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A description of the pupae of *Philonthus umbriatilis* (GRAVENHORST, 1802), *Ph. lepidus* (GRAVENHORST, 1802) and *Bisnius* (= *Philonthus* sensu lato) *nitidulus* (GRAVENHORST, 1802) (Coleoptera: Staphylinidae)

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ABSTRACT. The pupae of *Philonthus umbriatilis* (GRAV.), *Ph. lepidus* (GRAV.) and *Bisnius nitidulus* (GRAV.) are described and illustrated for the first time. The differences in morphological structure between the examined pupae are presented. A modification of an identification key to known pupae of Central European *Staphylininae* is also proposed.

Key words: entomology, *Coleoptera*, *Staphylinidae Philonthus*, *Bisnius*, *umbriatilis*, *lepidus*, *nitidulus*, morphology, pupa.

INTRODUTION

The pupae of the *Philonthus* CURTIS are still poorly known. Among about 1300 described species of *Philonthus* in the world, actually only the pupae of about 20 species are known (VERHOEFF 1918, MANK 1923, SZUJECKI 1965, EGHTEDAR 1970, TAWFIK et al. 1976a, b, c, PRINS 1984, BYRNE 1993, STANIEC 1999, 2001, 2002, 2003). However, even the existing descriptions are often fragmentary and require detailed supplements. In order to determine the pupae of individual *Philonthus* species (and species of other closely related genera as well) correctly, the following diagnostic, morphological features should be considered: measurements, general view of the body, number, structure and length of setiform projections on pronotum and abdomen, microstructure of abdominal tergites, absence or presence and structure of ventral prolongations in the female pupa, structure of

terminal prolongations, structure of functional and atrophied spiracles (STANIEC 1999, 2001, 2002, 2003).

Philonthus umbriatilis is a widely distributed species, known from Europe, Tunisia, Canary Islands, Madeira, Azores, Russia, Caucasus, Canada and USA. KOCH (1989) defined it as an eurytopic, hygrophilous, and phytodetriticolous species. It occurs on swampy soils, moist fields and meadows, in moss, rotten plant remains, compost, excrements, and carrion.

Ph. lepidus and *Bisnius nitidulus* are similar in their distribution (Europe, Russia, Kazakhstan, Mongolia and China), and habitat requirements as well. Therefore they are often found together. Both are stenotopic staphylinids, occur on exposed areas and insolated slopes, specially on sandy and limestone soils. They are found in rotten plant remains, excrements, and under stones. In literature the first one is defined as a thermophilous, xerophilous, psamophilous and phytodetriticolous species. The second one is regarded as a psammobiontic and phytodetriticolous taxon (BURAKOWSKI at al. 1980, KOCH 1989). Formerly it was included in the *Philonthus* genera. Now, according to HERMAN's (2001) taxonomic classification the use of *Bisnius nitidulus* (GRAVENHORST) is a valid name. The pupae of the three above mentioned species have not been described up to date.

MATERIAL EXAMINED

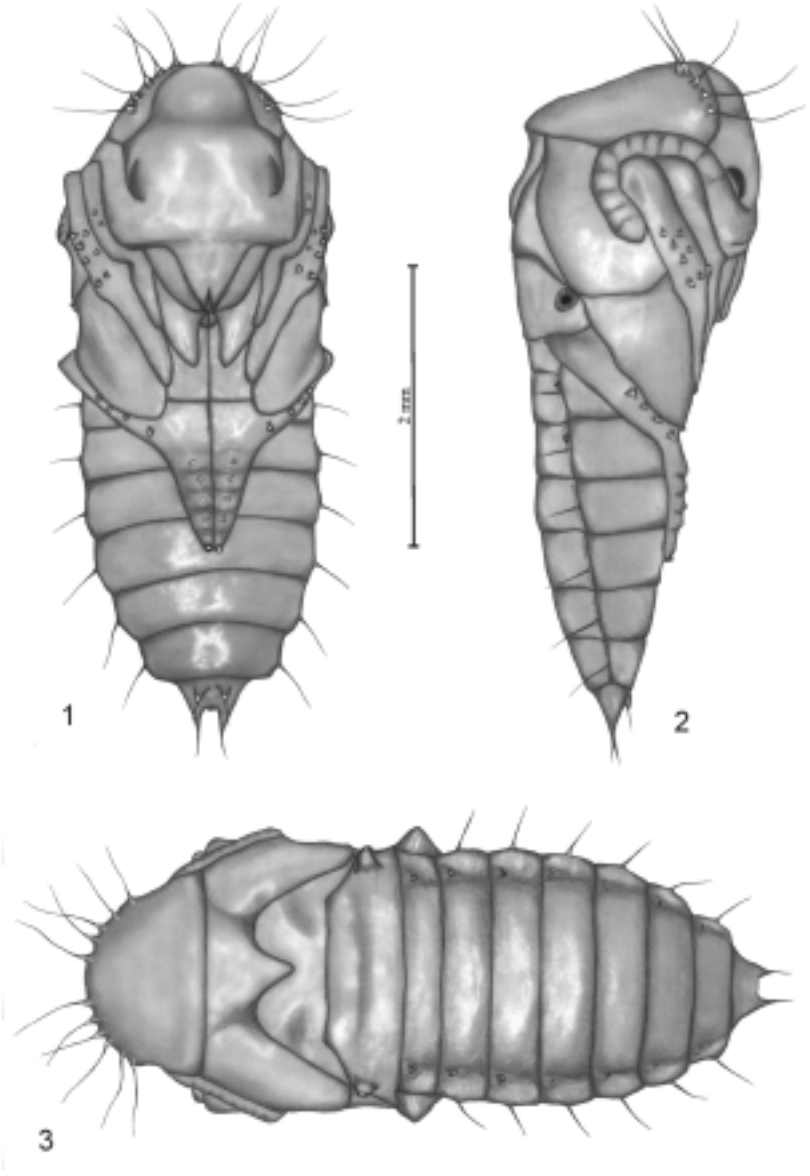
Philonthus umbriatilis: 5 pupae (3 ♂♂); *Ph. lepidus*: 8 pupae (4 ♂♂); *Bisnius nitidulus*: 8 pupae (5 ♂♂).

