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THE LARVA AND PUPARIUM OF THE ORIENTAL *PEGADOMYIA PRUINOSA* KERTÉSZ, WITH A WORLD LIST OF THE DESCRIBED PACHYGASTRINAE LARVAE (DIPTERA: STRATIOMYIDAE)

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***ABSTRACT.* –** The larva and puparium of *Pegadomyia pruinosa* Kertész, 1916, are described and compared with the other known saproxylic larvae from the subfamily Pachygastrinae. Diagnostic characters at the subfamily level as well as specific distinguishing characters of the pachygastrine larvae are summarized and a list of the described larvae for the world is given. An original identification key to the Oriental and East Palaearctic larvae (14 spp.) is proposed. Basic diagnostic characters of the described larva and puparium are illustrated and documented by SEM images.

***KEY WORDS.* –** Stratiomyidae, *Pegadomyia*, larva, puparium, saproxylic, Malaysia, Thailand.

INTRODUCTION

Woodley (2001) recorded 561 species of world Pachygastrinae and 19 species and 1 subspecies were subsequently described by Krivosheina (2002: one species; 2004: three species, one subspecies), Krivosheina & Freidberg (2004: two species), Rozkošný & Kozánek (2007: 7 spp.), Rozkošný & Kovac (2007: one species; 2008: four species) and Woodley (2008: one species). However, larvae are described for only 48 species (see Table 1), i.e. for 8.3 % of the world fauna of this subfamily.

Larvae of Pachygastrinae are generally found under the bark of dead or decaying trees, rarely also in soil, at roots of plants, in decaying remains of vegetation or under specialised conditions; e.g. larvae of *Eupachygaster alexanderi* (Bréthes, 1922) were reared from rotting *Opuntia sulphurea* in Argentina (cf. Blanchard, 1923; James, 1967), *Zabrachia stoichodes* James, 1965, and *Cactobia opuntiae* James, 1966, from cacti in the southwestern United States and Mexico, larvae of *Zabrachia yuccae* James, 1965, from yucca in Arizona and those of *Camptopteromyia fractipennis* de Meijere, 1914, were collected inside the internodes of bamboo in Malaysia (Rozkošný & Kovac, 1991). They are often gregarious, with several to many occurring together at the same site. Essentially, they are micropantophagous scavengers and they may even shown certain sapronecrophagous tendencies feeding upon dead saproxylic insects and their larvae (cf. Mamaev et al., 1977). Larvae of Holarctic Pachygastrinae apparently feed on fermenting sap, fungus spores or decay-producing microorgasnisms (Teskey, 1976). In the gut contents of a larva of *Camptopteromyia fractipennis* sporangia with spores of fungi, bacteria and unidentified organic debris were found (Rozkošný & Kovac, 1991).

Keys to the known larvae of Nearctic genera of this subfamily were published by Kraft & Cook (1961), McFadden (1967) and James (1981), and keys to the known larvae at the species level are to be found in the first two papers; the known Nearctic *Zabrachia* larvae were keyed by James (1965). Larvae of Palaearctic genera may be distinguished according to Krivosheina (1977), Mamaev et al. (1977) and Rozkošný (1997). A key to Palaearctic *Neopachygaster* larvae is given by Krivosheina (1976) and those to *Zabrachia* by Krivosheina & Rozkošný (1990). A key to five Neotropical pachygastrine larvae was published by Xeres et al. (2003b).

Table 1. World list of the known larvae of Pachygastrinae. Abbreviations used: AF, African; AU, Australasian; NE, Neartic; NT, Neotropical; OR, Oriental; PA, Palaeartic.

Species	Distribution	Author	Synonyms
Alliophlebs elliptica Becker, 1908	PA: Canary Is.	Rozkošný & Baez, 1986	
Aspidacantha atra Kertész, 1916	AF: Ethiopia, Tanzania, Uganda, Zaire, Zimbabwe	Krivosheina, 1975	
	PA: Egypt, Israel, Turkmenistan		
Berkshiria albistylum Johnson, 1914	NE: Canada, USA	Kraft & Cook, 1961	
Berkshiria hungarica (Kertész, 1921)	PA: Europe, W Siberia	Krivosheina, 1965; Rozkošný, 1983	*Pseudowallacea*
Camptopteromyia fractipennis de Meijere, 1914	OR: Indonesia (Java), W Malaysia	Rozkošný & Kovac, 1991	
Cechorismenus flavicornis Kertész, 1916	PA: Far East of Russia	Krivosheina, 1977	
	OR: Taiwan		
Chalcidomorphina aurata Enderlein, 1914	NT: from Mexico to Peru and Brazil	Pujol-Luz & Xeres, 1999	
Cosmariomyia argyrosticta Kertész, 1914	NT: Argentina, Brazil, Costa Rica, El Salvador	Xeres et al., 2002	
Craspedometopon basale (Matsumura, 1915)	PA : Far East of Russia, Korea, Japan	Krivosheina, 1977	*C. ussuricum* Krivosheina, 1973
Dactylodeictes lopesi Lindner, 1964	NT: from Mexico to Brazil	Xeres et al., 2002	
Damaromyia tasmanica Kertész, 1916	AU: Australia, Tasmania	James, 1950	
Eidalimus fuscus (Kraft & Cook, 1961)	NE: Canada, USA	Kraft & Cook, 1961	*Eupachygaster*
Eidalimus henshawi (Malloch, 1917)	NE: USA		
	NT: Cuba, Mexico	Kraft & Cook, 1961	*Eupachygaster*
Engicerus major Lindner, 1964	NT Brazil	Xeres et al. 2003a	
Eupachygster alexanderi (Brèthes, 1922)	NT: Argentina	Blanchard, 1923	
Eupachygaster tarsalis (Zetterstedt, 1842)	PA: Europe, Azerbaijan, Turkmenistan	Krivosheina, 1975; Rozkošný, 1983	
Gabaza nigrotibialis (Pleske, 1930)	PA: Far East of Russia	Krivosheina, 1977; Mamaev et al., 1977	*Wallacea*
Gowdeyana punctifera (Malloch, 1915)	NE: USA NT: Mexico	Kraft & Cook, 1961	*Eupachygaster punctifer*
Maackiana laminiformis Krivosheina, 1973	PA: Far East of Russia	Krivosheina, 1977	
Manotes crassimanus James, 1980	NT: Brazil, Mexico	Lopes et al., 2006	
Neopachygaster intermedia (Krivosheina, 1965)	PA: Mongolia, Uzbekistan	Krivosheina, 1965, 1976	
Neopachygaster maculicornis (Hine, 1902)	NE: Canada, USA	Kraft & Cook, 1961	
Neopachygaster meromelas (Dufour, 1841)	PA: Europe	Krivosheina, 1965; Rozkošný, 1983	*Pachygaster orbitalis*
Neopachygaster occidentalis Kraft & Cook, 1961	NE: Canada, USA	Kraft & Cook, 1961	
Neopachygaster reniformis Hull, 1942	NE: Canada, USA	Kraft & Cook, 1961	
Neopachygaster secernibilis Krivosheina 1973	PA: Far East of Russia	Krivosheina, 1976	
Neopachygaster stackelbergi Krivosheina 1973	PA: Far East of Russia	Krivosheina, 1976	
Neopachygaster vitrea Hull, 1930	NE: USA	Kraft & Cook, 1961	
Ornopyramis tener Krivosheina, 1973	PA: Far East of Russia	Krivosheina, 1977	
Pachygaster atra (Panzer, 1798)	PA: Europe, Israel, Turkey	Dušek & Rozkošný, 1975; Rozkošný, 1983	
Pachygaster leachii Curtis, 1824	PA: Europe, Azerbaijan, Georgia	Brindle, 1962; Krivosheina & Rozkošný, 1985	*Praomyia*
Pachygaster piriventris Rozkošný & Kovac, 1998	OR: W Malaysia, Thailand	Rozkošný & Kovac, 1998	
Pachygaster pulchra Loew, 1863	NE: USA	Kraft & Cook, 1961	
Pedinocera longicornis Kertész, 1909	NT: Brazil, Peru	Lopes et al., 2006	

