личинки Encaustini, габитус, сбоку: 91 — *Encaustes cruenta praeenobilis*; 92 — *Episcapha morawitzi*; 93 — *Episcapha flavofasciata*; 94 — *Aulacochilus luniferus decoratus*; 95 — *Megalodacne bellula*.



- cally. Maximal length about 1 cm (Figs 57, 94)
 *Aulacochilus* Lacordaire, 1842
- Dorsal surfaces of all segments with convex granulae of various size, urogomphi short, widely separated, upturned (Figs 74, 95). Maximal length about 1.7 cm (S. Kurils, Kunashir Isl.)
 *Megalodacne* Crotch, 1837 (*M. bellula*)

THE KEY TO THE LATE-INSTAR LARVAE OF *EPISCAPHA* OCCURRING IN RUSSIA

1. Finger-like lobes on lateral parts of tergites small, antennomere II broadened apically, mala with dorsal field of 5 asperities, inner side of mala in apical part with about 10 asperities (Figs 40, 93). Maximal length about 1.9 cm (Khabarovskiy krai, Amurskaya oblast, Primorskiy krai, Siberia) *E. flavofasciata*
- Finger-like lobes on lateral parts of tergites considerably larger, antennomere II slightly tapering anteriorly, mala with dorsal field of about 20 asperities, inner side of mala in apical part with about 20 asperities (Figs 23, 92). Maximal length about 1.7 cm (Khabarovskiy krai, Amurskaya oblast, Primorskiy krai, Siberia) *E. morawitzi*