Eleven mature larvae of *Ph. umbriatilis* together with a few adults were collected by the second author in Samoklęski near Lublin (the central part of eastern Poland) on the 10th of July 2003. They were obtained by sifting building material of the nest of a bittern (*Botaurus stellaris*) which was simmering on a pond. Five larvae were reared to pupation (13-15th July), and then three to adults. The examined pupae of *Ph. lepidus* and *B. nitidulus* were obtained by rearing adults in room temperature. The mature individuals of both species were collected (using Barber's traps) in the first decade of May 2003 in the xerothermic areas in Ciechanki Łańcuchowskie near Lublin, and Gródek near Zamość (the central part of eastern Poland). In laboratory the pupation of *Ph. lepidus* was observed from the 27th of May until the 1st of June, and the pupation of *B. ntidulus* was recorded from the 28th until the 30th of May. Imagines of all examined species were determined by the first author. Total drawings of alive pupae were made. For more detailed studies, fragments of pupal exuvia were used.

DESCRIPTIONS

Philonthus umbriatilis (GRAVENHORST, 1802)

Body length: 4.60-4.90 mm (mean 4.70 mm); width in widest place (between hind knees): 1.96-2.10 mm (mean 2.00 mm); head width (between eyes): 1.10-

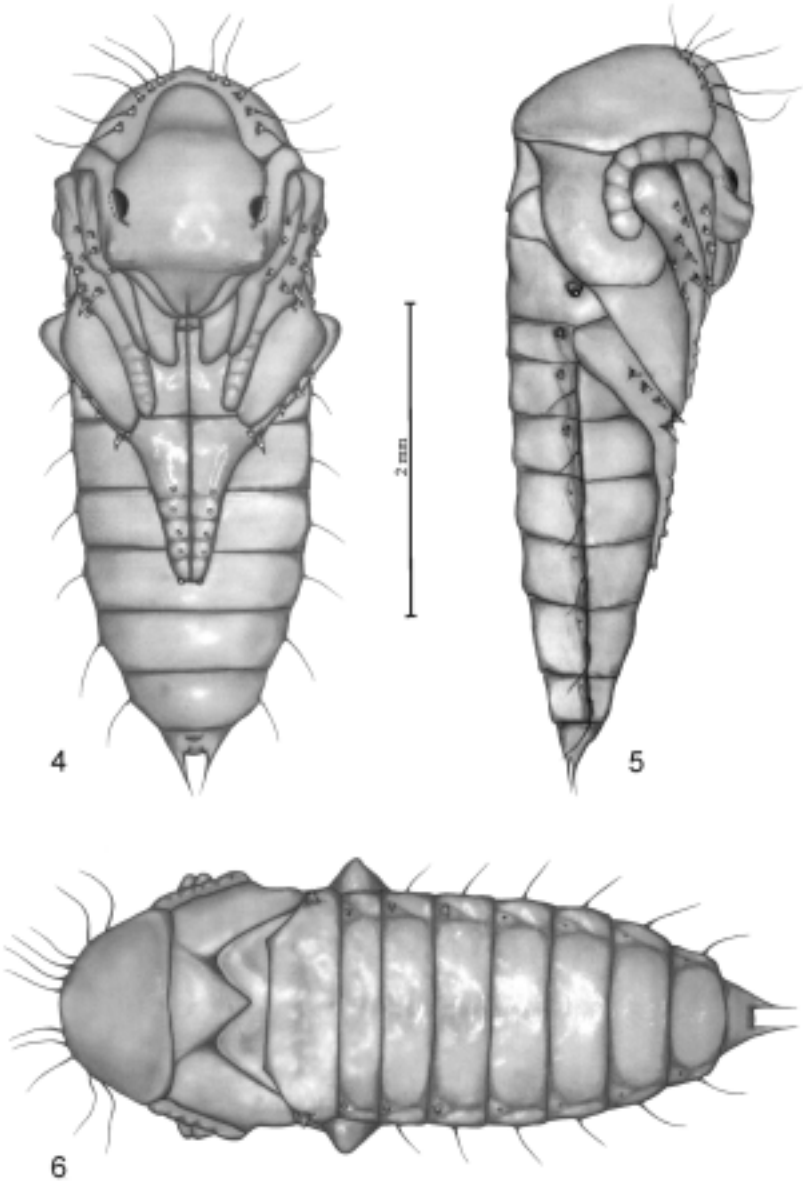


1-3. Pupa of *Philonthus umbriatilis*. 1 - ventral aspect; 2 - lateral aspect; 3 - dorsal aspect

1.20 mm (mean 1.12 mm); 1.1-1.2 times as long as broad; pronotum width in widest place: 1.37-1.46 mm (mean 1.44 mm), about 1.1 times as long as broad at the base. Colour from dark yellow just after pupation to yellowish brown with darker edges, body relatively stocky (Figs 1-3). Antennae reaching two thirds of length of the shortened elytra (Fig. 2). Anterior margin of pronotum with 9-12 setiform projections (looking from ventral side 5/6, 6/5, 6/6, 4/5, 6/5, 6/5 projections on sides). Wings reaching the posterior margin of the first (actually the 3rd) well visible abdominal sternite. Each fore, middle and hind tibiae with 2, 7 and 4 well visible outlines of protuberances, respectively. Hind tarsi distinctly protruding half of length of 4th (actually 6th) well visible abdominal sternite (Fig. 1). Abdomen narrowed below sternite V (Fig. 3). Abdominal tergite I nearly twice longer than the second tergite. Segments III-VIII, each bearing a pair of long