*Russian Entomol. J. 14(1):* 61–66 

# Immature stages and biology of the freshwater weevil *Litodactylus leucogaster* (Marsham, 1802) (Coleoptera: Curculionidae: Ceutorhynchinae)

# Преимагинальные стадии и биология пресноводного долгоносика *Litodactylus leucogaster* (Marsham, 1802) (Coleoptera: Curculionidae: Ceutorhynchinae)

**M.Ja. Orlova-Bieńkowskaya**
**М.Я. Орлова-Беньковская**

Institute of Ecology and Evolution, Russian Academy of Sciences, Leninsky pr. 33, 119071 Moscow, Russia.
Институт Проблем Экологии и Эволюции Российской Академии Наук, Ленинский пр. 33, 119071 Москва, Россия.

KEY WORDS: Curculionidae, Ceutorhynchinae, *Litodactylus leucogaster*, habit of life, morphology, larva, pupa

КЛЮЧЕВЫЕ СЛОВА: Curculionidae, Ceutorhynchinae, *Litodactylus leucogaster*, образ жизни, морфология, личинка, куколка.

ABSTRACT. Adults of *Litodactylus leucogaster* (Marsh.) occur on *Myriophyllum spicatum* mostly above the water. Adult's habit of life including feeding and copulation are described in details for the first time. Larvae develop on inflorescences of the host plant above the water. Pupation takes place on the stem of the host plant under water. Last instar larva and pupa are described for the first time. Morphological differences between larvae of *L. leucogaster* and *Eubrychius velatus* (Beck) are given.

РЕЗЮМЕ. Имаго *Litodactylus leucogaster* (Marsh.) обитают на *Myriophyllum spicatum* большей частью над водой. Впервые подробно описан образ жизни имаго, включая питание и спаривание. Личинки развиваются на соцветиях кормового растения над водой. Окукливание происходит на стеблях кормового растения под водой. Впервые описаны личинка последнего возраста и куколка. Приводятся отличия личинок *L. leucogaster* и *Eubrychius velatus* (Beck).

## Introduction

The weevils *Litodactylus leucogaster* (Marsham, 1802) and *Eubrychius velatus* (Beck, 1817) are very common freshwater beetles. Both belong to the subfamily Ceutorhynchinae and are widely distributed from Western Europe to the Far East [Egorov, 1988].

Biology and larval morphology of *E. velatus* have been studied by Urban [1929], Scherf [1964] and Egorov [1988]. On the other hand, the life history and immature stages of *L. leucogaster* have been studied insufficiently. Some data on the habit of life of adult and larva of this species are included in Brocher [1911], Pavlovsky & Lepneva [1948], Klausnitzer [1984], Wesenberg-Lund [1943], Reichardt & Ogloblin [1940], Gaevskaya [1966], Scherf [1964], Wagner [1940], Egorov [1988]. However, some of them contradict to each other. Such aspects as mating behaviour, pupation, emergence of adult from cocoon have not been studied till now. Larva and pupa have not been described.

## Material and methods

The observations have been performed in the Moscow region at Glubokoe lake (23 km west of Zvenigorod) in the field and laboratory environment from July to September 1997.

Last instar larvae and pupae were fixed and preserved in 70% ethanol. Ten specimens of last instar larva and ten pupae were used for the morphological study. Larvae of *Eubrychius velatus* were kindly disposed by Dr. V.G. Grachiov.

