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Description of pupae of sap beetles *Carpophilus* (s. str.) *marginellus* Motschulsky, 1858 and *Carpophilus* (*Myothorax*) *pilosellus* Motschulsky, 1858 (Coleoptera: Nitidulidae)

Описание куколок жуков-блестянок *Carpophilus* (s. str.) *marginellus* Motschulsky, 1858 and *Carpophilus* (*Myothorax*) *pilosellus* Motschulsky, 1858 (Coleoptera: Nitidulidae)

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КЛЮЧЕВЫЕ СЛОВА: куколка, диагноз, Coleoptera, Nitidulidae, Carpophilinae, *Carpophilus*.

ABSTRACT. Pupae of sap beetles *Carpophilus* (s. str.) *marginellus* Motschulsky, 1858 and *C.* (*Myothorax*) *pilosellus* Motschulsky, 1858, reared in Samara Province, are described for the first time. They compared with descriptions and drawings of pupae other species of genus *Carpophilus* Stephens, 1830 published before.

РЕЗЮМЕ: Впервые описаны куколки жуков-блестянок *Carpophilus* (s. str.) *marginellus* Motschulsky, 1858 и *C.* (*Myothorax*) *pilosellus* Motschulsky, 1858, выведенные в Самарской области. Проведено их сравнение с описаниями и рисунками куколок других видов рода *Carpophilus* Stephens, 1830, опубликованных ранее.

Introduction

Sap beetles pupae of genus *Carpophilus* Stephens, 1830 of the subfamily Carpophilinae Erichson, 1943 were described by some authors. The first brief description of the pupa of *C.* (*Ecnomorphus*) *sexpustulatus* (Fabricius, 1791) without illustration was published by Perris [1853]. He also published short description of the pupa of *C.* (s. str.) *hemipterus* (Linnaeus, 1758) [Perris, 1877]. Hinton [1945] composed a first identification key to pupae of 2 *Carpophilus* species [*C.* (s. str.) *hemipterus* and *C.* (*Myothorax*) *dimidiatus* (Fabricius, 1792)] and listed some characters for distinguishing their pupae of this genus from some genera of sap beetles. Besides, he gave a comprehensive description of pupa of *C.* (s. str.) *hemipterus* with the drawing of its dorsal side and in a very short description of the pupa of *C.* (*M.*) *dimidiatus* indicated at its differences from those of the latter. Pupa of *C.* (s. str.) *hemipterus* was redescribed and illustrated later also by Plaza [1976], but her description and drawing significantly differs from those given by Hinton [1945]. In addition, in her drawing the pupa of *C.* (*M.*) *hemipterus* was depicted with 7 abdominal segments instead of 8. Plaza [1976] shortly characterized pupa of C. (*M.*) *dimidiatus* and *C.* (*M.*) *mutilatus* Erichson, 1843, and published drawing of the pupa of the former. Rozen [1963] in the identification key gave general characters of the pupae of 3 *Carpophilus* species [*C.* (s. str.) *hemipterus*, *C.* (*M.*) *mutilatus* and *C.* (*Megacarpolus*) *lugubris* Murray, 1864] but only pupa of *C.* (*M.*) *mutilatus* and several structural elements of some *Carpophilus* species pupae drawn from the dorsal view.