setiform projections on sides. All setiform projections with numerous, tiny cuticular processes occurring on the greater part of projections (Figs 10, 12). Segments III-VI only slightly longer (1.1-1.2 time) than setiform projections on sides. Setiform projections of segments VII and VIII somewhat longer than others. Structure of IX sternite in male pupa as in Fig. 15. In female pupa sternite IX (Figs 16, 20) with well-developed two ventral prolongations (Vp); terminal abdominal prolongation (Tp) in the greater part with numerous, relatively long, sharp cuticular processes (Figs 16, 17). Structure functional and atrophied spiracle as in Figs 23, 26.

Philonthus lepidus (GRAVENHORST, 1802)

Body length: 3.42-4.60 mm (mean 4.30 mm); width in widest place (between hind knees): 1.78-2.00 mm (mean 1.90); head width (between eyes): 0.87-0.95 mm (mean 0.90 mm); about 1.3 times as long as broad; pronotum width in widest place: 1.26-1.38 mm (mean 1.29 mm), about 1.1 times as long as broad at the base. Colour from dark yellow just after pupation to yellowish brown with darker edges, body relatively slender (Figs 4-6). Antennae reaching two thirds of length of the shortened elytra (Fig. 5). Anterior margin of pronotum with 8-13 setiform projections (looking from ventral side 7/6, 6/5, 6/5, 5/5, 7/6, 4/4, 5/5, 6/6 projections on sides). Wings distinctly protrude beyond the posterior margin of the first (actually the 3rd) well visible abdominal sternite. Tibiae with relatively strongly protruding, sharp protuberances (on middle and hind tibiae specially); fore, middle and hind tibiae, each with 3, 8 and 4 protuberances respectively. Hind tarsi reaching the half of length of 4th (actually 6th) well visible abdominal sternite (Fig. 4). Abdomen narrowed below segment V, relatively slender (Fig. 6). Abdominal tergite I twice longer than the second tergite. Segments III-VIII, each bearing a pair of long setiform projections on sides. All setiform projections with relatively sparse, tiny cuticular processes occurring on the greater part of projections (Figs 11, 13). Segments III-VI 1.1-1.3 times longer than setiform projections on sides. Setiform projections of segments VII and VIII usually longer than others, nearly as long as segments. Structure of IX sternite in male and female pupa similar, as in



4-6. Pupa of *Philonthus lepidus*. 4 - ventral aspect; 5 - lateral aspect; 6 - dorsal aspect.