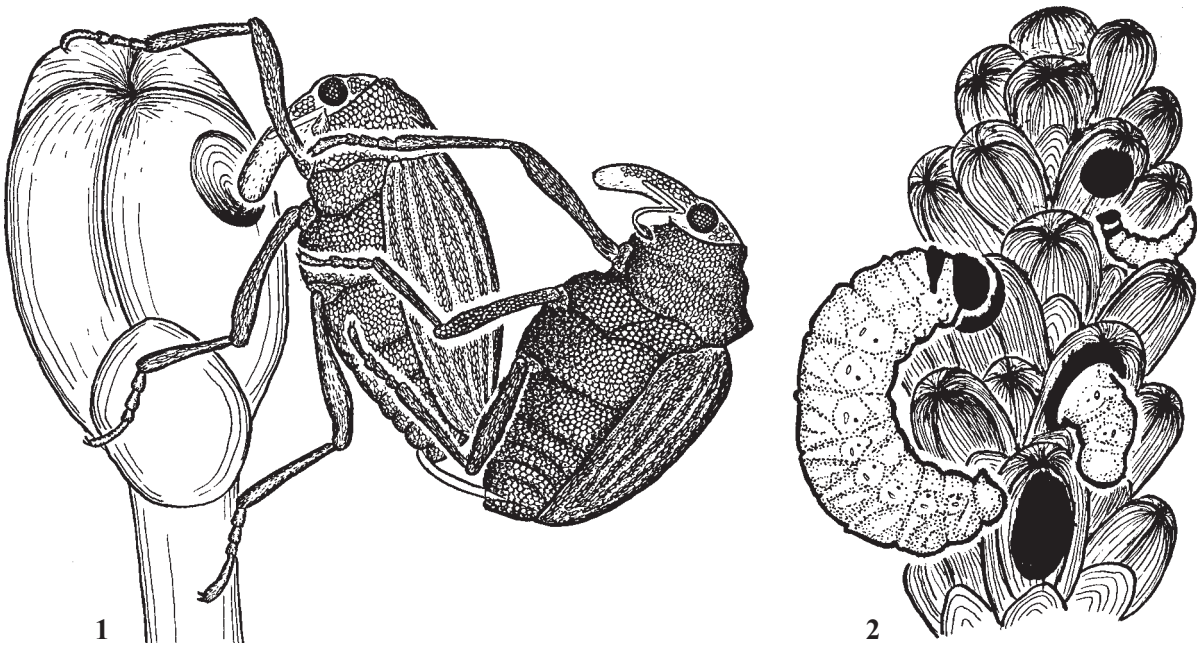
Terminology for description of larva is given according to Anderson [1947] and Krivets & Burlak [1986], for description of pupa — according to Scherf [1964].

## Results and discussion

ADULT HABIT OF LIFE. Adults of *L. leucogaster* were abundant in the locality under observation from late July to late August during the flowering of the host plant, *Myriophillum spicatum*.

Klausnitzer [1984] and Wesenberg-Lund [1943] reported that beetles live mostly under water and fly only at night. Reichardt & Ogloblin [1940] noted that they can swim.

I found beetles mostly on flowers of the host plant above the water. They fly from one inflorescence to




Figs. 1–2. *Litodactylus leucogaster*: 1 — copulation, 2 — larvae on the inflorescence of *Myriophyllum spicatum*.
Рис. 1–2. *Litodactylus leucogaster*: 1 — спаривание, 2 — личинки на соцветии *Myriophyllum spicatum*.