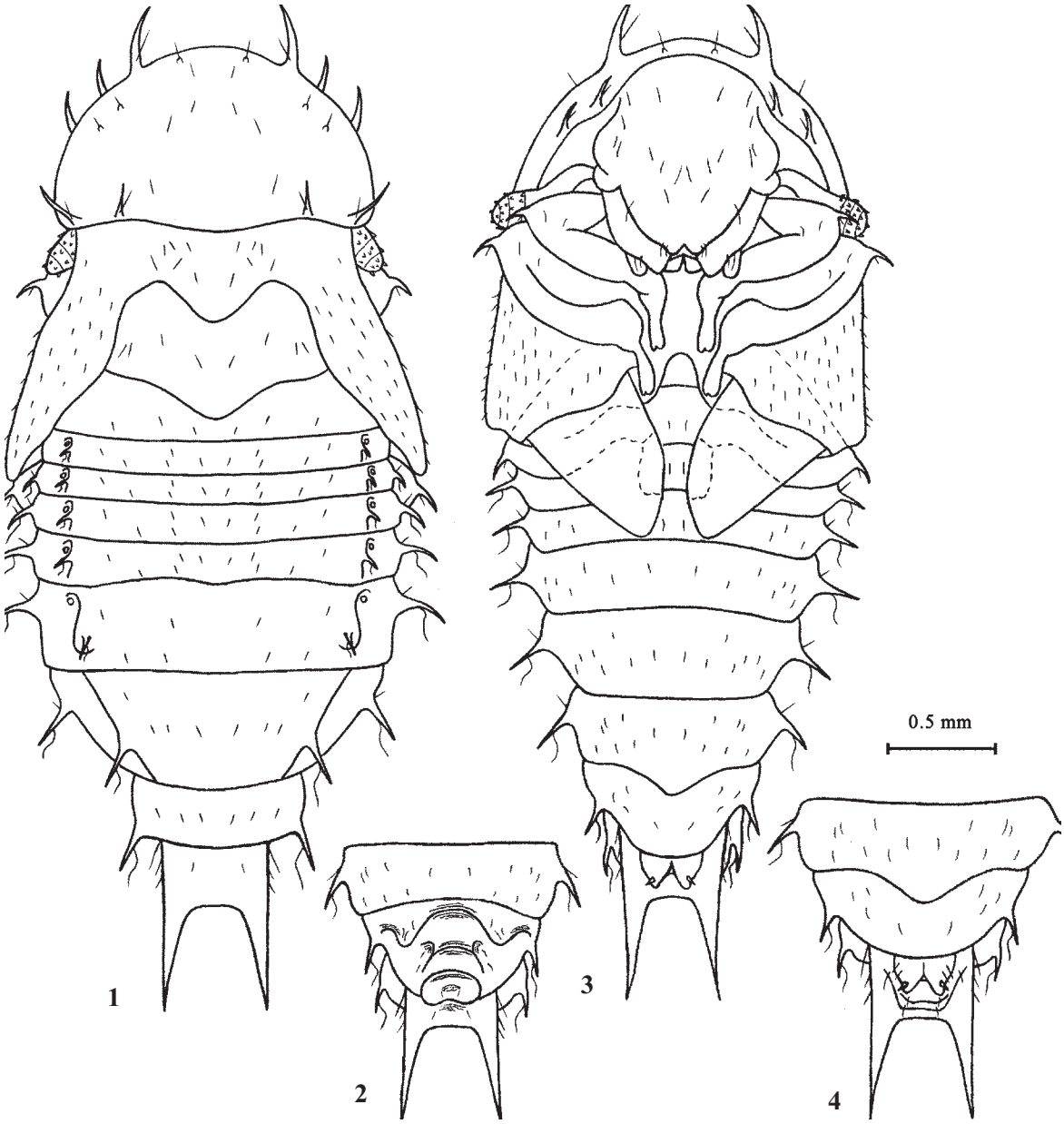
All studied pupae are kept in 70% alcohol. The study was carried out at MBS–9 stereoscopic microscope provided with 8x and 10x oculars and at Leica DME microscope provided with oculars Leica PERIPLAN 10x/18 and lenses Leica C PLAN 10x/0.22 PH 1, 20x/0.40 PH 1.

The subfamily classification of Nitidulidae in this paper follows the interpretation proposed by Kirejtshuk [1998]. All studied specimens are deposited in the collection of the Zoological Institute of Russian Academy of Science, St. Petersburg.

Carpophilus (s. str.) *marginellus* Motschulsky, 1858
Figs 1–4.

MATERIAL. Russia, Samara Prov.: about 170 spec. (larvae, pupae and adults reared from eggs of specimens collected on mouldy onions transported from Egypt/Alexandria), Kinelsky Distr., Krasnosamarskoe forestry farm, quarter 80, broad-leaved forest, A.S. Kurochkin. Reared on mouldy onions and on yeast/banana/sugar/water mixture and pupated 29.VII.2003 in soil.