Table 1. Continued.

Species	Distribution	Author	Synonyms
Popanomyia femoralis Kertész, 1909	NT: Brazil, Panama, Peru	Xeres et al., 2003a	
Pegadomyia pruinosa Kertész, 1916	OR: Malaysia, Thailand	This paper	
Psephiocera modesta (Lindner, 1949)	NT: Brazil	Xeres et al., 2003b	
Vittiger schnusei Kertész, 1909	NT: Barzil, Peru	Xeres & Pujol-Luz, 2001	
Xylopachygaster mamaevi Krivosheina, 1973	PA: Far East of Russia	Krivosheina, 1977	
Zabrachia magnicornis Cresson, 1919	NE: USA NT: Mexico	James, 1965	
Zabrachia minutissima (Zetterstedt, 1838)	PA: Europe, Israel, Kazakhstan, Uzbekistan, Siberia, Far East of Russia, Japan	Krivosheina & Rozkošný, 1985, 1990	
Zabrachia occidentalis Rozkošný & Baez, 1983	PA: Canary Is.	Rozkošný & Baez, 1986	
Zabrachia plicata Kraft & Cook, 1961	NE: Canada, USA	Kraft & Cook, 1961	
Zabrachia polita Coquillett, 1901	NE: Canada, USA	Kraft & Cook, 1961	
Zabrachia stackelbergi Krivosheina & Rozkošný, 1990	PA: Far East of Russia	Krivosheina & Rozkošný, 1990	
Zabrachia stoichoides James, 1965	NT: Mexico	James, 1965	
Zabrachia tenella (Jaenicke, 1866)	PA: Europe, Siberia, Far East of Russia incl. Kunashir I.	Krivosheina & Rozkošný, 1985, 1990	
Zabrachia yuccae James, 1965	NE: USA	James, 1965	

Numbers of pachygastrine larvae described in different biogeographical regions vary considerably (cf. Table 1). The highest number of larvae is known from the Palaearctic Region (18 species and eight of them described from the Russian Far East), one additional species penetrates to the Palaearctic Region from Africa and one species from the Oriental Region. Ten known larvae originate from the Nearctic Region, and three additional larvae are known from both the Neotropical and Nearctic Regions. Eleven larvae are described from the Neotropical Region, three are Oriental and one Australian.

According to present knowledge the known larvae of Pachygastrinae may be characterised by combination of the following characters: (1) anal segment rounded posteriorly as in other terrestrial larvae, (2) posterior spiracular opening usually placed dorsally (with a few exceptions), without any pinnate float hairs, (3) subapical sensilla on antenna usually absent (but distinct in *Pegadomyia*), (3) setae CF2 and V2 on head inserted far before eye prominence, (4) lateral seta on head placed close to anterior margin of eye, (5) marginal setae of body segments considerably elongate in many species (though not in all), (6) elongate or rounded sternal patch confined to abdominal segment 6, (7) five ventral setae on anal segment, (8) arboreal mode of life (under the bark of trees) distinctly predominating in the known larvae.

