

**A description of the mature larva  
of *Philonthus lepidus* (GRAVENHORST, 1802)  
– a stenotopic species of rove-beetle**

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**ABSTRACT.** The mature larva (L<sub>3</sub>) of *Philonthus lepidus* (GRAVENHORST, 1802) is described for the first time; 31 detailed illustrations of structural features are provided. This species together with four others previously described by the authors are included in a modified key of *Philonthus* species.

**KEY WORDS:** Coleoptera, Staphylinidae, *Philonthus, lepidus*, mature larva, stenotopic species, Poland.

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INTRODUCTION

The genus *Philonthus* STEPHENS, 1829 represents one of the largest genera of Staphylinidae, with about 1260 (19 doubtful) described species, of which some 70 have been recorded from central Europe and almost 60 from Poland (BURAKOWSKI et al. 1980, HERMAN 2001, KOCH 1989, LUCHT 1987). Within this genus, however, few data about the morphology of the larvae of over 30 species have been reported (BOLLER 1983, BYRNE 1993, CERRUTI 1941, CHANI-POSSE 2006, KASULE 1970, KRANEBITTER & SCHATZ 2002, MOORE 1977, PAULIAN 1941, PIETRYKOWSKA-TUDRUJ & STANIEC 2006, POTOTSKAYA 1966, 1967, SMETANA 1958, 1962, STANIEC & PIETRYKOWSKA-TUDRUJ 2007a, 2008a, b, SZUJECKI 1965, TAWFIK et al. 1976a, b, c, TOPP 1978). Because many descriptions are incomplete and poorly illustrated, correct identification of the preimaginal stages of individual species, especially of closely related taxa, is still highly problematic.

Consequently, these descriptions require supplements or revision.

*Philonthus lepidus* (GRAVENHORST, 1802) (Figs 32-34) is distributed in Europe, Russia, Kazakhstan, Mongolia and China. In the literature it is defined as a stenotopic, thermophilous, xerophilous, psammophilous and phytodetriticolous species, occurring in exposed areas and on insolated slopes, especially on sandy and limestone soils, in decaying plant remains, excrement and under stones (BURAKOWSKI et al. 1980, KOCH 1989). With reference to the immature stages of *Ph. lepidus*, the egg and pupae have been described by STANIEC & KITOWSKI (2004) and STANIEC & PIETRYKOWSKA-TUDRUJ (2007b). The purpose of this study is to describe the unknown so far mature larval stages (L<sub>3</sub>).

#### MATERIALS AND METHODS

The mature individuals were collected using BARBER traps in the first ten days of May 2003 in the xerothermic areas around Ciecchanki Łańcuchowskie near Lublin, and Gródek near Hrubieszów (east-central Poland). The imagines of the species examined were identified by the first author. In order to obtain the mature larval stages (L<sub>3</sub>) for the morphological description, rearing was started on 8 May 2003 in temperature of 20±3°C. The adults were kept in plastic containers (10 cm diameter x 7 cm high) filled with soil. In the laboratory the larvae were observed from 16 May until the beginning of June. The reared mature larvae (L<sub>3</sub>) were preserved in a 1:4 solution of glycerine and alcohol. For the microscopic slides the punctured larvae were rinsed in distilled water and cleared in KOH for 2-3 days. The drawings of morphological details were made using light microscopy (Olympus) with a camera lucida. Habitus illustrations of larva, adult, some details (microstructure, sensilla, seta types, tentorial pit, stemmata) of larva and aedeagus were drawn from photographs taken with an Olympus C-5060 digital camera.

The chaetotaxy of *Ph. lepidus* was coded on the basis of the general principles used to describe the genus *Arrowinus* of the Staphylininae by SOLODOVNIKOV & NEWTON (2005).

Material examined includes 12 larvae and 9 adults.

#### DESCRIPTION

Body length (from anterior margin of nasale to end of pygopod): 5.80-7.40 mm (mean 6.8 mm); head width (between stemmata): 0.72-0.77 mm (mean 0.74 mm); head length (from anterior margin of nasale to neck): 0.77-0.90 mm (mean 0.82 mm); pronotum width: 0.78-0.88 mm (mean 0.84 mm). Colour: head, mandibles reddish-brown, thoracic tergites brownish-grey; first abdominal tergite light brown; remaining abdominal tergites grey; sternites, antennae, legs and body dirty white; setae light brown or brown. Body elongate, prothorax 1.1-1.2 times as wide as head and 1.4 times as long as mesothorax; meso- and metathorax of similar length and width; abdomen widening slightly to segment IV or V, then tapering to the terminal segment of the body (Fig. 1). All setae of head, thorax, abdominal

sternite I, urogomphi and longest and shortest setae of abdominal tergites I-VIII and sternites II-VIII, most setae of pygopod simple (Figs 2, 8); remaining macro- and microsetae of abdominal segments I-X, rod-shaped and frayed or bifurcate apically (Figs 3-7).