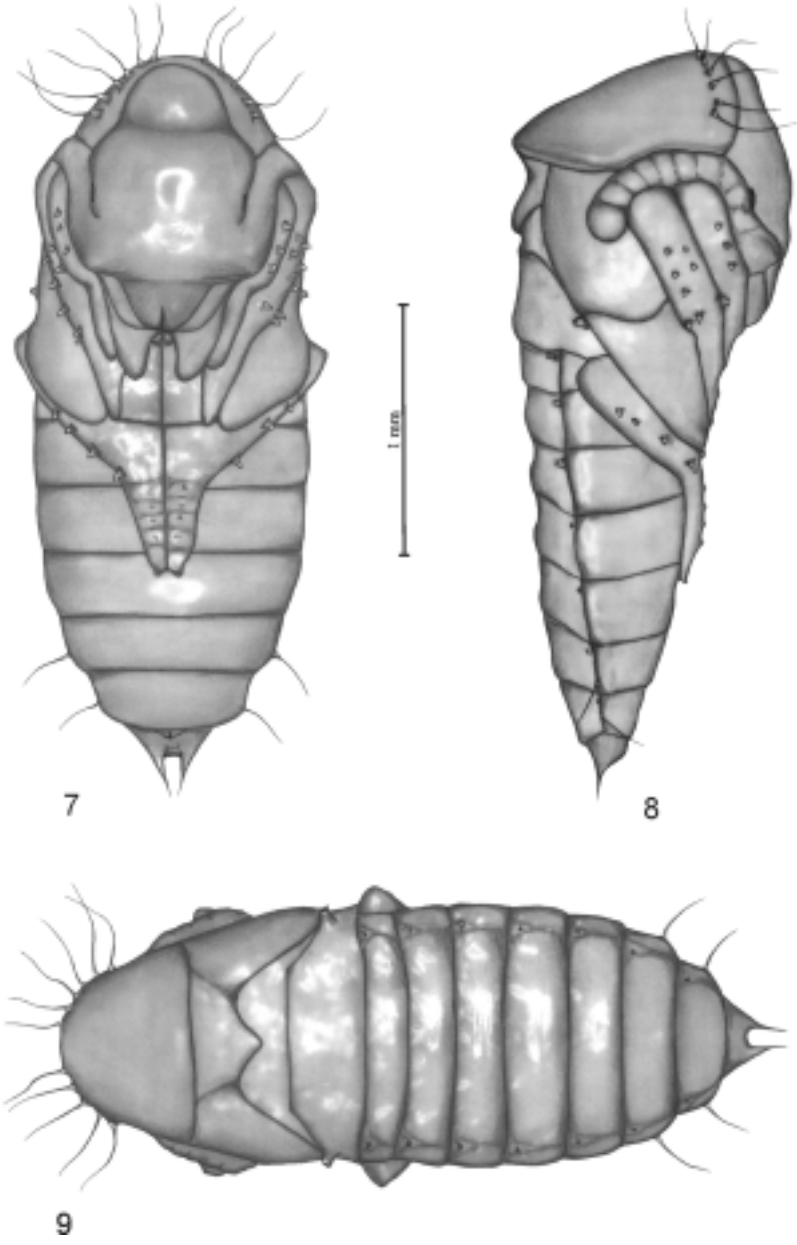
Figs 15 and 16. In female pupa ventral prolongation of IX sternite as in Fig. 21; terminal abdominal prolongation only in terminal part with long, sharp cuticular processes (Fig. 18). Structure functional and atrophied spiracle as in Figs 24, 27.

Bisnius (= *Philonthus* sensu lato) *nitidulus* (Gravenhorst, 1802)