Summed up from the descriptions published until now, the following characters may be used to distinguish between pachygastrine larvae (and puparia): (1) Head index (length to maximum width) and shape of head (especially presence of postocular or basal lobes), (2) relative length of head setae, (3) number of clypeofrontal setae, (4) presence of sensila besides apical segment of antenna, (5) shape of sublabral appendage, (6) structure of mandibular-maxillary complex, (7) arrangement of maxillary palpus, (8) form of constant setae (clavate, pointed, density and length of pubescence), (9) length of lateral setae on body segments, (10) arrangement of plaques on body segments (ornamentation on dorsal and ventral surface), (11) configuration of anterodorsal and dorsal setae on thoracic segment 1, (12) number of branches of outer ventral setae on thoracic segments 1-3, (13) abbreviation of outer dorsal setae on abdominal segments, (14) configuration of setae on lateral wall of abdominal segments, (15) shape of sternal patch on abdominal segment 6, (16) position of posterior spiracular opening on anal segment, (17), length of transverse integumentary fold above posterior spiracular opening, (18) relative length of marginal setae on anal segment and their position, (19) length of anal slit, (20) presence of marginal structures along anal slit, (21) configuration of ventral setae on anal segment, (22) number of visible pupal respiratory horns on abdominal segments, (23) position of pupal respiratory horns relative to setae on lateral wall of abdominal segments.

In a recent revision of *Pegadomyia* Kertész, 1916 (see Rozkošný & Kovac, 2008) this genus was split into two genera. *Pegadomyia* proper now includes 4 exclusively Oriental species and *Pseudopegadomyia* Rozkošný & Kovac, 2008, contains three species, two of them distributed mainly in the Australasian and Oceanic Regions, and the third, *Ps. jamesi* Rozkošný & Kovac, 2008, on western islands of the Philippines. No remarks concerning biology or morphology of the larva or puparium belonging to *Pegadomyia* have been published. Damir Kovac succeeded in rearing *Pegadomyia pruinosa* Kertész, 1916, from larvae collected under the

bark of trees in Malaysia and Thailand. The larva and puparium could thus be described, illustrated and compared with the other known saproxylic larvae of the subfamily Pachygastrinae.

MATERIAL AND METHODS

Material examined: **– WEST MALAYSIA**: Ulu Gombak, Field Studies Centre, under the bark of a fallen tree, 1 May 2002, 7 mature larvae, 2 larvae of penultimate instar, 2 males emerged 27 May 2005; **THAILAND**, Mae Hong Son Province, near Ban Nam Rin, under the bark of a fallen tree, Nov.2003, 2 larvae, a female emerged 2 Oct.2003; 2 Nov.2004, 3 larvae, a female emerged 31 Mar.2005 and a male 3 Apr.2005; all D. Kovac lgt. Deposited in the Faculty of Science, Masaryk University, Brno, Czech Republic (9 larvae and 4 puparia) and in the Forschungsinstitut Senckenberg, Frankfurt a.M, Germany (2 larvae, 3 puparia).

Rearing and preparation. – Larvae were collected individually and reared in separate dishes containing substrate (rotting wood and pieces of bark) from the original locality. A portion of the larvae and puparia was preserved in 70% ethanol for further study. Preparation for scanning electronic micrographs (SEM) was as follows: after cleaning and preservation in alcohol, the immature stages were dehydrated in a graded series of ethanol solutions, dried by the critical point technique with CO_2, and coated with palladium-gold before observation under the scanning microscope. Measurements are given without the length of marginal setae which may be different in length in individual larval instars.
Terminology. – Terminology including the chaetotaxy follows the monograph by Rozkošný (1982) and a general review of the dipteran larval morphology by Courtney et al. (2000). The term *plaque* is used in the same sense as James (1965) used it, following some earlier authors. Such cuticular structures are larger and mostly darker than the other small surface plates.

Abbreviations. – a – antenna, ac – apical segment, AD – anterodorsal seta, AMS – apical mandibular setae, AP – apical seta, as – anterior spiracle, asl – anal slit, AV – anteroventral seta, bl – basal lobe, bs – basal segment, bsc – basal sclerite, CF – clypeofrontal seta, D – dorsal seta, DC – dorsocentral seta, DL – dorsolateral seta, e – eye, L – lateral seta, lb – labrum, ma – molar area, mf – maxillary fringe, MMS – marginal mandibular setae, mp – maxillary palpus, pso – posterior spiracular opening, sa – sublabral appendage, SAP – subapical seta, sn – sensilla, sp – sternal patch, V – ventral seta, VL – ventrolateral seta.

DESCRIPTION OF LARVA

Measurements. – length 6.6-8.1 mm, maximum width 1.6-2.1 mm (based on 7 larvae).

Head. – (Figs 1-2, 12-16): about 1.6 times as long as wide in dorsal view and even longer in ventral view. Somewhat arched clypeus well separated by a clypeofrontal suture on each side, occupying about central third of head. Small antenna (Fig. 21) placed at latero-apical corner of head capsule, two-segmented. Basal segment short and semi-spherical, apical segment at least 3.0 times longer and conical. Rod-like sensillum present, being somewhat shorter than apical segment and placed lateral to it. Eyes situated laterally beyond middle of head on slightly convex eye elevations distinct especially in dorsal view. Basal lobe distinct on each side of head capsule. Labrum relatively narrow (Fig. 16), with a very characteristic sublabral appendage hanging on its ventral surface (Figs. 13, 22). Mandibular-maxillary complex elongate and margined by several rows of flattened and mostly serrate setae (Fig. 9). Maxillary palpus with 3 rounded sensorial papillae at apex (Figs 13, 23). Molar area transversely ridged, basal sclerite small (Fig. 9).