**Head** (Figs 9-19): 1.1-1.2 times as long as wide, side margins almost parallel; epicranial suture bifurcate before half of head length (Fig. 9). Chaetotaxy of dorsal side of head with 58 setae (Figs 9, 9A, 12): nasale (Na) with 22 setae (codes: 1-11), a pair of glandular pits (Gp), a pair of olfactory organs (Og) and 2 pores medially (Fig. 12); epicranial part (E) with 30 setae (codes 12-26), a pair of glands (Gl) and 10 pores (codes: a-e); posterior (P) part with 6 microsetae (codes 27-29) and 2 pores (shown as f). Each side of head with 4 stemmata in the cluster (Fig. 9B). Apotome (Ap) in broad outline triangular (Fig. 19), distinctly extending beyond tentorial pits (Tp) by one length of tentorial pit; with 6 setae, 2 pores and a pair of glandular pits (Gp).

Antenna (Figs 10, 11): 4-segmented, length ratio of segments I-IV: 1.0:1.8:1.6:1.2 respectively; segment I almost 1.1 times as long as wide at the base, with one pore ventro-apically; segment II 2.8 times as long as wide, with 2 pores (1 latero-dorsally, 1 ventro-apically); segment III 2.9 times as long as wide at maximum width, with 3 macrosetae (1 growing on the outer margin, 2 on the inner margin), 2 sensory appendages (Sa) (one club-shaped and the other tiny), 2 solenidia (So) and 1 ventral pore; segment IV 3.2 times as long as wide, about 2.6 times as long as the larger sensory appendage of segment III, with 3 macrosetae and 4 solenidia (So) apically.

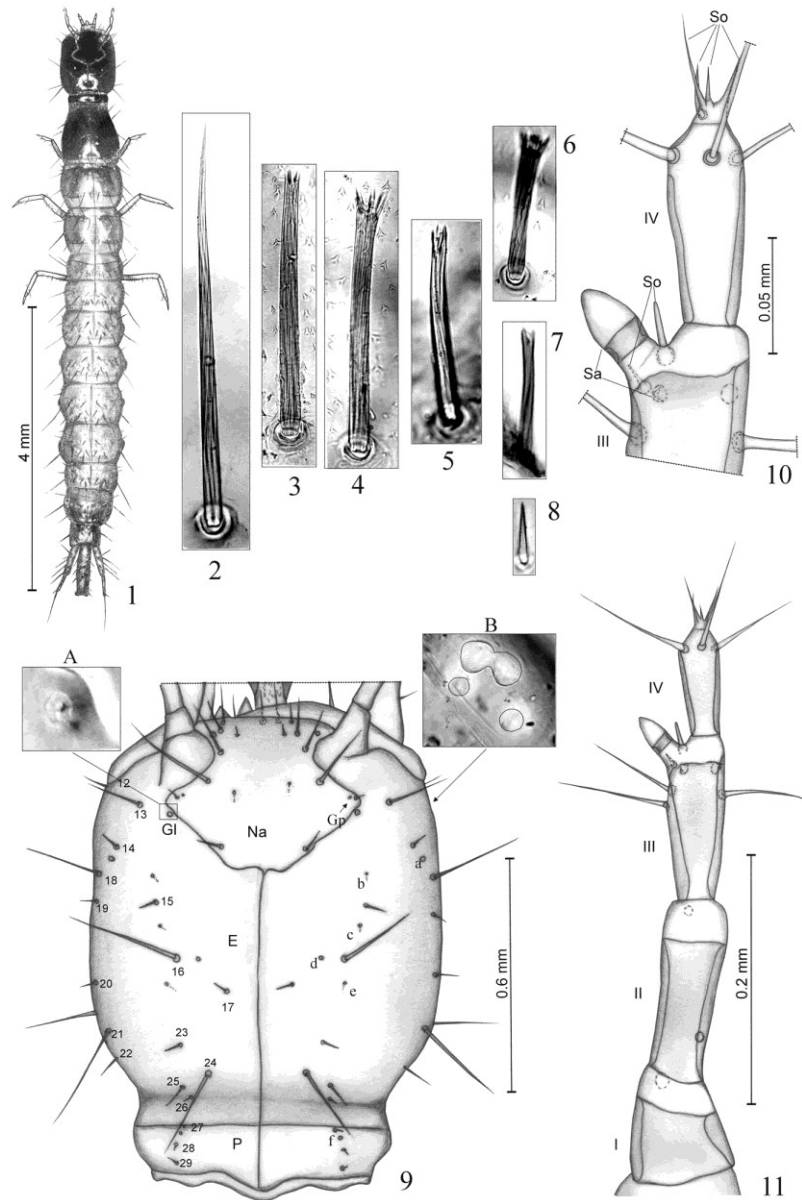
Anterior margin of nasale (Fig. 12) with 9 teeth divided into 3 distinct clusters (one median and two lateral), paramedian teeth (Pmt) about 2.1 times as long as median tooth (Mt); median teeth of lateral clusters weakly developed. Epipharynx (Fig. 14) with 4 bunches of long straight hairs anteriorly and 17 long cuticular processes posteriorly. Mandible (Fig. 13) slender with 2 setae on outer margin and 2 pores dorsally; internal edge not serrated. Maxilla (Figs 15, 16): length ratio of cardo (Cd) and stipes (St) 1:1.5; cardo about 1.3 times as long as wide, bearing 1 ventro-lateral seta; stipes 2.5 times as long as wide with 8 setae (2 on outer margin, 2 ventral, 1 dorsal, 2 on or near inner margin, 1 ventro-apical) and 1 pore near inner margin. Mala (Ma) (Fig. 16) finger-shaped, 3.5 times as long as wide; with 2 microsensory appendages, 2 setae apically and 2 pores at the base; length ratio of mala and segment I of maxillary palp 1:1.2 respectively. Palpifer (Pf) (Fig. 16) with 1 pore and 1 seta ventrally. Maxillary palp (Pm) 4-segmented; length ratio of segments I-IV: 1.5:2.4:1.8:1 respectively; segment I twice as long as wide, with 2 pores; segment II 3.6 times as long as wide, with 2 setae and 3 pores near apex; segment III 4.6 times as long as wide, with 1 digitiform sensory appendage basally on outer margin; segment IV 3.3 times as long as wide, with 2 pores and a few microsensory appendages on the apex. Hypopharynx (Fig. 17) membranous and thickly pubescent; membranous vertical stripe with about 40 hairs. Labium (Fig. 18): ventral side of prementum (Pmnt) sclerotized, with 4 setae (2 macro, 2 micro) and 2 pores laterally. Ligula (Lg) conical, about 2.1 times as long as wide at the base and as wide as segment I of labial palp at the base; length ratio