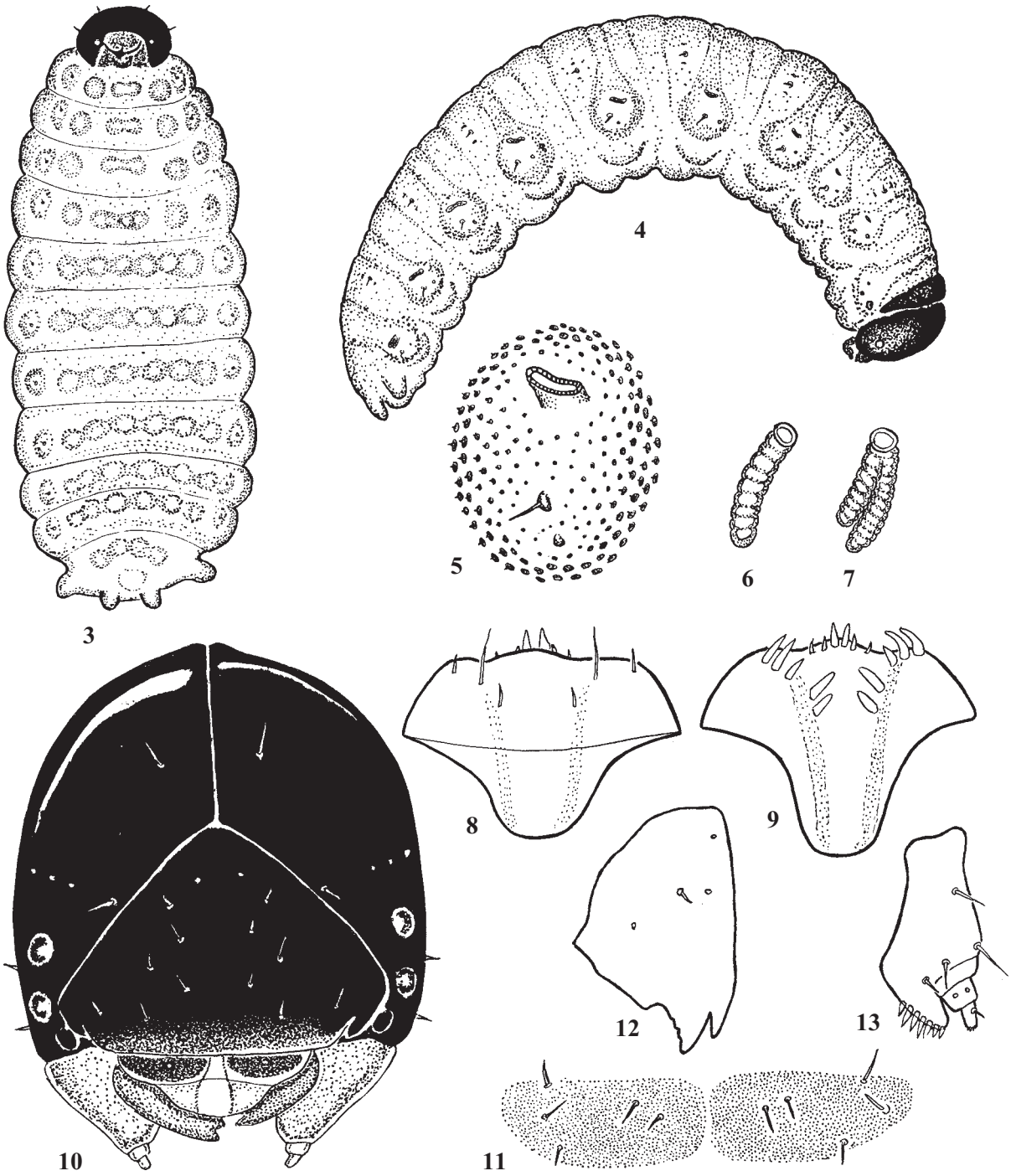
another by day. If the beetle falls on the water, it flies up immediately or moves upon the water surface and then gets on a plant. Sometimes beetles crawl on plant under water. They clench the stem with the narrow tarsi bearing elongate last tarsomere. Such structure of tarsi is an example of the convergence between such freshwater beeltes, as Curculionidae: *L. leucogaster* and *E. velatus*, Chrysomelidae: *Macroplea* species, Hydrophilidae: *Helophorus* species, and various members of the families Elmidae and Dryopidae. Obviously, it is an adaptation for crawling on plants under water. In contrast to closely related species, *E. velatus*, adults of *L. leucogaster* cannot swim. *L. leucogaster* bears an air layer on its head, thorax, elytra and abdomen, covered with nonwettable scales. However it can be submerged only for several minutes, and leaves the water entirely for respiration. The body of *E. velatus* is wettable, the air reserve is under the elytra. According to Gaevskaya [1966], adults of *L. leucogaster* damage only the submersed organs of the host plant. Brocher [1911] and Pavlovsky & Lepneva [1948] observed this weevil to cut off the ends of the host plant sprouts in abundance. Because of that, a great number of gnawed off pieces float on the water. I have not observed this phenomenon in locality under observation in spite of the great number of the beetles. I found adults of *L. leucogaster* to feed on inflorescences of *M. spicatum*. They gnaw mostly flowers and axis of inflorescences, rarely stems under the water. When eating, the weevil turnes its head from side to side and bites off piece by piece evenly.