DESCRIPTION OF PUPA. Length 3.40–3.90 mm (with urogomphi), breadth 1.40–1.55 mm. Body elongate oval, live



Figs 1–4. Pupa of *Carpophilus* (s. str.) *marginellus* Motsch.: 1 — dorsal; 2–4 — ventral; 1–2 — ♀, 3–4 — ♂.
Рис. 1–4. Куколка *Carpophilus* (s. str.) *marginellus* Motsch.: 1 — сверху; 2–4 — снизу; 1–2 — ♀; 3–4 — ♂.

individuals creamy-white, except all tubercles and urogomphi, all being light brownish; head either weakly shining or not, pro-, meso- and metanota, elytra and legs moderately shining, abdomen without shine. Head deflected ventrally, invisible dorsally (entirely covered by pronotum) and without longitudinal tubercles, with 9 pairs of subrecumbent whitish setae: 2 pairs near each eye and 10 setae on frons. Meso- and metafemorotibial articulations visible dorsally. Pronotum with 10 elongate tubercles each bearing a seta basally: 2 anteromedial tubercles (the largest), 1 tubercle at each of anterior corner and 1 tubercle at each posterior one, 2 anterolateral and 2 posterosubmedial tubercles and also with 14 erect whitish setae. Three pairs of these setae, an anteromedial pair and 2 anterolateral pairs, disposed on small setibearing tubercles. Elytra extended posteriorly to metafemorotibial articulation, their posterior edge curving apically and almost reaching the middle of sternite II and also with numerous whitish setae. Hind wings reaching an abdominal segment V. Mesonotum at least with 6 pairs of setae. Metanotum with 4 pairs of setae. Antennae moderately long and oriented outwards between lateral edge of pronotum and anterior edge of profemur with large antennal club well visible dorsally. Antennal club disposing above mesofemorotibial articulation, oriented posteriorly and bearing distinctly visible and somewhat pointed tubercles. Labrum fused with frons, with anterior edge almost sharply excised, bearing 2 fine, long setae in addition to 4 very small setae disposed at its outer edge. Apices of maxillary palpi somewhat cylindrical and exposed from under lateral edge of mandibles. Outer edge of

each mandible with 2 setae of various length. Each of abdominal III–VIII segments with an elongate pleural tubercle. Pleural tubercles of abdominal III–VII segments bear a shorter seta at base and a longer seta disposed at the middle. Pleural tubercles of abdominal segment VIII have only such a longer seta. Abdominal tergites II–VII on each side with a shorter paralateral tubercle bearing a seta disposed at the middle. Paralateral tubercles of abdominal tergites II–VII with a long seta as disposed as those on pleural tubercles of abdominal VII–VIII segments. Tergite I at least with 2 pairs of very small paramedial setae and with a pair of paralateral setae. Each of tergites II–V with 3 pairs of paramedial setae and with 2 pairs of paralateral ones. Tergite VI bears at least 2 pairs of paramedial and 2 pairs of paralateral setae. Pygidium (tergite VII) and abdominal tergite VIII transverse and with truncate posterior edge. Pygidium with a pair of paramedial setae and with 3 pairs of paralateral ones. Tergite VIII at least with 3 pairs of long setae. Sternites II–IV with a number of setae (small paramedial setae always present). Sternites V and VI each with 2 pairs of paramedial setae and with 5 pairs of paralateral ones. Sternite 7 with a pair of paramedial setae and with 6 pairs of paralateral ones. Urogomphi of abdominal segment IX long, thin, simple, sharply pointed, and rather widely separated at base and bearing a pair of setae at base as well as with some small setae. Underside of abdominal segments 8 and 9 with transformed sclerites and appendages, showing two types of structures corresponding to sexes. Each femorotibial articulation with an elongate tubercle bearing a seta at base. Femora of all legs with 2 setae along posterior edge in distal half. Abdominal segments I–VI with circular spiracles.

SEXUAL DIMORPHISM. **Male**. Sternite VII with slightly emarginate posterior edge and bearing setae as shown on Fig. 3. Sternite VIII with slightly convex posterior edge and with a pair of strong tubercles (not seen from above) bearing a medial seta. Surface of sternite VIII with a number of membranous folds as shown and at least with 6 pairs of setae. Underside of abdominal segment IX without mammiform processes.

Female. Sternite VII with angularly projecting posterior edge and with chaetotaxy similar to that in males. Sternite VIII with moderately convex posterior edge and tubercles similar to those in males. Underside of abdominal segment IX with a pair of comparatively large mammiform processes. Each of these processes bearing a smaller tubercle at apex and with 2 erect brownish setae. Large mammiform processes lying on 2 membranous folds of different size, each of which disposing one under another and with setae as shown on Fig. 4.