of ligula and segment I of labial palp 1:1.2 respectively. Labial palp (Pl) 3-segmented; length ratio of segments I-III: 2.8:1.8:1 respectively; segment I with 1 lateral pore dorsally; segment III with 1 pore laterally and a few apical microsensory appendages.

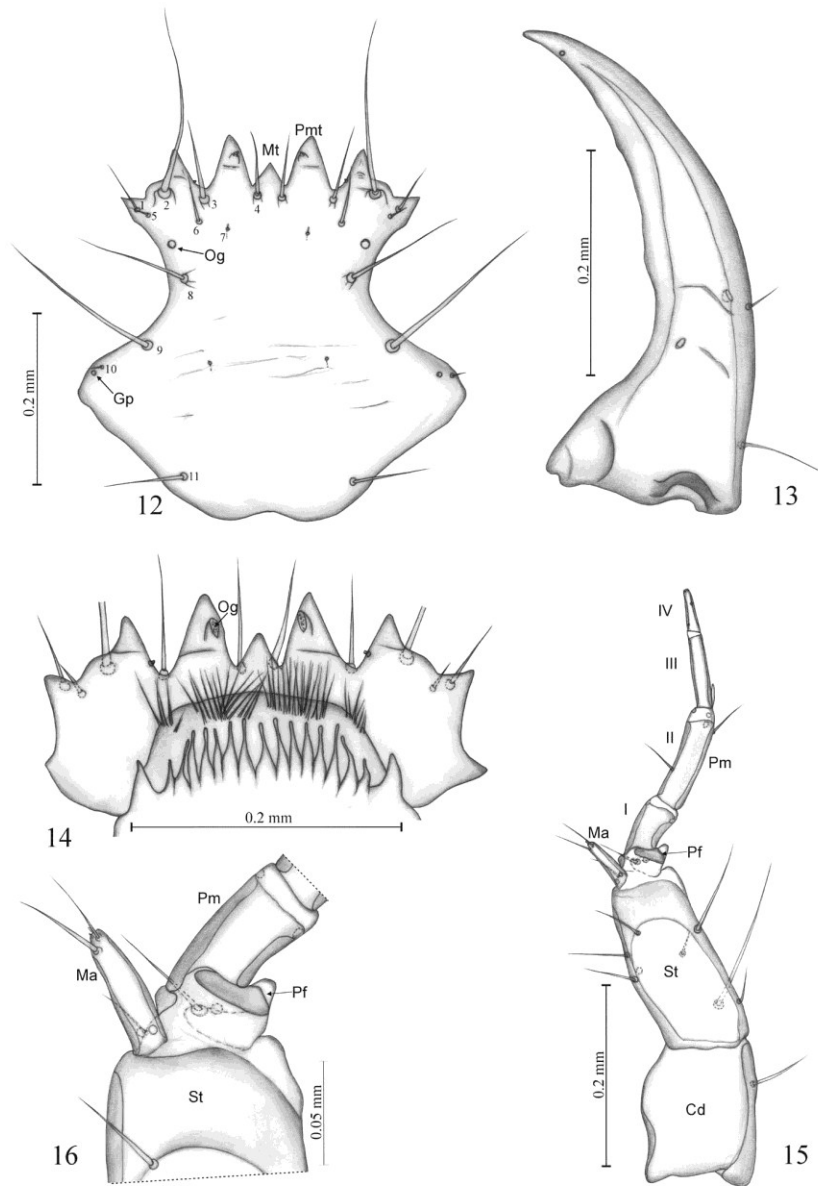
**Foreleg** (Figs 20, 21): coxa (Cx) with 17 setae, trochanter (Tr) with 9 setae, femur (Fe) with 25 setae: 15 spine-shaped of different length on ventral side generally, 10 microsetae on dorsal side (15-25) and 2 pores (a, b); tibia (Tb) with 18 spine-shaped setae of different length and 3 microcuticular processes at the apex (Fig. 21), tibial comb rudimentary, consisting of only 1 seta (code: 16); tarsungulus (Tu) with 3 spine-shaped setae. Length ratio of coxa, trochanter, femur, tibia and tarsungulus: 3.1:1.5:3:2.2:1 respectively.