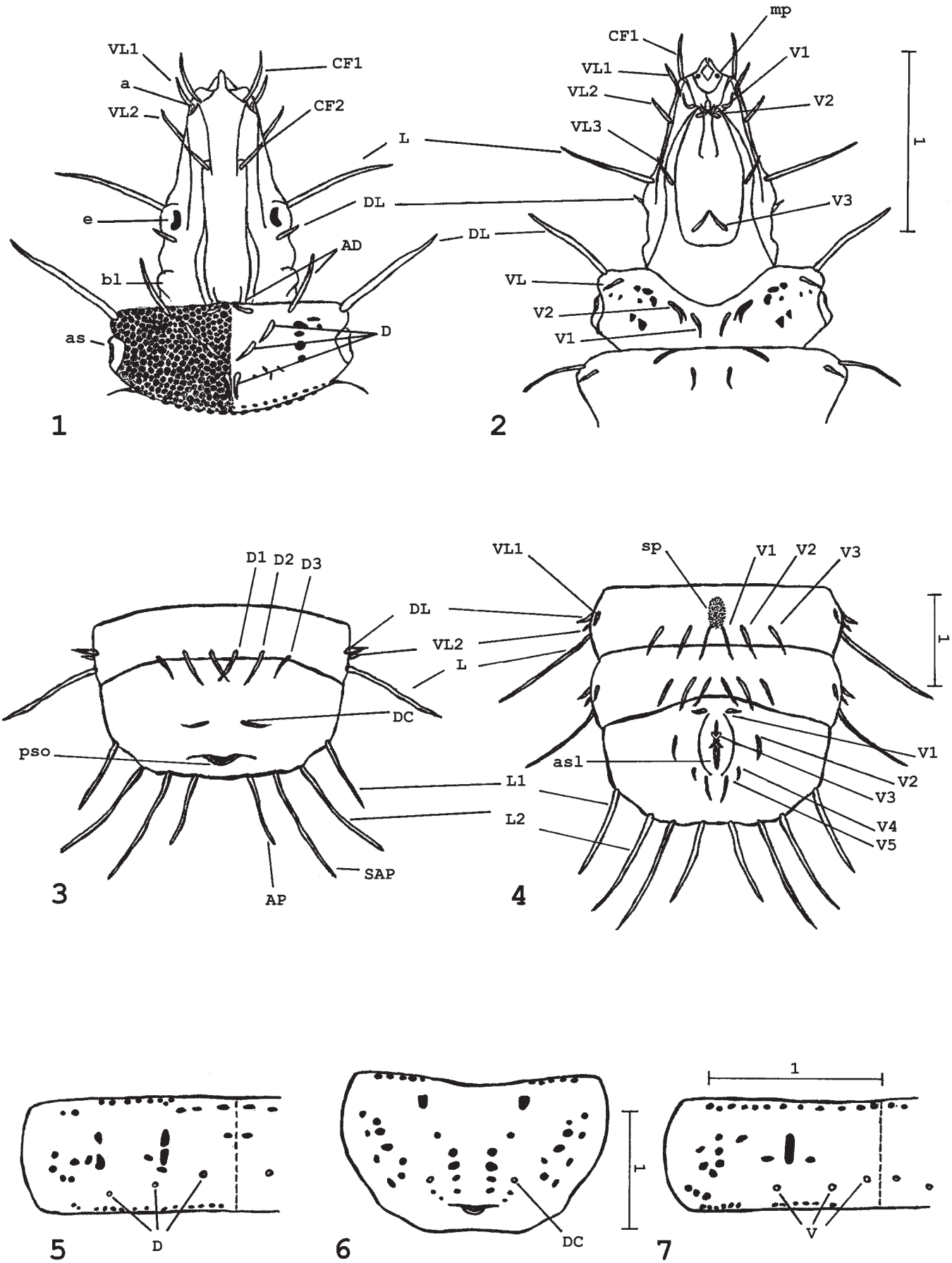
Chaetotaxy (Figs. 1–2): Two labral setae (or at least their insertions) visible on sides of labrum. Of two pairs of clypeofrontal setae (CF1 and CF2) first shorter and placed in front of antennae; CF2 placed in middle between antenna and eye. Long lateral seta (L) visible below eye and much shorter dorsolateral seta (DL) at upper posterior margin of eye. Two pairs of ventrolateral setae VL1, VL2) developed in distal third of head laterally and two pairs of ventral setae inserted ventrally near mouth opening. Last pair of ventrolateral setae (VL3) located almost at same level as lateral setae, last ventral seta (V3) near posterior margin of oval ventral plate.

Colouring and ornamentation: Ground colour yellow but central third (clypeofrons) more brownish, also labrum darkened along sides. Ventral surface yellow, only suboval ventral plate somewhat darker. No ornamentation consisting of brownish plaques present.

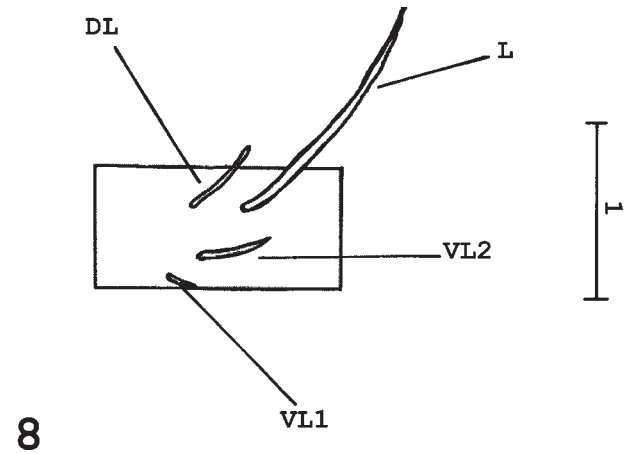
Thoracic segments. – 1st segment narrower than next two, anterior spiracle on first thoracic segment large, subtriangular and prominent, with a distinct cleft.

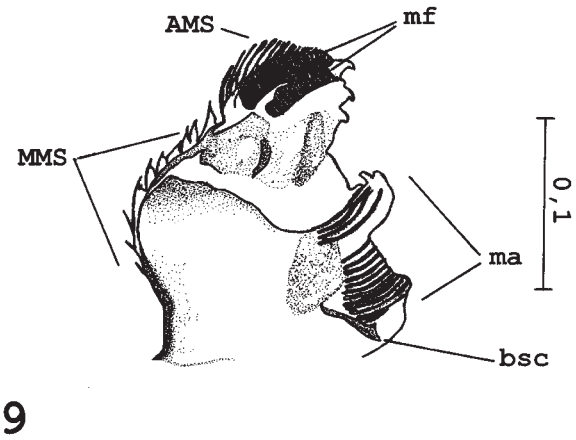
Chaetotaxy (Figs 1-2): Setae short plumate, reaching 1/3-1/2 segment length, only dorsolateral setae (DL) long. Two pairs of anterodorsal setae (AD1, AD2) placed in transverse row near anterior margin of thoracic segment 1, three pairs of dorsal setae (D1, D2 and D3) arranged in Y-shaped formation. On thoracic segment 2 and 3 only 3 pairs of dorsal setae developed in a transverse row. Two pairs of ventral setae on each thoracic segment represent so called thoracic leg groups, V1 simple and V2 doubled (Fig. 12). Dorsolateral (DL) and ventrolateral seta (VL) present near each lateral margin.