NOTES. The development of species had the following dynamics: 08.VII.2003, capture of adults; 11–13.VII, lying of eggs; 14.VII, emergence of first larvae; 17–18.VII, appearance of mature larvae; 20.VII, mature larvae left food substrate for soil; 21–25.VII, pupation; 26–30.VII and later, emergence of imago.

Laid eggs were: length 0.75–0.85 mm, breadth 0.22–0.25 mm. Elongate oval, almost subparallel or slightly arcuated; color milky-white; surface smooth and shining.

DIAGNOSIS. The pupa of *C.* (s. str.) *marginellus* differs:

— from pupa of *C.* (s. str.) *hemipterus* by the absence of 2 posterolateral tubercles on the pronotum [see Hinton, 1945];

— from pupa of *C.* (*E.*) *sexpustulatus* by the having of 5 pairs of tubercles on the pronotum [see Perris, 1853];

— from pupa of *C.* (*M.*) *pilosellus* by the 2 posterosubmedial tubercles on the pronotum and anterior femorotibial articulation not visible dorsally; denser pubescense on the elytra and having of long setae on the pleural, paralateral and sternal tubercles;

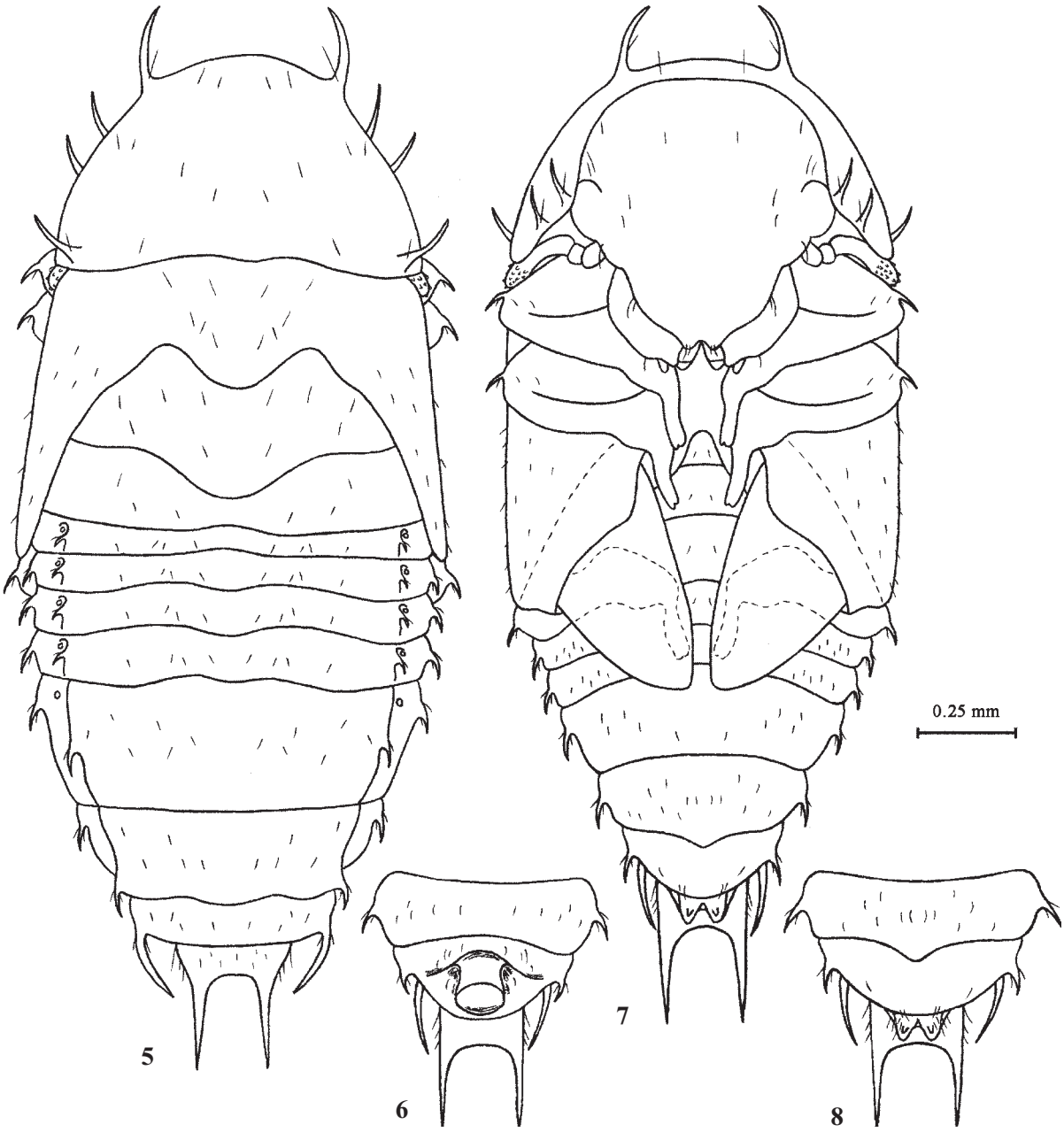
— from pupa of *C.* (*M.*) *dimidiatus* by the presence of 2 posterosubmedial tubercles and absence of 2 posterolateral tubercles on the pronotum (if the latter are present on the pronotum of *C.* (*M.*) *dimidiatus*) and having 2 posterobasal tubercles (if such tubercles reduced on the pronotum of *C.* (*M.*) *dimidiatus*) [see Hinton, 1945].