**Thorax** (Figs 2, 22, 23): pro-, meso- and metanotum with anterior and posterior carina and mid-longitudinal ecdysial line; microstructure of carina as in Fig. 22A. Pronotum (Fig. 22) with 50-52 setae (40 macro, 10-12 micro), several pores and a pair of probably coeloconic sensillum (Cs) (Fig. 22B); meso- and metanotum (Fig. 22) with similar chaetotaxy, each with 46-50 setae (30 macro and 16-20 micro), 10-12 pores and a pair of probably coeloconic sensilla (Cs) anteriorly (Fig. 22C). Cervicosternum (Cr) (Fig. 23) triangular with 6 setae and 2 pores. Prosternal area with 2 quadrangular sternites (Sn), each with one seta; surface between sternites with 4 microsetae, and that between cervicosternum (Cr) and sternites (Sn) with 6 setae and 4 pores.

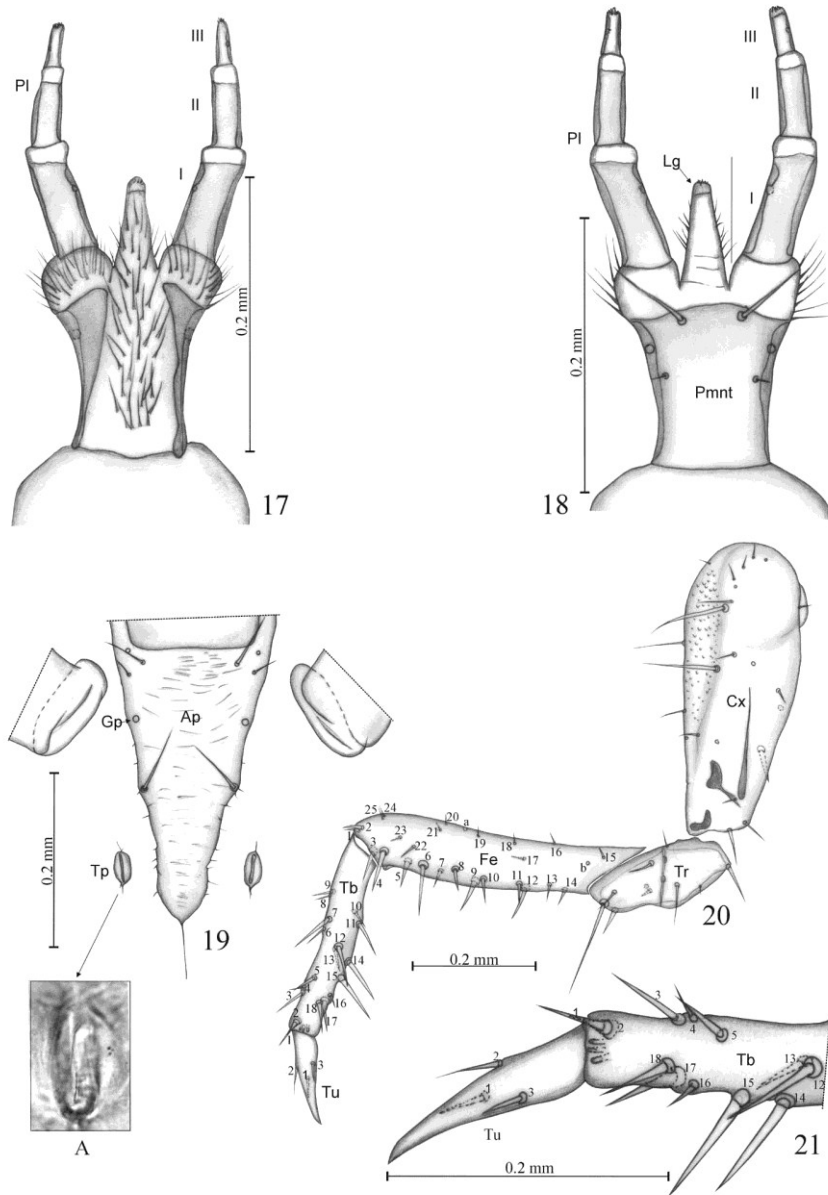
**Abdomen** (Figs 2, 24-31): segments I-VIII each with tergite (Te) and sternite (St), a pair of paratergites (Pt) and a pair of parasternites (Ps) laterally; on segment I paratergites and parasternites fused (Fig. 27); on segments II-VIII paratergites divided into two parts: large anterior and tiny posterior (Fig. 26); tergites and sternites of abdominal segments I-VII divided into two parts by membranous, longitudinal area (Figs 24, 25). Segment I: tergites with 34-36 simple setae (16 macro, 16 micro) and 2 rod-shaped and frayed setae (code: 19), 8 pores (a-d) and a pair of campaniform sensilla (Ca) (Figs 25, 25B); sternites with 22 simple setae and 4 pores (a, b) (Fig. 24); fused paratergite and parasternite on each side with 7 setae (5 rod-shaped, 2 simple). Segments II-VIII: tergites with 44 setae: 30 macro rod-shaped and frayed, 4 macro simple (code: 15, 20) and 10 simple micro (code: 1, 4, 8, 9, 13), 4 pores and a pair of campaniform sensilla (Ca) (Figs 25, 25C); sternites with 28 setae: 18 macro rod-shaped and frayed, 2 simple macro (code: 10) and 8 simple micro (code: 2, 4, 5, 9). Tergite and sternite of segment IX with 18 setae, 2 pores and 16-20 setae, 4-6 pores respectively (Figs 28-30). Segment IX with a pair of 2-segmented urogomphi (Figs 30, 31); segment I of urogomphus with 22 setae (14 rod-shaped and frayed, 8 simple) and 1 pore (Fig. 31); segment II with 3 setae (one long apical); length ratio of segments I and II of urogomphus and apical seta: 1.6:1:1.2 respectively; microstructure of urogomphi as in Figs 31A, B. Microstructure of tergites of segments I-IX as in Figs 25A, 30A. Segment X (pygopod), distinctly longer (1.5 times) than segment I of urogomphus and almost as long as segment I and II together; dorsal side with about 20 setae (6 rod-shaped and frayed) and 2 pores (Fig. 28); ventral side with about 26-28 different length simple setae and 4 pores (Fig. 29); Abdominal segments I-VIII, each with a pair of spiracles located between tergites and paratergites.