Colouring and ornamentation: Thoracic segments darker than head, especially along anterior margin of prothorax and in longitudinal dorsolateral bands but lateral margins of segments more yellow. Ventral surface generally paler. Ornamentation (Fig. 1) consisting of brownish and usually larger scales (plaques) visible in dorsolateral depression on each side as a longitudinal row of 4 plaques, anteriorly two additional plaques shifted more laterally; 3-4 small plaques more or less visible in an irregular transverse row on each side at boundary of last fourth of segment. About 18-20 mostly rounded plaques along posterior margin of segment.



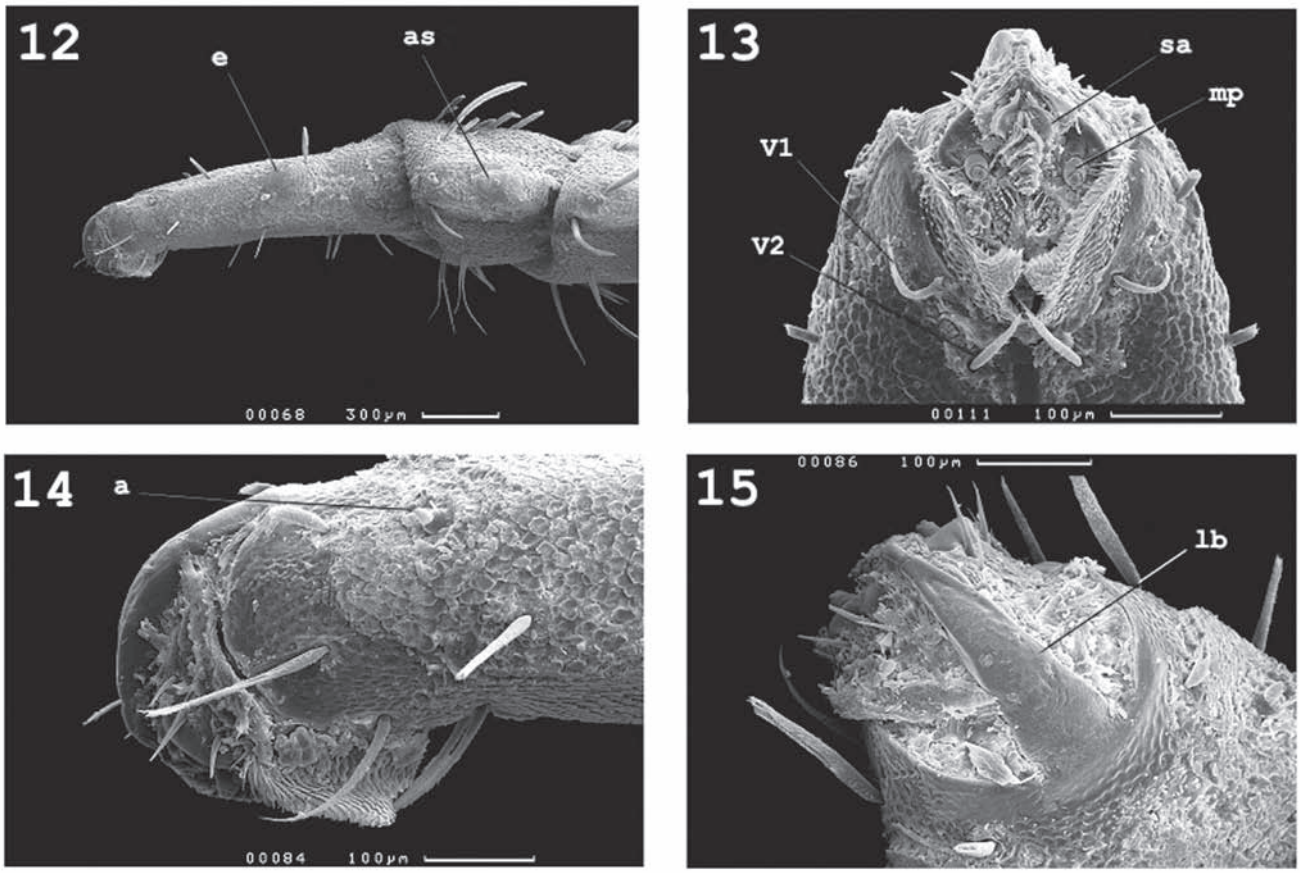
Figs. 1–7. *Pegadomyia pruinosa* (mature larva): 1, Head and thoracic segment 1 in dorsal view; 2, Head and thoracic segment 1 in ventral view; 3, Last two abdominal segments in dorsal view; 4, Last three abdominal segments in ventral view; 5, Ornamentation of abdominal segment 3 in dorsal view; 6, anal segment in dorsal view; 7, Abdominal segment 3 in ventral view. Scales bars = 1.0 mm.