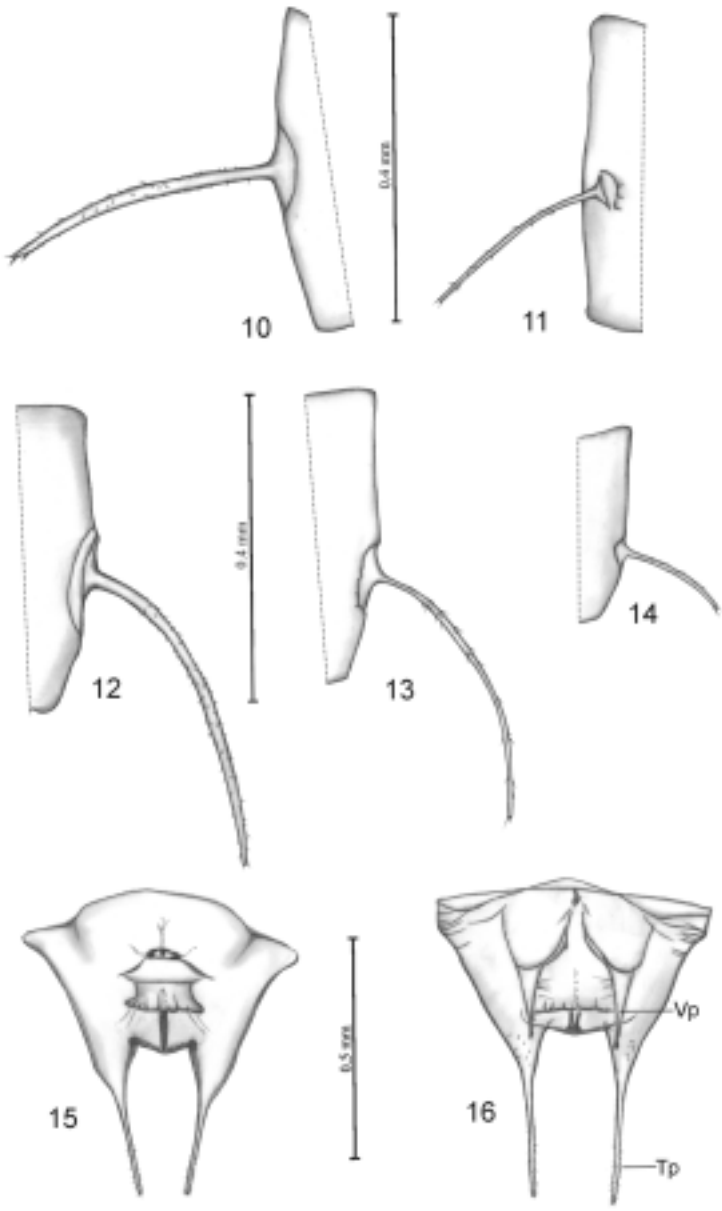
Body length: 2.65-3.00 mm (mean 2.81 mm); width in widest place (between hind knees): 1.12-1.27 mm (mean 1.18 mm); head width (between eyes): 0.59-0.63 mm (mean 0.60 mm); about 1.4 times as long as broad; pronotum width in widest place: 0.76-0.81 mm (mean 0.80 mm), about 1.1 times as long as broad at the base. Colour from light yellow just after pupation to dark yellow with darker edges, body relatively stocky (Figs 7-9). Antennae almost reaching half of length of the shortened elytra (Fig. 8). Anterior margin of pronotum with 8-11 setiform projections (looking from ventral side 6/5, 5/5, 5/5, 4/4, 4/4, 4/5, 5/4, 5/5 projections on sides). Wings slightly protrude beyond the posterior margin of the first (actually 3rd) well visible abdominal sternite. Tibiae with well visible outlines of protuberances; fore, middle and hind tibiae with 3, 8, 4 protuberances, respectively. Hind tarsi distinctly protrude beyond anterior margin of 4th (actually 6th) well visible abdominal sternite (Figs 7, 8). Abdomen gradually and slightly widened to segment IV, and then narrowed below this segment to the terminal part of the body (Fig. 9). Abdominal tergite I about twice longer than the second tergite. Segments VII and VIII each bearing a pair of long setiform projections on sides. Setiform projections at least longer than half of length of segments, with a few, very tiny cuticular processes (Fig. 14). Structure of IX sternite in male and female pupa similar, as in Figs 15 and 16. In female pupa ventral prolongation of IX sternite as in Fig. 22; terminal abdominal prolongation only in terminal part with sparse, sharp cuticular processes (Fig. 19). Structure functional and atrophied spiracle as in Figs 25, 28.