**Figs 1-11.** *Philonthus lepidus*, mature larva. 1 – general aspect; 2-7 – simple macrosetae of pronotum (2), rod-shaped and apically frayed setae of abdominal tergite II (3), V (4), VII (5, 6), bifurcate setae of urogomphus (7); 8 – microseta of abdominal tergite VII; 9 – head, dorsal aspect; 9A – gland; 9B – stemmata; 10 – apical part of right antenna, dorsal aspect; 11 – right antenna, dorsal aspect. Abbreviations: E – epicranial part, Gl – gland, Gp – glandular pit, Na – nasale, P – posterior part, Sa – sensory appendage, So – solenidia, I-IV – antennal segments, 1, 2... – code of setae, a-f – code of pores.

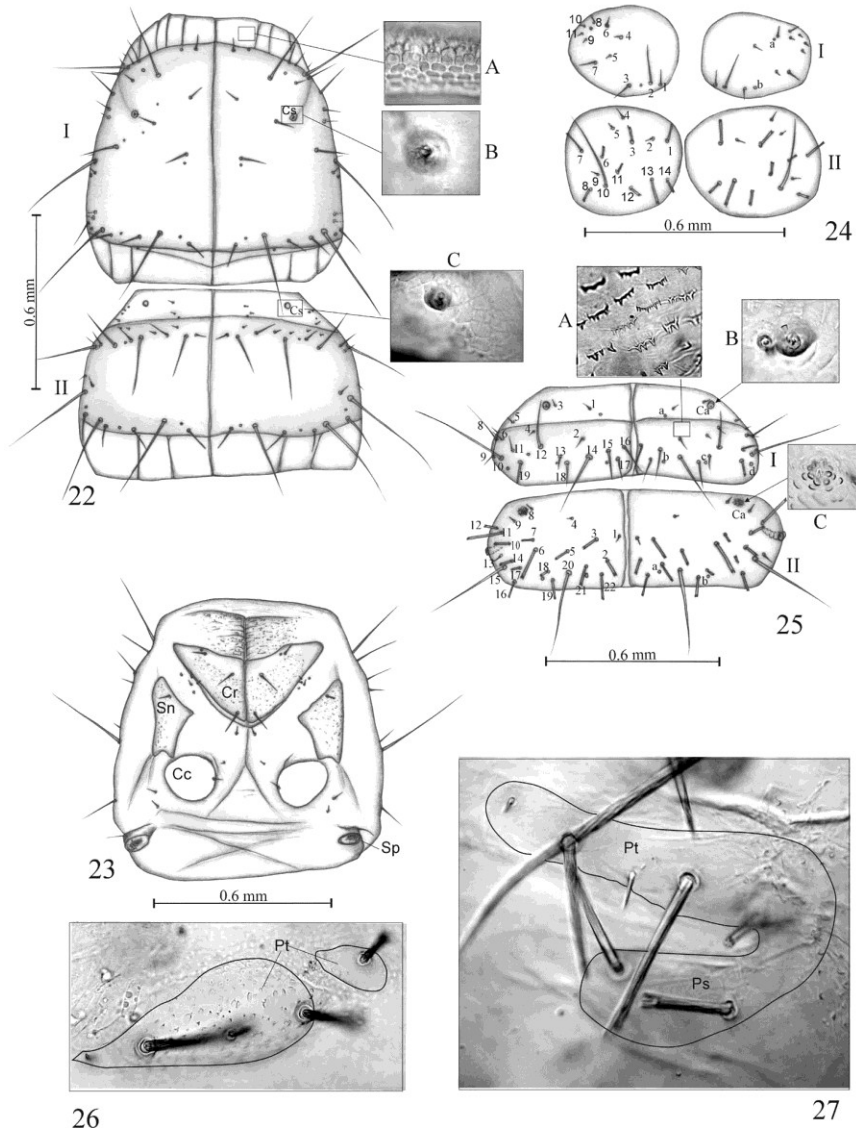


**Figs 12-16.** *Philonthus lepidus*, mature larva. 12 – nasale, dorsal aspect; 13 – right mandible, dorsal aspect; 14 – epipharynx; 15 – right maxilla, dorsal aspect; 16 – anterior part of stipes, dorsal aspect. Abbreviations: Cd – cardo, Gp – glandular pit, Ma – mala, Mt – median tooth, Og – olfactory organ, Pf – palpiger, Pm – maxillary palp, Pmt – paramedian tooth, St – stipes, I-IV – segments of maxillary palp.