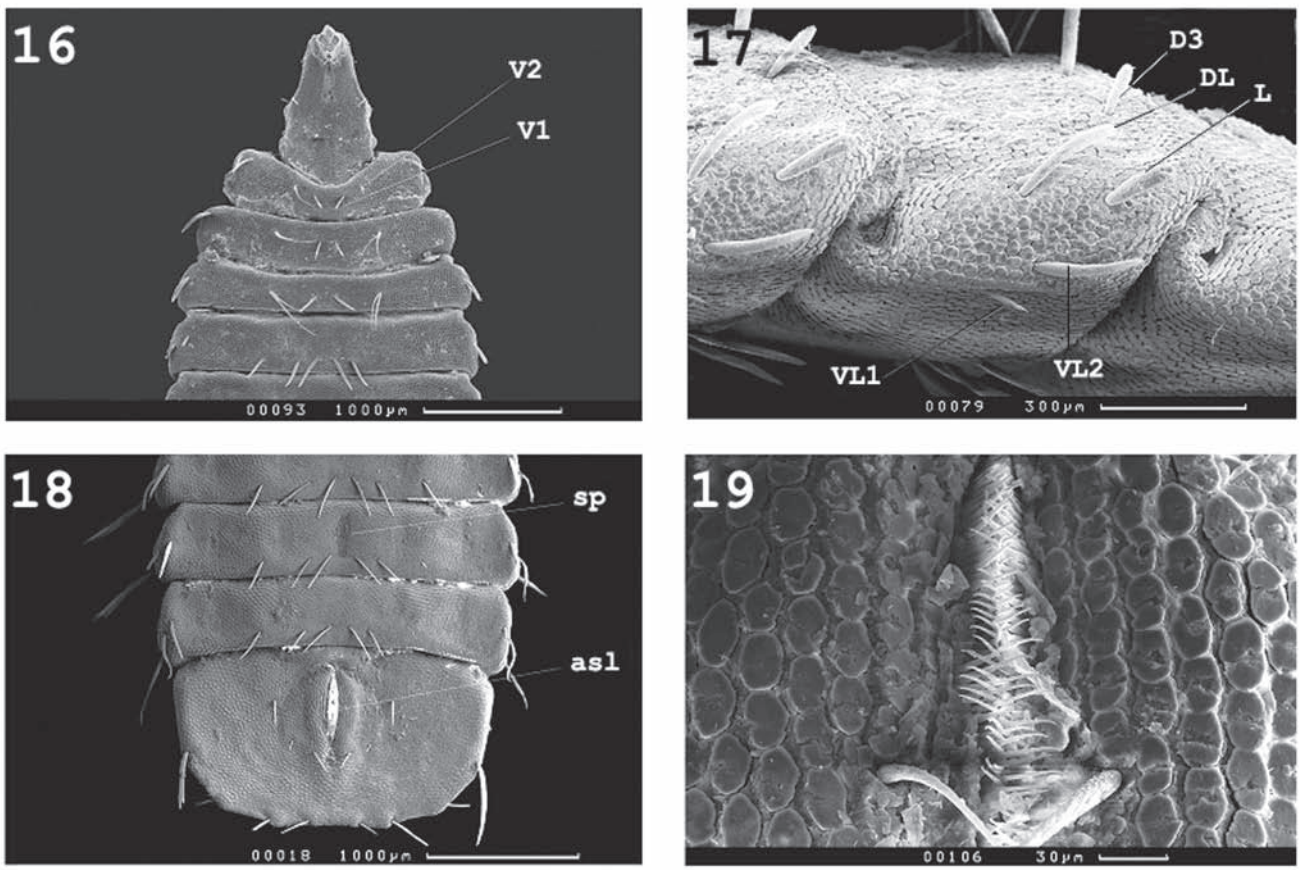


Figs. 8–9. *Pegadomyia pruinosa* (mature larva). 8, Diagram of setae on lateral wall of abdominal segments 1-7; 9, Mandibular-maxillary complex from inner side.

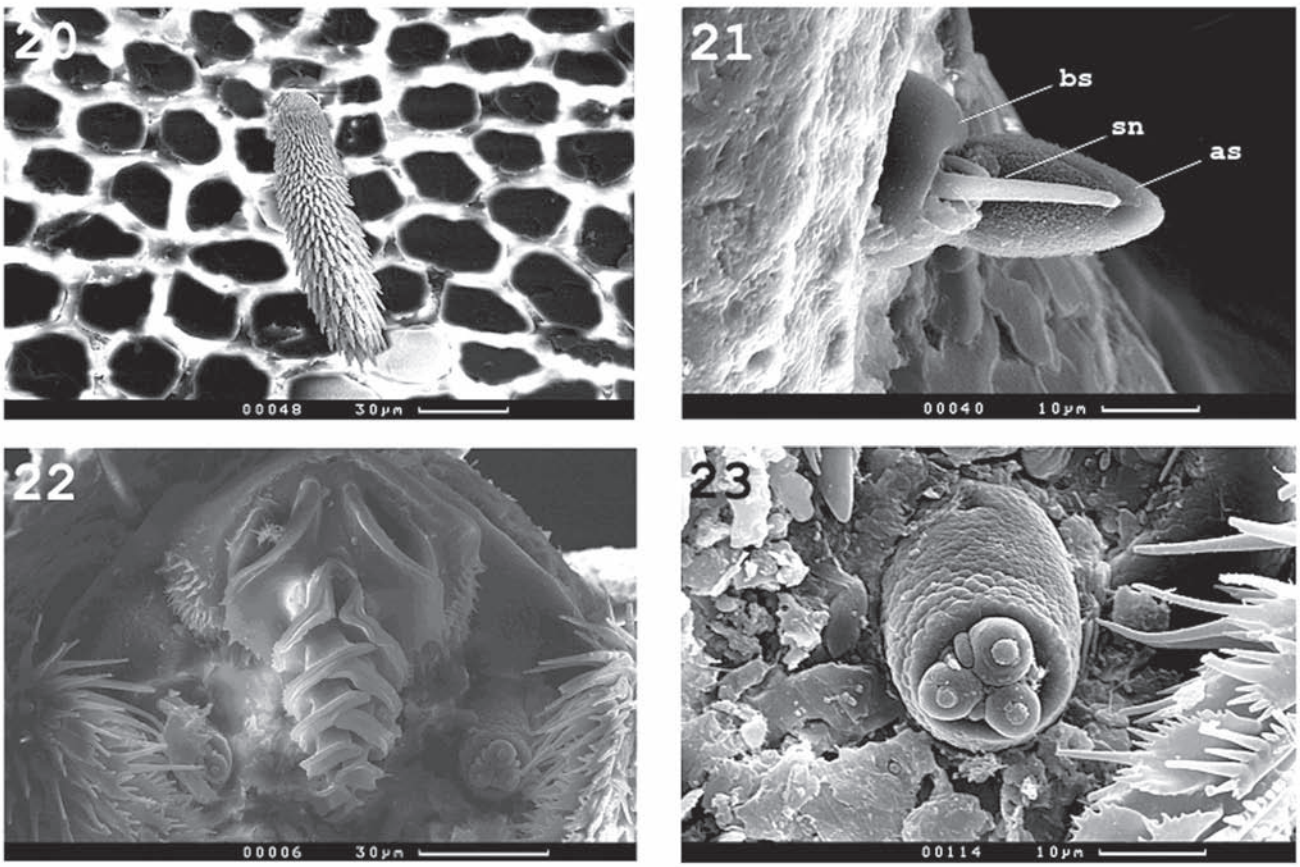
Figs. 10–11. *Pegadomyia pruinosa* (penultimate larval instar) in dorsal (10) and ventral view (11). Scale bars = 0.5 mm.