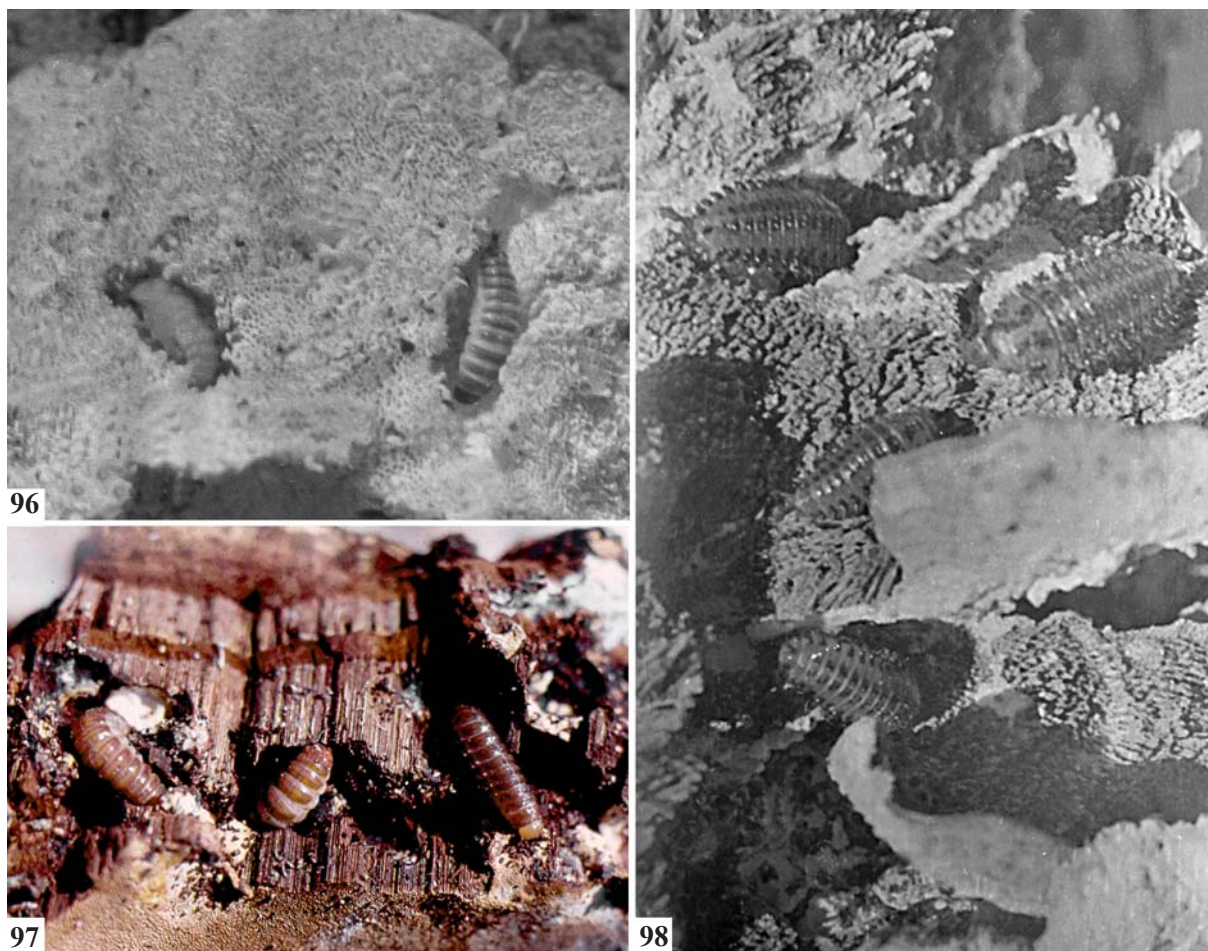
THE KEY TO THE LATE-INSTAR LARVAE OF *AULACOCHILUS* OCCURRING IN RUSSIA

1. Each urogomph with distinct 1 lateral and 1 ventral processes bearing long setae (Figs 73, 94). Far East (Khabarovskiy krai, Amurskaya oblast, Primorskiy krai, S. Kuril Islands) *A. luniferus decoratus*
- Lateral and ventral processes on urogomphi indistinct (after Nobuchi, 1954). (S. of Khabarovskiy krai, Amurskaya oblast, Primorskiy krai) *A. sibiricus*

Habitat of larval Encaustini

The development of the majority of larval Encaustini is connected with filamentous tissues of various polyporales fungi. Adults inhabit living or moribund bracket fungi carpophores thus becoming one of the characteristic group of beetles on earlier stages of its destruction. By the type of habitat Encaustini forms clearly defined morpho-ecological groups.

Whole life-cycle of *Aulacochilus* and *Megalodacne* take place inside carpophores, and their larvae have adaptations for feeding and moving in depth of fruit body. Thus, they have cylindrical, curved body, relatively small antennae, and



Figs 96–98. Habitat of larval Encaustini: 96 — *Aulacochilus luniferus decoratus*, larva in fruiting body of *Trametes hirsutus*; 97 — *Megalodacne bellula* larvae in fruiting body of *Fomes tomentarius*; 98 — *Episcapha morawitzi* larvae on fruiting body of *Trichaptum biforme*.

Рис. 96–98. Местообитания личинок Энкаустини: 96 — *Aulacochilus luniferus decoratus*, личинка в плодовом теле гриба *Trametes hirsutus*; 97 — *Megalodacne bellula*, личинки в плодовом теле гриба *Fomes tomentarius*; 98 — *Episcapha morawitzi*, личинки на плодовом теле гриба *Trichaptum biforme*.

various structures for locomotion in borrows: rows of sclerotized asperities and granulae on thoracic and abdominal terga and well developed massive urogomphi.

Larvae of *Aulacochilus luniferus* develop in annual carpophores of various *Trametes* Fr. (Agaricomycetes, Polyporales), mostly in *Trametes hirsuta* (Wulfen) Pilát, 1939 and *Trametes ochracea* (Pers.) Gilb. et Ryvar den, 1987, which fruit tissue has slightly phelloid consistence (Fig. 96).