Contrary to the suggestion of Klausnitzer [1984], *L. leucogaster* copulate above the water, on inflorescence. Only if being disturbed, the couple hides into the water for several minutes. When a male meets a female, he perches on her elytra and performs a precopulatory courtship. Male's hind-legs clasp female's metathorax. Male holds the head or prothorax of female with his fore-tarsi and strokes her last abdominal sternum with his hind-tarsi and swings from side to side. During copulation (Fig. 1), the male puts his hind-tarsi near the female's hind-coxae. The length of the mating period was several minutes. During this process, the male is immovable, and the female crawl, feeds, or cleans her tarsi. The female sometimes prevents the mating and drive male away by her legs. The same happens if the male perches on the other male.

LARVAL BIOLOGY. There were several different opinions about the habit of life of *L. leucogaster* larvae. Reichardt & Ogloblin [1940] and Scherf [1964] noted that it live in the water on the submersed parts of *M. spicatum*. Wesenberg-Lund [1943] suggested that larva develops within the stem. The last opinion was mentioned by Pavlovsky & Lepneva [1948], Gaevskaya [1966], and Egorov [1988]. On the other hand, Brocher [1911] and Wagner [1940] reported this larva to be free-living.

My own observation confirm the latter point of view. The larvae occur above the water (Fig. 2), feed on inflorescences and sometimes gnaw through flowers or axis of the inflorescence. Contrastingly, the larvae of *E. velatus* live on submersed parts of the host plants, *Myriophillum* and *Potamogeton*.

PUPATION. Larva pupates in the water. It gnaws the stem of the host plant, reaches the air cavities and makes an elongate hole along the stem. Then larva places itself in this hole and surrounds itself with a semitransparent brown cocoon (Figs. 22, 23). The cocoon is half-submersed into the stem and is filled with