Figs. 12–15. *Pegadomyia pruinosa* (mature larva). 12, Head and thoracic segment 1 in lateral view; 13, Mouthparts in ventral view; 14, Anterior part of head in lateral view; 15, Anterior part of head in dorsal view.



Figs. 16–19. *Pegadomyia pruinosa* (mature larva). 16, Head and four anterior body segments in ventral view; 17, Abdominal segment 6 in lateral view; 18, last four abdominal segments in ventral view; 19, Anal slit with crossed setulae.



Figs. 20–23. *Pegadomyia pruinosa* (mature larva). 20, Pubescent seta on thoracic segment 1; 21, Two-segmented antenna with sensilla; 22, Sublabral appendage; 23, Maxillary palpus.

Plaques on thoracic segment 2 scattered almost circularly in dorsolateral depression (12 plaques on each side) and also a transverse row along posterior margin well developed. In addition longitudinally oriented pair of elongate-oval, large plaques distinct at sides of central third of segment. Each of these large plaques with a small rounded plaque in a transverse mid-line. Thoracic segment 3 only with a dorsolateral group of plaques but these more transverse, occupying almost lateral third of segment. Transverse row along posterior margin again well developed. Ventral side of thoracic segments with almost same configuration of plaques including large longitudinal plaques of thoracic segment 2 but with two small oval plaques between ventral setae on segment 3 on each side.

Abdominal segments (Figs. 3–4). **–** Segments 1–7 each of almost same shape, last abdominal (anal) segment broadly rounded posteriorly. Cleft of breathing chamber (posterior spiracular opening) placed dorsally on anal segment, somewhat convex, partly hidden by a fold of integument in front of it and somewhat shifted to posterior margin of segment (placed at beginning of apical fourth); transverse fold distinct only in middle third (or less) of anal segment. Longitudinally oval sternal patch (special structure with unknown function) placed in middle of segment 6 (Fig. 4). Anal slit slightly longer than middle third (Figs. 18–19), margined with a fringe of long and fine, inner, crossed setae.

Chaetotaxy (Figs. 3, 4): Three pairs of setae developed in transverse rows on dorsal as well as ventral surface, in contrast to thoracic segments, setae gradually shifted to posterior margin of segments 1–7. Dorsal setae convergent, inner dorsals (D1) longest, outer dorsal (D3) very short. Length of all ventral setae nearly equal, setae divergent. On each lateral wall 4 setae visible Figs 8, 17), one dorsolateral (DL), one lateral (L) and two ventrolateral (VL1, VL2). Lateral seta longest, much longer than length of relevant abdominal segment. Last abdominal (anal) segment only with one pair of medial dorsal setae. All marginal setae inserted below middle of anal segment, second lateral and subapical setae as long as lateral setae of abdominal segments, first lateral and apical setae distinctly shorter. Insertions of ventral setae placed on oval wall around anal slit, V1 in middle basally, V2 almost in middle between margin and anal cleft though shifted more centrally, V4 and V5 in middle third below anal area. Only convergent V3 placed close to anal cleft.

Colouring and ornamentation**:** Ground colour as in thoracic segments, i.e. brownish, lateral margins and posterior margin of anal segment more yellow. Dorsal ornamentation on abdominal segments 1–7 as described in thoracic segment 2 but dorsolateral groups consisting of 9 differently large plaques and large longitudinal plaques at sides of central third split in middle into 2 elongate scales (Fig. 5). Additional small plaques developed symetrically below them and a pair of small plaques visible on segments 2–7 in middle or

above it in central position. All abdominal segments 1–7 with an additional dorsal row of 22–24 small plaques along anterior margin, 6–8 of them in central third slightly shifted posteriorly. Similar row of small plaques along posterior margin as well. Ventral side of abdominal segments 1–7 with very characteristic longitudinal and relatively narrow plaques (Fig. 7) as on thoracic segment 2. Rows of small plaques along anterior and posterior margin distinct also on ventral surface. Anal segment (Fig. 6) with relatively small and mostly rounded plaques, dorsolateral group consisiting of 7 plaques on each side and a pair of broadly separated, enlarged plaques near anterior margin and two dorsomedial longitudinal rows (inner between large anterior plaques and dorsal spiracular opening and outer below dorsal setae). Ventral surface with 18 small plaques forming a submarginal group on each side and 2 longitudinal rows of plaques along the anal elevation on each side. Two pairs of droplike plaques in a transverse row near anterior margin.