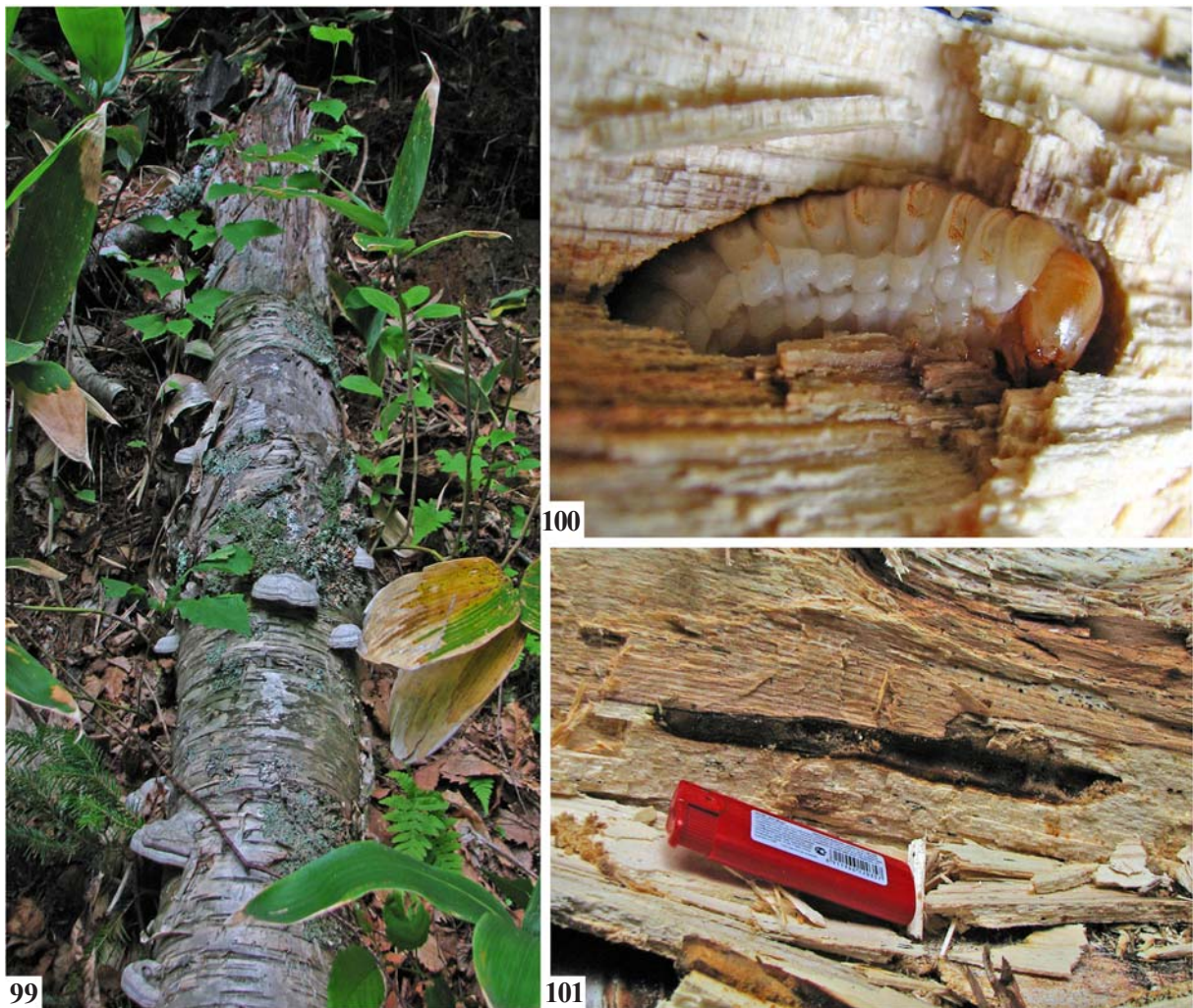
Larvae of *Megalodacne bellula* develop in fresh perennial fruiting bodies of *Fomes fomentarius* (L.) Fr., 1849, which have dense ligneous structure (Fig. 97). Perhaps, it corresponds with heavier sclerotized vestitures and urogomphi as well as ability of these larvae to get rid of excrements through the opening on the bottom of the carpophore.

Transition to feeding on the surface of the carpophores can be observed in various tribes of Erotylidae — Erotylini [Costa et al., 1988], Tritomini [Skelley et al., 1997; McHugh, 2001] and Encaustini [Kompantsev, 1982] and characterized by the number of common morphological features. The most important are lateral lobe-like lobes of tergites, long branched urogomphi, relatively long antennae and aposematic coloration. Similar adaptations can be found in some epibiotic

larvae of phytophagous beetles, such as Epilacninae (Coleoptera: Coccinellidae) and Cassidinae (Coleoptera: Chrysomelidae). Feeding on surface of fruiting bodies make possible the development on fungi with thin carpophores, which are unavailable for cryptobiotic erotylid larvae.