**Figs 17-21.** *Philonthus lepidus*, mature larva. 17 – hypopharynx; 18 – labium, ventral aspect; 19, 19A – apotome (Ap) and tentorial pits (Tp); 20 – foreleg, anterior aspect; 21 – anterior part of fore tibia with tarsungulus.

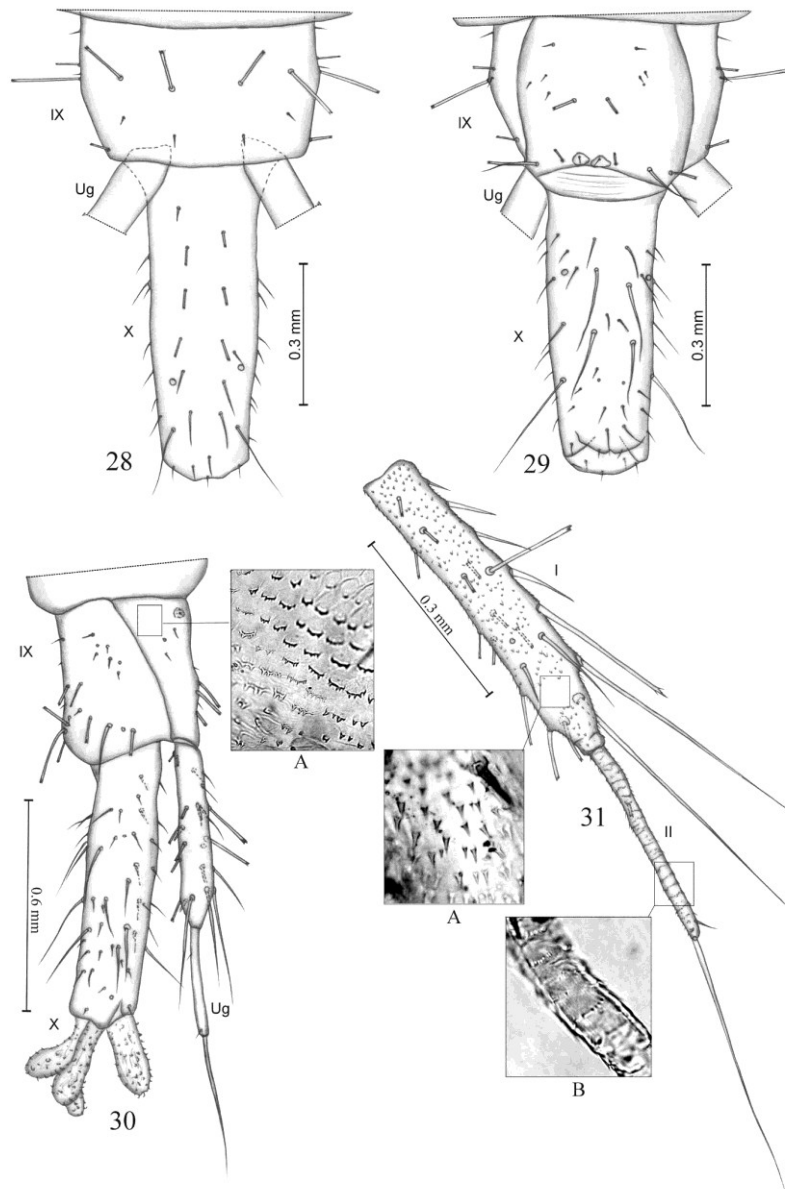
Abbreviations: Ap – apotome, Cx – coxa, Fe – femur, Gp – glandular pit, Lg – ligula, PI – labial palp, Pmnt – prementum, Tb – tibia, Tp – tentorial pit, Tr – trochanter, Tu – tarsungulus, 1, 2 ... – code of setae, a, b – code of pores, I-III – segments of labial palp.



**Figs 22-27.** *Philonthus lepidus*, mature larva. 22 – pronotum (I) and mesonotum (II), dorsal aspect; 22A – microstructure of pronotum carina; 22B, C – coeloconic sensillum of pronotum and mesonotum; 23 – prothorax, ventral aspect; 24 – abdominal sternites I and II; 25 – abdominal tergites I and II with microstructure (25A); 25B, C – coeloconic sensillum of tergite I and II; 26 – divided paratergites of abdominal segment II; 27 – fused paratergite (Pt) and parasternite (Ps) of abdominal segment I.