CONCLUDING REMARKS

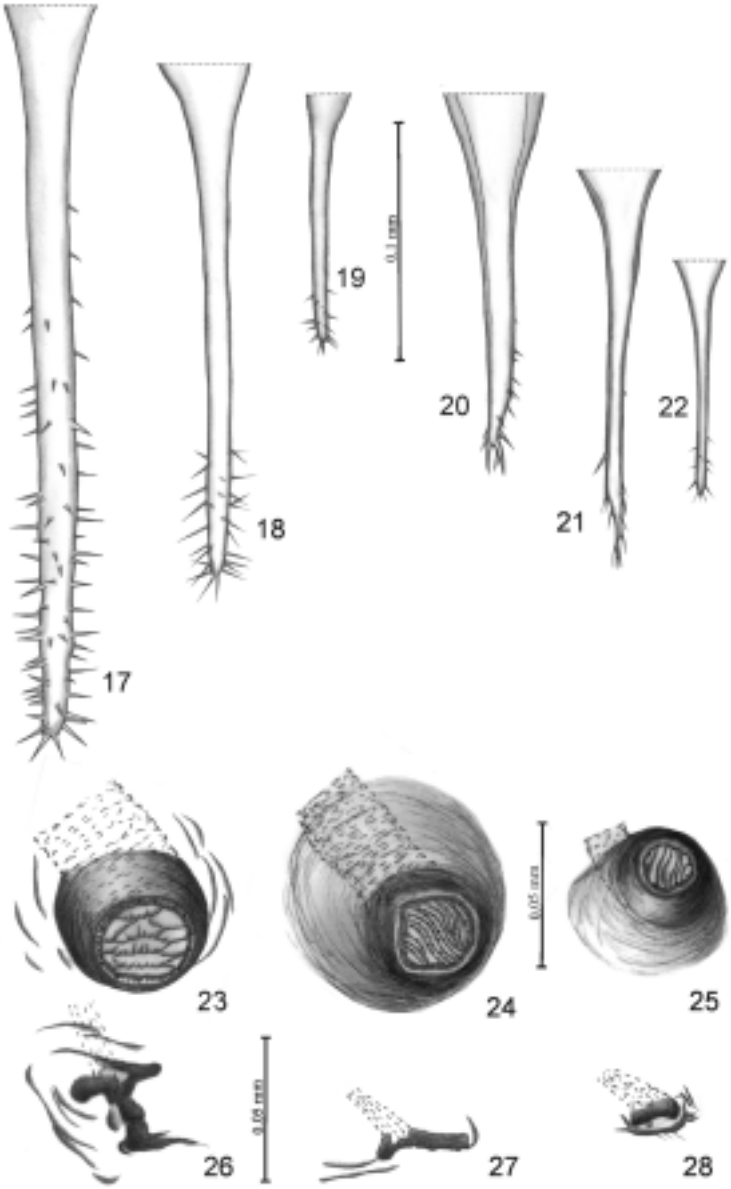
The combination of the most important, diagnostic characters of the pupae of *Ph. umbriatilis* (P.u), *Ph. lepidus* (P.l) and *B. nitidulus* (B.n) is as follows: (1) body length: 4.60-4.90 mm (P.u), 3.42-4.60 mm (P.l), 2.65-3.00 mm (B. n); (2) head width: 1.10-1.20 mm (P.u), 0.87-0.95 mm (P.l), 0.59-0.63 mm (B.n); (3) pronotum width: 1.37-1.46 mm (P.u), 1.26-1.38 mm (P.l), 0.76-0.81 mm (B.n); (4) number of setiform projections on pronotum: 9-12 (P.u), 8-13 (P.l), 8-11 (B.n); (5) number of pairs of setiform projections on abdomen: 6 (P.u, P.l), 2 (B.n); (5) antennae length: reaching two thirds of length of elytra (P.u, P.l), reaching half of length of elytra (B.n); (6) protuberances of middle and hind tibiae: moderately protrude (P.u, B.n), strongly protrude (P.l) (Figs 1, 2, 4, 5, 7, 8); (7) structure of ventral and terminal prolongation as in Figs 17-22; (8) structure of spiracles as in Figs 23-28.



7-9. Pupa of *Bisnius nitidulus*. 7 - ventral aspect; 8 - lateral aspect; 9 - dorsal aspect.



10, 11. Lateral margin of abdominal segment VI of *Ph. umbriatilis* (10) and *Ph. lepidus* (11). Figs 12-14. Lateral margin of abdominal segment VII of *Ph. umbriatilis* (12), *Ph. lepidus* (13) and *Bisnius nitidulus* (14). Figs 15, 16. Terminal sternite of *Ph. umbriatilis*: 15 – male, 16 - female (Vp - ventral prolongation, Tp - terminal prolongation).



17-19. Terminal abdominal prolongation (Tp) in pupae of *Ph. umbriatilis* (17), *Ph. lepidus* (18) and *Bisnius nitidulus* (19). Figs 20-22. Ventral abdominal prolongation (Vp) in pupae of *Ph. umbriatilis* (20), *Ph. lepidus* (21) and *Bisnius nitidulus* (22). Functional (23-25) and atrophied (26-28) spiracles in pupae of *Ph. umbriatilis* (23, 26), *Ph. lepidus* (24, 27) and *Bisnius nitidulus* (25, 28)

A key to the identification of the known pupae of the Central European *Philonthini* (STANIEC 2001, 2002, 2003), including pupa of *Ph. umbriatilis, Ph. lepidus and B. nitidulus* is given below.