Known larvae of *Episcapha* are feeding on the surface of hymenophore of living or moribund fruiting bodies, but can move freely on other nearby carpophores (Fig. 98). According to our data, in Primorskyi krai and Priamurye *E. morawitzi* prefer to inhabit the fruiting bodies of *Trichaptum biforme* (Fr.) Ryvar den, 1972 (Agaricomycetes, Polyporales), while *E. flavofasciata* develops in *Bjerkandera adusta* (Willd.) P.Karst., 1879 and *B. fumosa* (Pers.) P.Karst., 1879. Both species pupate under the bark or in the rotten wood.

Representatives of *Encaustes* form separate trophic group of Encaustini. Larvae of *Encaustes cruenta praenobilis* inhabit light-colored and rather durable rotten wood of *Betula platyphylla*, penetrated by the mycelium of *Fomes fomentarius* (Figs 99–101), while adults feeding on its fruiting bodies. Larvae have specific adaptations connected with living in depth of wood, such as low-sclerotized, pale vestitures, short antennae, heavy sclerotized clypeus and labrum, short but



Figs 99–101. Habitat of larva *Encaustes cruenta praenobilis*: 99—habitat; 100 — larva in *Betula platyphylla* wood; 101 — larval burrow in *Betula platyphylla* wood.

Рис. 99–101. Местообитания личинок *Encaustes cruenta praenobilis*: 99—местообитание; 100 — личинка в древесине *Betula platyphylla*; 101 — ход личинки в древесине *Betula platyphylla*.

strong legs and small, spike-like urogomphi. It is a unique and probably plesiomorphic case of larval habitat for the family which extends known trophic spectrum of Erotylidae and can assist in clarifying of formation of mycetophagy in Erotylinae.

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References

- Costa C., Vanin S.A., Casari-Chen S.A. 1988. Larvas de Coleoptera do Brasil. São Paulo: Museo de Zoologia, Universidade de São Paulo. 282 p. + 165 pls.
- Hayashi N., Takenaka H. 1965. [Notes on the immature stages of *Encaustes praenobilis* Lewis (Coleoptera: Erotylidae)] // Mikado. Vol.1. P.35–39 [in Japanese].
- Kompantsev A.V. 1982. [Morphoecological peculiarities of Erotylidae (Coleoptera) larvae inhabiting the fruiting bodies of higher fungi] // Pravdin F.N. (ed.). Morfo-ekologicheskie adaptatsii nasekomykh v nazemnykh soobshchestvakh. Moscow: Nauka. P.81–91 [in Russian].
- Leschen R.A.B., Buckley T.R. 2007. Multistate characters and diet shifts: evolution of Erotylidae (Coleoptera) // Systematic Biology. Vol.56. No.1. P.97–112.
- Leschen R.A.B. 2003. Erotylidae (Insecta: Coleoptera: Cucujoidea). Phylogeny and review // Fauna of New Zealand. Vol.47. 108 p.
- McHugh J.V. 2001. Description of immature stages for *Megischyrus* (Erotylidae: Triplacinae) and a review of literature on larval Erotylidae // Annales Zoologici. Vol.51. No.3. P.113–124.
- Morimoto K., Hayashi N. 1986. The Coleoptera of Japan in color. Vol.1. Osaka: Hoikusha Publishing. 320 p. [in Japanese].
- Nobuchi A. 1954. Morphological and ecological notes of fungivorous insects (I). On the larva of erotylid-beetles from Japan (Erotylidae, Coleoptera) // Kontyû. Vol.22. Nos 1–2. P.1–6. [in Japanese].
- Skelley P.E., Leschen R.A.B., McHugh J.V. 1997. A revision of *Lybanodes* Gorham, 1888 (Coleoptera: Erotylidae: Tritominae) // Annales Zoologici. Vol.47. Nos 1–2. P.33–48.
- Slipinski S.A., Leschen R.A.B., Lawrence J.F. 2011. Order Coleoptera Linnaeus, 1758 // Zhang Z.-Q. (ed.). Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. Zootaxa. Vol.3148. P.99–103.
- Wegrzynowicz P. 2002. Morphology, phylogeny and classification of the family Erotylidae based on adult characters (Coleoptera: Cucujoidea) // Genus. Vol.13. No.4. P.435–504.
- Wegrzynowicz P. 2007. Erotylidae // Löbl I., Smetana A. (eds.). Catalogue of Palaearctic Coleoptera. Vol.4. Stenstrup: Apollo Books. P.78–87.