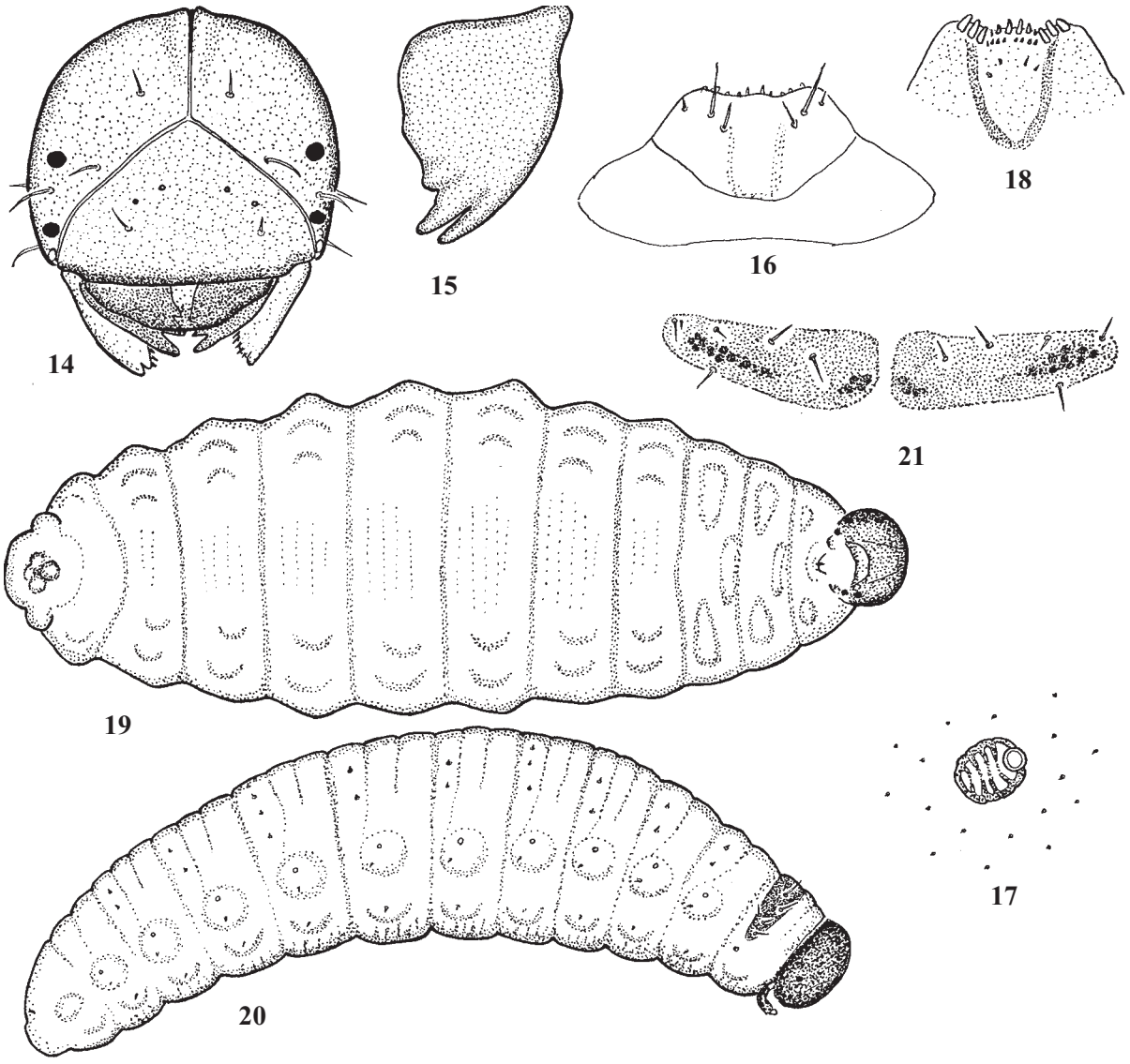



Figs. 3–13. *Litodactylus leucogaster* larva: 3 — ventral view, 4 — lateral view, 5 — spiracular area, 6 — spiracle of 3rd abdominal segment, 7 — thoracic spiracle, 8 — labrum, 9 — epipharynx, 10 — head, 11 — sclerite of pronotum, 12 — mandible, 13 — maxilla.

Рис. 3–13. Личинка *Litodactylus leucogaster*: 3 — вид снизу, 4 — вид сбоку, 5 — дыхальцевая область, 6 — дыхальце 3-го сегмента брюшка, 7 — грудное дыхальце, 8 — верхняя губа, 9 — эпифаринкс, 10 — голова, 11 — склерит переднеспинки, 12 — мандибула, 13 — максилла.

an air from the air cavities of the stem. Later a cocoon becomes untransparent. When larva molted and became a pupa, larval exuvium laid in the hind end of the cocoon. A cocoon of *E. velatus* is attached to the leaves of the host plants.

EMERGENCE OF ADULT FROM COCOON. When the time of emergence arrives, the beetle gnaws a hole in the front end of the cocoon, directed to the water surface. The newly emerged beetle is surrounded with air and goes out of the water.




Figs. 14–21. *Eubrychius velatus* larva: 14 — head, 15 — mandible, 16 — labrum, 17 — spiracle, 18 — epipharynx, 19 — ventral view, 20 — lateral view, 21 — sclerite of pronotum.

Рис. 14–21. Личинка *Eubrychius velatus*: 14 — голова, 15 — мандибула, 16 — верхняя губа, 17 — дыхальце, 18 — эпифаринкс, 19 — вид снизу, 20 — вид сбоку, 21 — склерит переднеспинки.