Unfortunately, it was impossible to compare the pupa of *C.* (s. str.) *marginellus* with the pupae of *C.* (*M.*) *lugubris* and *C.* (*M.*) *mutilatus* as Rozen [1963] was not sure about their true species identity.

Carpophilus (*Myothorax*) *pilosellus* Motschulsky, 1858
Figs 5–8

MATERIAL. Russia, Samara: about 60 spec. (larvae, pupae and adults reared from eggs of specimens collected on mouldy onions transported from Egypt/Alexandria). Reared on mouldy onions and on yeast/banana/sugar/water mixture and pupated 29.VII.2003 in soil.

DESCRIPTION OF PUPA. Length 2.35–2.65 mm (with urogomphi), breadth 0.95–1.05 mm. Body elongate oval, live individuals whitish with creamy shade, all tubercles, urogomphi and pregomphi light brownish; head, pro-, meso- and metanota, elytra and legs slightly shining, abdomen without shine. Head deflected ventrally, invisible dorsally (entirely covered by pronotum), without longitudinal tubercles and with 14 erect whitish setae: 4 setae at each eye, 4 setae on frons and a seta at antennal base. All femorotibial articulations visible dorsally. Pronotum with 8 elongate tubercles each bearing a seta basally: 2 anteromedial tubercles (largest), 1 tubercle at each of anterior corner and 1 tubercle at each posterior one and 2 anterolateral tubercles and with sparse whitish setae. Elytra extended posteriorly to metafemorotibial articulation and with short and sparse whitish setae, their posterior edge curving apically and almost reaching the base of sternite IV and also with hind wings reaching the abdominal segment VI. Meso- and metanota each at least with 10 setae as shown on Fig. 5. Antennae moderately long and oriented outwards between surface and anterior edge of profemur with comparatively large antennal club somewhat visible dorsally. Antennal club disposed at anterior femorotibial articulation, oriented posteriorly and with somewhat pointed tubercles. Labrum fused with frons, moderately widely excised at anterior edge, bearing a long fine seta and a much shorter seta on its outer edge and 2 smaller fine setae at its outer edge. Apices of maxillary palpi exposed from under lateral edge of mandibles. Each mandible with a long seta at outer edge. Abdominal segments III–VIII each with a long pleural tubercle at each side bearing 2 setae at base (tubercles on segment 8 longest). Abdominal tergites II–VI on each side with a shorter paralateral tubercle bearing a seta at base. Paralateral tubercles of abdominal tergite VII with 2 setae at base. Tergite I with 3 pairs of paramedial setae. Tergites II–V each with 6 paramedial and a pair of paralateral setae. Tergite VI with 6 long paramedial and with 6 long paralateral setae. Pygidium (tergite VII) and abdominal tergite VIII transverse and with truncate posterior edge. Pygidium with 6 long paramedial and with 4 paralateral setae. Tergite VIII with a pair of paramedial and with 3 pairs of paralateral setae. Sternites I–V with a number of setae (small parame-