KEY TO THE PUPAE OF CENTRAL EUROPEAN *PHILONTHINI*

1. Lateral margins of abdomen with 6 pairs of setiform projections ……..... 2.
-. Lateral margins of abdomen bearing 2 pairs of setiform projections ……. 11.
2. Anterior margin of pronotum usually at least with 9 setiform projections. If pronotum with 8 setiform projections, then its width 1.26-1.38 mm, and head width 0.87-0.95 mm ….……..... 3.
-. Anterior margin of pronotum with 8 setiform projections. Body length 3.4-3.5 mm, body width 1.50-1.55 mm, head width 0.7 mm, pronotum width 0.90-0,94 mm. Antennae slightly protrude beyond half of length of the shortened elytra. Tarsi of hind legs almost reaching half of length of 4th visible abdominal sternite. Structure of setiform projections of abdomen, terminal prolongations (spines) and spiracle as in Figs 7, 9, 11, 12 (STANIEC 2002). ……..……. *Philonthus albipes* (GRAV.).
3. Anterior margin of pronotum with 8-13 or 18-22 setiform projections ..… 4.
-. Anterior margin of pronotum with 16 setiform projections. Body length 7.0-8.0 mm. ……..……... *Philonthus cognatus* STEPH.
4. Body length 3.42-4.60 mm ……..…….. 7.
-. Body length 4.55-6.7 mm ..……..……... 5.
5. Body length 4.55-5.18 mm. Anterior margin of pronotum with 9-12 setiform projections ……..……. 6.
-. Body length 5.2-6.7 mm, width 2.3-2.8 mm. Anterior margin of pronotum with 10 setiform projections. ……..... *Philonthus longicornis* STEPH.
6. Abdominal tergites I-VII close to the hind margins with microstructure similar to fish scales (Fig. 10; STANIEC 2003). Abdominal segments III-VI about 2.7 times as long as setiform projections on sides. Setiform projections on sides of abdomen smooth, without cuticular processes (Fig. 12; STANIEC 2003). In female pupa ventral prolongation of sternite IX atrophied (Fig. 17; STANIEC 2003). Structure of terminal prolongations and spiracles as in Figs 20, 23, 26 (STANIEC 2003). Body length 4.55-5.18 mm … *Philonthus corvinus* ER.
-. Abdominal tergites I-VII on the whole surfaces without microstructure similar to fish scales. Abdominal segments III-VI 1.1-1.2 time as long as setiform projections on sides. Setiform projections of sides of abdomen with numerous tiny cuticular processes (Fig. 10). In female pupa ventral prolongation of sternite IX developed (Fig. 16, 20). Structure of terminal prolongations and spiracles as in Figs 17, 23, 26. Body length 4.60-4.90 mm. ……... .....……. *Philonthus umbriatilis* (GRAV.).
7. Anterior margin of pronotum with 18-24 setiform projections …… 10.
-. Anterior margin of pronotum with 8-13 setiform projections ……..…….. 8.

8. Hind tarsi reaching half of length of 4th visible abdominal sternite …..... 9.
-. Hind tarsi almost reaching posterior margin of 4th visible abdominal sternite. Body length 4.30-4.38 mm, width 1.85-1.90 mm, head width 0.80-0.84 mm, pronotum width 1.33 mm. Anterior margin of pronotum with 10 or 11 setiform projections. Abdominal segments III-VI at most twice as long as setiform projections on sides. Structure of setiform projections of abdomen, terminal prolongations (spines) and spiracle as in Figs 8, 10, 13, 14 (STANIEC 2002). ……..…… *Philonthus varians* (PAYK.).
9. Head width 0.78-0.87 mm, pronotum width 1.05-1.19 mm, body width 1.53-1.68 mm. Anterior margin of pronotum with 10 (exceptionally 11) setiform projections. Body length 3.80-4.13 mm. Structure of setiform projections of abdomen, terminal prolongations (spines) and spiracles as in Figs 13, 15, 21, 24, 27 (STANIEC 2003). ……..…….. *Philonthus micans* (GRAV.).
-. Head width 0.87-0.95 mm, pronotum width 1.26-1.38 mm, body width 1.78-2.00 mm. Anterior margin of pronotum with 8-13 setiform projections. Body length 3.42-4.60 mm. Structure of setiform projections of abdomen, terminal prolongations (spines) and spiracles as in Figs 11, 13, 18, 21, 24, 27. ……..…… *Philonthus lepidus* (PAYK.).
10. Anterior margin of pronotum with 22-24 setiform projections. ……. ….....……... *Philonthus decorus* (GRAV.).
-. Anterior margin of pronotum with 18-20 (exceptionally 22) setiform projections. Body length 7.0-7.2 mm, width 3.1-3.3 mm, head width 1.8-1.83 mm, pronotum width 2.0-2.2 mm. …….. *Philonthus succicola* THOMS.
11. Body length 2.65-3.00 mm, width in widest place (between hind knees) 1.12-1.27 mm; head width (between eyes) 0.59-0.63 mm, pronotum width in widest place 0.76-0.81 mm. Structure of terminal prolongations and spiracles as in Figs 19, 25, 28. ……..…….. *Bisnius nitidulus* (GRAV.).
-. Body length 3.9-6.63 mm, width in widest place 1.57-2.59 mm, head width 0.84-1.54 mm, pronotum width 1.12-1.82 ……..……..…… 12.
12. Body length 3.9-4.30 mm, width in widest place 1.57-1.74 mm, head width 0.84-0.91 mm, pronotum width 1.12-1.33 mm. Pronotum with 10 setiform prolongations. Antennae almost reaching half of length of the shortened elytra. Microstructure of abdomen, structure of terminal prolongations and spiracles as in Figs. 3, 5a, 9, 11, 12 (STANIEC 2001). ……..…… .....…… *Philonthus quisquiliarius* (GYLL.).
-. Body length 4.55-6.63 mm, width in widest place 1.92-2.59 mm, head width 0.91-1.54 mm, pronotum width 1.36-1.82 mm. Pronotum with 10 or 14-17 prolongations ……..…….. 13.
13. Anterior margin of pronotum with 10 setiform prolongations. Body length 4.55-4.70 mm, width in widest place 1.92-1.96 mm, head width 0.91-0.94 mm, pronotum width 1.36-1.40 mm. Antennae distinctly protrude beyond half of length of the shortened elytra. Microstructure of abdomen, structure of terminal prolongations and spiracles as in Figs 5b, 10, 13, 14 (STANIEC 2001). ……..…… *Philonthus nigrita* (GRAV.).