DESCRIPTION OF THE LAST INSTAR LARVA. Body 6mm long, curved, apodal (Figs 3–4). Entirely covered with short setae. Head black, shining, with 2 pairs of eye spots (Fig. 10); frontal and epicranial sutures pale along whole length; frons black with dark brown anterior margin, without endocarina. There are 6 pairs of frontal setae and 1 pair of frontal pores. Epicranium with 2 pairs of lateral setae, 2 pairs of dorsal setae and 3 pairs of pores. Labrum (Fig. 8) dark-brown, with 3 pairs of setae. 1st and 3rd labral setae short, 2nd seta longer. Epipharynx (Fig. 9) with 3 anterolateral, 3 anteromedian and 2 median pairs of setae. Median setae rather large. Mandibles (Fig. 12) dark-brown, with 2 apical teeth, 1 short seta and several pores. Maxilla (Fig. 13) with 4 setae on stipes and 7 setae on mala. Maxillary palpus two-segmented, apical segment with lateral seta and several very fine apical denticles; basal one with 2 pores. Pronotum (Fig. 11) with black, shining sclerite, devided into right and left halves; each half bears 5 setae. Thorax and abdomen whitish, sometimes whity-pink or grayish. Tegument entirely covered with minute black, shining asperities (Fig. 5), which hemispherical, bearing fine spine. Dorsum of each body segment, except prothorax and abdominal segments 9 and 10, divided by transversal grooves into folds. Abdominal segments 1–7 each with 3 folds. The spiracles placed on small prominences; thoracic spiracles and spiracles of segment 7 are bicameral (Fig. 7); all other spiracles unicameral (Fig. 6). Air tubes elongate. Postdorsum of

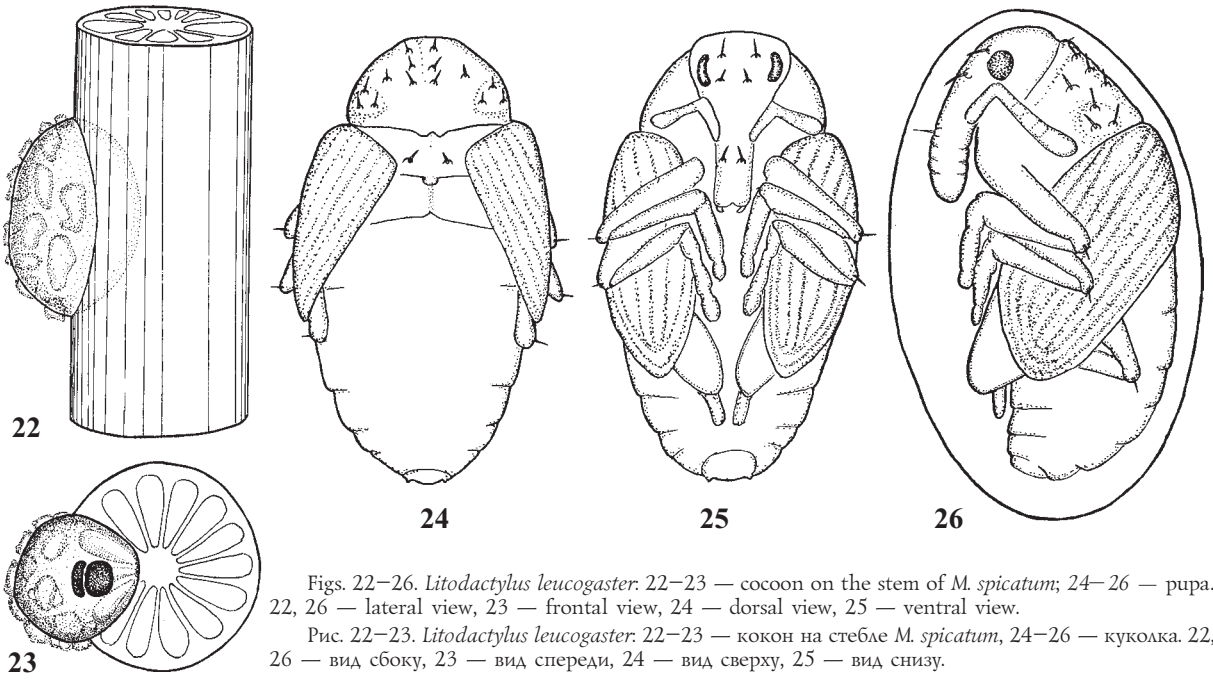
Table. The character features *L. leucogaster* and *E. velatus* larvae .
Таблица. Отличительные особенности личинок *L. leucogaster* и *E. velatus*.