Figs 5–8. Pupa of *Carpophilus* (*Myothorax*) *pilosellus* Motsch.: 5 — dorsal, 6–8 — ventral; 5–6 — ♀; 7–8 — ♂.
Рис. 5–8. *Carpophilus* (*Myothorax*) *pilosellus* Motsch.: 5 — сверху; 6–8 — снизу; 5–6 — ♀, 7–8 — ♂.

dial setae always present). Sternite VI with a pair of paramedial setae and with 4 pairs of paralateral ones. Sternite VII with 2 pairs of paramedial setae and 4 pairs of paralateral setae. Urogomphi of abdominal segment IX long, simple, sharply pointed, moderately separated and with a pair of setae at base as well as with some small setae. Underside of abdominal segments VIII and IX with transformed sclerites and appendages, showing two types of structures corresponding to sexes. Each femorotibial articulation with a tubercle bearing a seta at base. Femora of all legs with 2 setae along posterior edge in distal half. Abdominal segments I–VI with circular spiracles.

SEXUAL DIMORPHISM. **Male**. Sternite VII with slightly emarginate posterior edge and bearing setae as shown on Fig. 7. Sternite VIII with convex posterior edge and with a pair of strong tubercles (not seen from above) bearing a pair of setae at base. Surface of sternite VIII with a number of membranous folds as shown and has a pair of paramedial setae in addition to at least 4 pairs of setae. Underside of abdominal segment IX without mammiform processes.

Female. Sternite of abdominal segment VII with angularly projecting posterior edge and with the chaetotaxy as that in males. Sternite 8 with moderately convex posterior edge and with tubercles as those in males and also with 3 pairs of setae.

Underside of abdominal segment IX with a pair of comparatively small mammiform processes. Each of these process bearing a smaller tubercle at apex and with 2 pairs of small, erect and brownish setae. Large mammiform processes lying on membranous folds of different size, and at least with a pair of long setae and 2 pairs of shorter ones.

NOTES. The development had the following dynamics: 06–07.VII.2003, capture of adults; 14.VII, lying of eggs; 16.VII, emergence of first larvae; 17–18.VII, appearance of mature larvae; 20.VII, mature larvae left food substrate for soil; 21–25.VII, pupation; 25–30.VII and later, emergence of imago.

Laid eggs were: length 0.63–0.75 mm, breadth 0.21–0.28 mm. Elongate oval, almosy subparallel; color milky-white; surface smooth and shining.

One specimen examined posesses a pair of light brownish, small, thin, simple, sharply pointed and moderately separated pregomphi each having a seta basally.

DIAGNOSIS. The pupa of *C.* (*M.*) *pilosellus* can be distinguished:

— from pupa of *C.* (s. str.) *hemipterus* by the lacking of 2 posterolateral and 2 posterosubmedial tubercles on the pronotum [see Hinton, 1945];

— from pupa of *C.* (s. str.) *marginellus* by the absence of 2 posterosubmedial tubercles on the pronotum and all femorotibial articulations visible dorsally, sparser pubescense on the elytra and lacking of long setae on the paralateral, paramedial and sternal tubercles;

It is hardly possible to compare examined pupa of *C.* (*M.*) *pilosellus* with that of *C.* (*E.*) *sexpustulatus* because Perris' [1853] description is strongly lacking of proper diagnostic information;

— from pupa of *C.* (*M.*) *dimidiatus* by the 2 posterolateral tubercles on the pronotum (if such tubercles reduced on the pronotum of *C.* (*M.*) *dimidiatus*) and absence of 2 posterobasal tubercles (if such tubercles present on the pronotum of *C.* (*M.*) *dimidiatus*) [see Hinton, 1945].

Remarks

Take into consideration descriptions and drawings of some *Carpophilus* species carried out by some authors (see Introduction) and description above; it is possible to give some characters of the pupae of genus *Carpophilus*. Head of the pupae of known Carpophilinae concealed from under pronotum or slightly visible dorsally, without tubercles but with great number of distinctly visible setae. All abdominal segments well developed. Pygidium (tergite VII) and abdominal tergite VIII transverse and with the subtruncate posterior edge. Pronotum with a number of elongate tubercles variable in size and arrangement, with or without setibearing tubercles. Abdomen with elongate pleural and paralateral tubercles. Antennal clubs visible dorsally. Elytra covered with setae. Apices of all femorotibial articulations with tubercles, median and posterior femorotibial articulations visible dorsally. Urogomphi simple and sharply pointed, some specimens also with simple pregomphi.

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