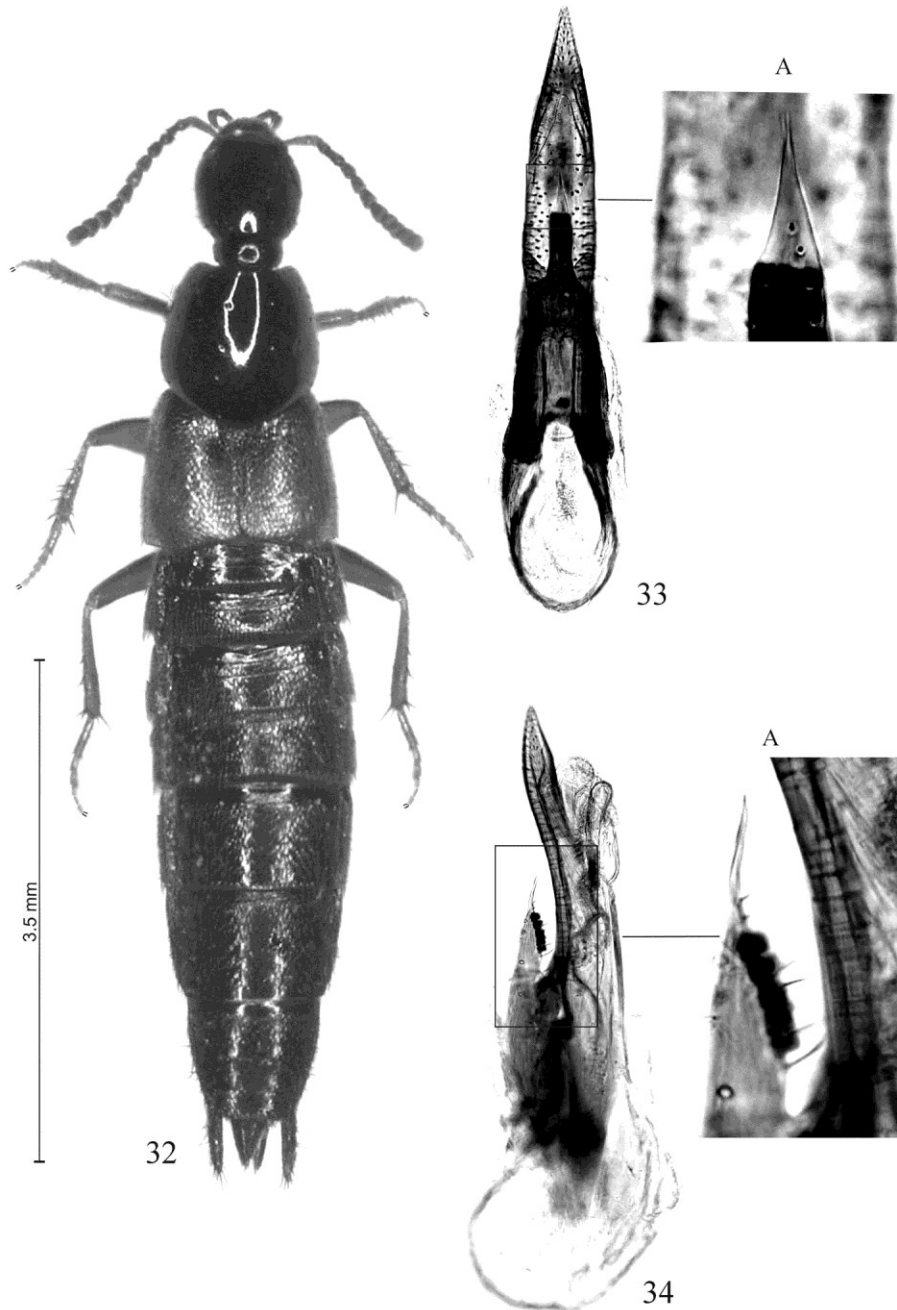
Abbreviations: Ca – coeloconic sensilla, Cc – coxal cavity, Cr – cervicosternum, Cs – coeloconic sensillum, Ps – parasternite, Pt – paratergite, Sn – sternite, Sp – spiracle, 1, 2, ... – code of setae, a, b ... – code of pores.





**Figs 28-31.** *Philonthus lepidus*, mature larva. 28 – Abdominal segment IX and X, dorsal aspect; 29 – abdominal segment IX and X, ventral aspect; 30 – abdominal segment IX and X, lateral aspect with microstructure of tergite IX (30A); 31 – right urogomphus with microstructure of segment I (31A) and II (31B), dorsal aspect.

Abbreviation: Ug – urogomphus.



**Figs 32-34.** *Philonthus lepidus*, adult. 32 – habitus; 33 – aedeagus with the upper part of a paramera (33A), ventral aspect; 34 – aedeagus with the upper part of a paramera (34A), lateral aspect.