-. Anterior margin of pronotum with 14-17 setiform projections. Body length 5.93-6.63 mm, width 2.24-2.59 mm, head width 1.33-1.54 mm, pronotum 1.58-1.82 mm. Structure of setiform projections of abdomen, terminal prolongations and spiracles as in Figs 16, 22, 25, 28 (STANIEC 2003). ……..……..... *Philonthus punctus* (GRAV.).

REFERENCES

BURAKOWSKI, B., MROCZKOWSKI, M., STEFAŃSKA J., 1980. Chrząszcze Coleoptera. Kusakowate - *Staphylinidae*, część 2. Katalog Fauny Polski, Warszawa, **XXIII**, 7: 1-272.

BYRNE, M., 1993. The immature stages of *Philonthus sanamus* TOTTENHAM (Coleoptera: Staphylinidae). African Entomol., **1**: 229-234.

EGHTEDAR, E., 1970. Zur Biologie und Ökologie der Staphyliniden *Philonthus fuscipennis* MANNH. und *Oxytelus rugosus* GRAV. Pedobiologia, **10**: 169-179.

HERMAN, L., H., 2001. Catalog of the Staphylinidae (Insecta: Coleoptera). 1758 to the end of the second Millennium. VI. Staphylininae group (Part 3). Bull. Am. Mus. Nat. Hist., **265**: 3021-3839.

KOCH, K., 1989. Die Käfer Mitteleuropas. Ökologie, 1. Goecke und Evers Verlag, Krefeld: 440 pp.

LUCHT, H., W., 1987. Die Käfer Mitteleuropas-Katalog. Goecke und Evers Verlag, Krefeld. 342 pp.

MANK, H. G., 1923. The biology of the Staphylinidae. Ann. Ent. Soc. Americ,a **16**: 220-237.

PRINS, A. J., 1984. Morphological and biological notes on some South African arthropods associated with decaying organic matter. Part. 2. Ann. South African Mus., **92**: 295-356.

STANIEC, B., 1999. A description of the pupa of *Philonthus succicola* THOMSON,1860 (Coleoptera: Staphylinidae). Pol. Pismo Ent. **68**: 41-46.

—, 2001. A description of the pupae of *Philonthus quisqiliarius* (GYLL.) and *Ph. nigrita* (GRAV.) (Coleoptera: Staphylinidae). Pol. Pismo Ent., **70**: 39-49.

—, 2002. A description of the pupae of *Philonthus albipes* (GRAVENHORST, 1802) and *Ph. varians* (PAYKULL, 1789) (Coleoptera: Staphylinidae: Staphylininae). Genus, **13**: 337-343.

—, 2003. Description of the pupa of *Philonthus corvinus* ERICHSON, 1839, *Ph. micans* (GRAVENHORST, 1802), and *Ph. punctus* (GRAVENHORST, 182)(Coleoptera: Staphylinidae). Genus, **14**: 15-26.

SZUJECKI, A., 1965. Obserwacje nad rozwojem i biologią *Philonthus fuscipennis* MANN. (Coleoptera, Staphylinidae). Fragm. Faun., **12**: 165-175.

TAWFIK, M. F. S, AWADALLAH, K. T., AMMAR, E. D., ABUL-ELA, S. M., 1976a. The life-history of *Philonthus misor* TOTT. (Coleoptera, Staphylinidae). Bull. Soc. ent. Egypte, **60**: 345-356.

—, 1976b. Life-history of the Staphylinid *Philonthus turbidus* ER. Bull. Soc. ent. Egypte, **60**: 357-366.

—, 1976c. On the bionomics of *Philonthus longicornis* STEPH. (Coleoptera: Staphylinidae). Bull. Soc. ent. Egypte, **60**: 379-387.

VERHOEFF, K. W., 1918. Studien Über die Organisation der Staphylinoidea. III. Zur Kenntnis der Staphyliniden-Pappen. Zeit. wiss. Insekt. Biol., **14**: 42-47, 167-171.