| Features | Species | |
|---|---|---|
| | *L. leucogaster* | *E. velatus* |
| Colour of head and pronotum | black | brown |
| Colour of sutura coronalis | light | light, with black base |
| Number of epicranial setae | 4 pairs (4 les, 4 des) | 5 pairs (4 les, 6 des) |
| Frontal setae | 6 pairs | 1 pair |
| Frontal pores | 1 pair | 2 pairs |
| Median setae of epipharynx | rather large | minute |
| Spiracles | on small prominences, first and last spiracles bicameral other unicameral | without prominences, unicameral |
| Air tubes | elongated | rounded |
| Number of ventral prominences of abdominal segments | 4 pairs | 2 pairs |
| Lateral prominences of IX abdominal segment | large | small |
| Asperities | dense, black, shining | sparse, brown, not shining |
| Setae on postdorsum of abdominal segments | 1 large and 2 small setae on each side | transversal row of minute setae |

Legend: des — dorsal epicranial setae, les — lateral epicranial setae.
Обозначения: des — дорсальные эпикраниальные хеты; les — латеральные эпикраниальные хеты.

metathorax and abdominal segments with 1 large and 2 fine setae at each side. Spiracular area of each segment with 1 seta on small prominence and 1 small prominence without seta (Fig. 5). Pedal area with 1 seta. Ventral body surface with prominences, which densely covered with asperities (Fig. 3). Thoracic segments with 3 pairs of ventral prominences, abdominal segments 1–7 with 4, segment 8 with 2 pairs of prominences. Abdominal segments 8 and 9 with a pair of large lateral prominences.

DIAGNOSIS. Larva of *L. leucogaster* is allied to that of *E. velatus*. I examined larvae of *E. velatus* (Figs 14–21) and revealed a number of characters to separate larvae of these two species (Table).




Figs. 22–26. *Litodactylus leucogaster*: 22–23 — cocoon on the stem of *M. spicatum*; 24–26 — pupa. 22, 26 — lateral view, 23 — frontal view, 24 — dorsal view, 25 — ventral view.
Рис. 22–23. *Litodactylus leucogaster*: 22–23 — кокон на стебле *M. spicatum*, 24–26 — куколка. 22, 26 — вид сбоку, 23 — вид спереди, 24 — вид сверху, 25 — вид снизу.

DESCRIPTION OF PUPA. Body white, immovable (Figs 24–26). Basicranium with 1 orbital seta (os1) on each side. Rostrum with 2 pairs of setae (pas1 and rs1). Pronotum with 7 pairs of setae. Each femur with 1 seta apically. Mesothorax with 1 pair of setae. Metathorax and abdomen without setae. Pseudocerci small.

DIAGNOSIS. Pupa is morphologically close to that of *Ceutorhynchus* members [Scherf, 1964], and differs by setation of head and prothorax, as well as a single seta on each femur apically. The cocoon of *E. velatus* is clebt to the leaves of water plant.

ACKNOWLEDGEMENTS. I am greatly indebted to Dr. N.V. Voronova for her invitation to contribute to this volume, to Prof. P. Zwick for his valuable comments, and to Dr. V.G. Grachiov for placing specimens of *E. velatus* at my disposal.

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