## TAXONOMIC REMARKS

The known mature larvae of *Philonthus* are in general distinguished by the combination of the following, diagnostic characters (BOLLER 1983, CHANI-POSSE 2006, KASULE 1970, KRANEBITTER & SCHATZ 2002, POTOTSKAYA 1967, TOPP 1978): 1. Head capsule more or less parallel-sided, elongate or quadrate, with four stemmata on each side; 2. Head with median epicranial suture and distinct neck; 3. Labrum fused with the fronto-clypeal region to form nasale, bearing nine teeth on anterior margin, second lateral teeth distinctly rounded, paramedian teeth longer than median tooth; 4. Epipharynx with four bunches of hairs anteriorly and a row of cuticular processes posteriorly; 5. Apotome extending to or beyond tentorial pits; 6. Third antennal segment with sensory appendage usually not more than half as long as terminal segment; 7. Maxillary and labial palps 4- and 3-segmented respectively; 8. Mala articulated; 9. Mala usually distinctly shorter than first segment of maxillary palp; 10. Ligula conical, usually narrower or at most as wide as first segment of labial palp; 11. Tibial comb, when present in second and third instar larvae, of simple setae; 12. Abdomen with numerous rod-shaped and frayed setae; 13. Second and third instar larvae with three setae on tarsungulus, first instar larvae with two setae; 14. Paratergites and parasternites on I abdominal segment fused; 15. Paratergites on II abdominal segment divided into two sclerites; 16. Urogomphi usually long, longer or as long as pygopod.

The key given below for eight species of *Philonthus* STEPHENS, associated with cattle dung (CHANI-POSSE 2006), is based on morphological characters. Some alterations have been made to the original version to include the following six species – *Ph. aerosus*, *Ph. fumarius*, *Ph. nigrita*, *Ph. lepidus*, *Ph. punctus* and *Ph. rubripennis* – described by KRANEBITTER & SCHATZ (2002), PIETRYKOWSKA-TUDRUJ & STANIEC (2006), STANIEC & PIETRYKOWSKA-TUDRUJ (2007a, 2008a, b).

Explanation: x\* – new statement, x\*\* – altered statement

- 1\*. Segment I of urogomphi longer than pygopod, protibia on inner side with comb of more than 5 short, spine-like setae (Figs 12, 14; KRANEBITTER & SCHATZ 2002) ..... *Philonthus aerosus* KIESW.  
 – Segment I of urogomphi shorter than pygopod, protibia on inner side with comb of less than 4 short, spine-like setae or comb absent (Figs 23, 31; STANIEC & PIETRYKOWSKA-TUDRUJ 2008b) ..... 1\*\*  
 1\*\*. Apotome extending behind tentorial pits (Fig. 23; CHANI-POSSE 2006); antennal segment III with sensory appendage (Sa) no more than half as long as segment IV (Figs 27, 62, 72a, 80a; CHANI-POSSE 2006)..... 1a\*\*  
 – Apotome extending to tentorial pits but not extending behind them; antennal segment III with sensory appendage (Sa) more than half as long as segment IV (Figs 5a, 17a, 43, 53;

- CHANI-POSSE 2006)..... 5
- 1a\*\*. Apex of ligula (Lg) not reaching medial campaniform sensillum of segment I of labial palp (Figs 29, 65, 82a; CHANI-POSSE 2006)..... 2
- . Apex of ligula (Lg) reaching medial campaniform sensillum of segment I of labial palp (Fig. 18; Fig. 26; STANIEC & PIETRYKOWSKA-TUDRUJ 2007a)..... 1b\*
- 1b\*. Epipharynx with 25 or less cuticular processes in horizontal row, width of head capsule smaller: 0.70-0.77 mm (Fig. 14)..... 1c\*
- . Epipharynx with more than 25 cuticular processes in horizontal row, width of head capsule larger: 0.88-1.02 mm (Fig. 16; STANIEC & PIETRYKOWSKA-TUDRUJ 2008b)..... 1d\*
- 1c\*. Urogomphi longer than pygopod, segment I of maxillary palp shorter than segment III, paramedian teeth (Pmt) about 2.1 times as long as median tooth (Mt), epipharynx with 16 cuticular processes; biotopes: exposed areas and insolated slopes, on sandy and limestone soil..... *Ph. lepidus* (GRAV.)
- . Urogomphi as long as or slightly shorter than pygopod, segment I of maxillary palp longer than segment III, paramedian teeth (Pmt) about 2.7-3 times as long as median tooth (Mt), epipharynx with 20 cuticular processes; biotopes: exposed sandy or clayey banks of water bodies..... *Ph. rubripennis* STEPH.
- 1d\*. Protibial comb with 4 short, spine-like setae, larva larger, body length: 9.10-10.7 mm; biotopes: raised and transitional bogs; ecotone between water bodies and surrounding peatbogs..... *Ph. nigrita* (GRAV.)
- . Protibial comb absent, larva smaller, body length: 6.48-8.0; biotopes: muddy shores of swamps and water bodies, decaying plant remains..... *Ph. fumarius* (GRAV.)
- 2\*\*. Setae basal to malar sensillum, no more than twice as long as malar sensillum (Figs 28, 63; CHANI-POSSE 2006); median seta of urogomphal segment II at basal fourth (Figs 39, 68; CHANI-POSSE 2006)..... 3
- . Setae basal to malar sensillum, more than twice as long as malar sensillum (Figs 73, 81; CHANI-POSSE 2006); median seta of urogomphal segment II at basal third (Fig. 76)..... 2a\*\*
- 2a\*\*. Urogomphi longer than pygopod..... 4
- . Urogomphi as long as pygopod..... *Ph. punctus* (GRAV.)

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