DESCRIPTION OF PUPARIUM

Measurements: length 9.1–9.8 mm, maximum width 2.5–2.7 mm (based on 4 puparia). Puparium formed from skin of last instar larva. Integument more rigid and somewhat more darkened than in larva, mouthparts obliterated and prothoracic spiracles more sclerotized, crossed setulae along inner margin of anal slit invisible. All surface structures including setae and ornamentation as described in mature larva. Microscopically short, stalk-like pupal respiratory horns on abdominal segments 2–6 placed between dorsolateral and lateral setae or even indistinct in some puparia.

DISCUSSION

The mature larva of *Pegadomyia* is characteristic, first of all, by long lateral setae on all body parts: lateral setae on the head, dorsolateral setae on the thoracic segments, lateral setae on abdominal segments 1–7 and 2 pairs of lateral setae on the anal segment. Similar configuration of setae is known only in two other pachygastrine genera, *Eupachygaster* and *Zabrachia*, distributed in the Nearctic and Palaearctic Regions but also in almost all pachygastrine larvae described from South America. However, the elongate sensilla which is developed lateral to the apical antennal segment seems to be unique among the known pachygastrine larvae. On the other hand, a similar slender antennal sensilla is well developed in all the known aquatic larvae of *Odontomyia*, *Oxycera* and *Stratiomys* from the subfamily Stratiomyinae and *Nemotelus* from the subfamily Nemotelinae. The very characteristic ornamentation on the body segments, especially the presence of a long and slender, longitudinally oriented pair of plaques on the ventral surface of thoracic segment 2 and each of abdominal segments 1–7 is probably autapomorphic.

Johannsen (1922) already noticed that the earlier instars differ from the final one in mouthparts, details of cuticular structure and sometimes also in chaetotaxy. This characteristic is fully confirmed by our examination of younger larvae. The larva of the penultimate instar of *Pegadomyia pruinosa* is smaller (length: 4.5–5.2 mm, maximum width: 0.8–0.9 mm), uniformly yellowish, without any cuticular ornamentation and with simple (not doubled) outer ventral setae on thoracic segments 1 and 2. Mature larvae possess complete mouthparts, well developed ornamentation consisting of enlarged and darkened cuticular plaques and a definitively developed, complete armature of constant setae.

The European pachygastrines usually possess 6 pairs of pupal respiratory horns on abdominal segments 1–6 like in the Beridinae whereas the Sarginae and Clitellariinae display only 4 pairs of pupal respiratory horns on abdominal segments 2–5 (cf. Rozkošný 1982). A tendency to a reduction of pupal respiratory horn number will very probably be more distributed in exotic Pachygastrinae and may even vary within some species.

A KEY TO THE IDENTIFICATION OF ORIENTAL AND EAST PALAEARCTIC PACHYGASTRINE LARVAE AND PUPARIA

1 Posterior spiracular opening close to posterior margin of anal segment, nearly apical in position 2
– Posterior spiracular opening placed well before posterior margin of anal segment in dorsal position (Fig. 3) 3
2 Structures bordering anal slit rounded; subapical seta not visible in dorsal view ..... *Craspedometopon basale* (Matsumura)
– Structures bordering anal slit subquadrate; subapical seta well visible in dorsal view .... *Maackiana laminiformis* Krivosheina
3 Sternal patch on abdominal segment 6 rounded, placed well in front of transverse row of ventral setae .... *Gabaza nigrotibialis* (Kertész)
– Sternal patch on abdominal segment 6 oval, at least touching transverse line of ventral setae (Fig. 4) 4
4 Subapical and apical setae of same length, at least 2/3 as long as anal segment 5
– At least one of these setae distinctly shorter (Fig. 3) 8
5 Subapical and apical setae on anal segment longer than lateral setae ..... *Xylopachygaster mamaevi* Krivosheina
– All marginal setae of anal segment nearly equal in length .. 6
6 Three pairs of anterodorsal setae and two pairs of dorsal setae on thoracic segment 1 ..... *Zabrachia tenella* (Jaennicke)
– Two pairs of anterodorsal setae and 3 pairs of dorsal setae on thoracic segment 1 7
7 Dorsal setae on abdominal segments gradually shortened toward lateral margin, i.e. D1 longest .... *Zabrachia stackelbergi* Krivosheina & Rozkošný
– D2 seta on abdominal segments longer than D1 seta .... *Zabrachia minutissima* (Zetterstedt)
8 Head unusually long, much more than twice as long as broad basally; marginal setae of anal segment short, barely ¼ as long as abdominal segments .... *Pachygaster piriventris* Rozkošný & Kovac, 1998
– Head at most twice as long as broad basally; at least some of marginal setae on anal segment longer 9
9 Apical setae on anal segment conspicuously longer than subapical setae ..... *Ornopyramis tener* Krivosheina
– Apical setae distinctly shorter than subapical setae 10

10 Lateral setae on abdominal segments longer than length of relevant segment (Figs. 3, 4); antenna with slender sensilla lateral to apical segment (Fig. 21) ..... *Pegadomyia pruinosa* Kertész
– Lateral setae on abdominal segments at most as long as relevant segments; antenna without sensilla 11
11 Head with conspicuous postocular lobe on each side; subapical setae on anal segment longer than lateral setae .... *Camptopteromyia fractipennis* de Meijere
– Head without postocular lobes; subapical setae on anal segment shorter than lateral setae 12
12 Two approximated transverse rows of enlarged cuticular plaques, first consisting of rhomboid and second of transversely oval or polygonal structures, distinct on abdominal segments below dorsal setae ..... *Cechorismenus flavicornis* Kertész
– Transverse rows of enlarged plaques on dorsal surface of abdominal segments absent 13
13 Two intersegmental rows of darkened plaques between thoracic segments 2 and 3 on ventral surface separated by one row of small cuticular plates .... *Neopachygaster secernibilis* Krivosheina
– Intersegmental rows of darkened plaques between thoracic segments 2 and 3 on ventral surface separated by 2 rows of small cuticular plates .... *Neopachygaster stackelbergi* Krivosheina

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