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The pupae of *Philonthus politus* (LINNÉ, 1758), *Gabrius astutus* (ERICHSON, 1840) and *Quedius cinctus* (PAYKULL, 1790)
(Coleoptera: Staphylinidae: Staphylininae)

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ABSTRACT. The pupae of *Philonthus politus* (LINNÉ, 1758), *Gabrius astutus* (ERICHSON, 1840) and *Quedius cinctus* (PAYKULL, 1790) are described and illustrated for the first time. The diagnostic morphological characters, including examined species, are mentioned for the known pupae of the genera *Philonthus*, *Gabrius* and *Quedius*.

Key words: entomology, morphology, Coleoptera, Staphylinidae, *Philonthus politus*, *Gabrius astutus*, *Quedius cinctus*, pupa.

INTRODUCTION

The paper is the first report on pupal stage for the three species mentioned above. Among 1255 (19 doubtful) species of *Philonthus* and 789 (3 doubtful) of *Quedius* known in the world, some information on pupal stages of 22 and 15 species, respectively, exist (Tab. 1, 2). For *Gabrius* (337 known species), only pupa of *G. splendidulus* (GRAVENHORST, 1802), species distributed in Europe, Russia, Caucasus, Canada and USA, has been described (PIETRYKOWSKA-TUDRUJ & STANIEC 2007).

Philonthus politus is a very widely spread cosmopolitan species, distributed in Tunisia, Algeria, Morocco, Canary Islands, Madeira, Azores, Iceland, Europe, Russia, Caucasus, Turkey, Iran, Turkmenistan, Kazakhstan, Mongolia, China, India, Canada, USA, Argentina, Chile, New Zeland, Chatham Islands and Australia. In Poland it is a common beetle known from throughout the country. It is defined as a eurytopic and phytodetriticolous species. This staphylinid inhabits organic, rotten remains, mushrooms, carrion and mammal excrements where its adults and larvae prey mainly on larvae of

Diptera. *Gabrius astutus* is known from Europe, Russia, Armenia, Turkey, Lebanon, Turkmenistan, Uzbekistan and Kazakhstan. In Poland it is a rare staphylinid, known only from a few localities, mostly mountain areas. It is a stenotopic, hygrophilous, ripicolous, silvicolous and humicolous species. It inhabits banks of mountain, fast flowing rivers and streams in forests, where occurs in gravel, damp moss, under stones and rotten plants. *Quedius cinctus* is distributed in Tunisia, Algeria, Morocco, Europe, Russia, Georgia, Turkey, Lebanon, Israel and USA. In Poland it is a rather rare beetle, known from a dozen or so localities. It inhabits organic debris and is defined as a eurytopic and phytodetricolous species (BURAKOWSKI *et al.* 1980, KOCH 1989, HERMAN 2001).

METHODS AND MATERIAL EXAMINED

The examined pupae of *Philonthus politus* and *Gabrius astutus* were obtained by rearing adults in room temperature ($20^{\circ}\text{C}\pm 2$). Imagines and different larval instars were fed with ant or fly larvae. A few adults of *Ph. politus* were extracted from a manure heap in the Wola Zarzycka situated ca. 15 km west of Leżajsk (Nizina Sandomierska Lowland, SE Poland) on 11 March 2008. Sixteen adults of *G. astutus* were obtained by sifting wet leaf litter in the forest ecotone zone between the stream flowing in the deep ravine and surrounding deciduous shaded forest. The insects were collected in the valley of Vistula river in the vicinity of Kazimierz Dolny (Wyżyna Lubelska Upland, SE Poland) on 30 April 2009. The pupations of *Ph. politus* and *G. astutus* in the laboratory were observed from 16 April to 15 May 2008 and on 6 June 2008 respectively. Fifteen pupae and 2 adults of *Quedius cinctus* were collected in Lublin (SE Poland, Wyżyna Lubelska Upland) on 16 April 2009. They were obtained by sifting heap of rotten leaves in the garden. Then four collected pupae were reared ($20^{\circ}\text{C}\pm 2$) to the adults (23-26 April). Adults of all three examined species were identified by the second author. The total drawings were made using alive pupae. For more detailed studies, fragments of pupal exuviae were used.

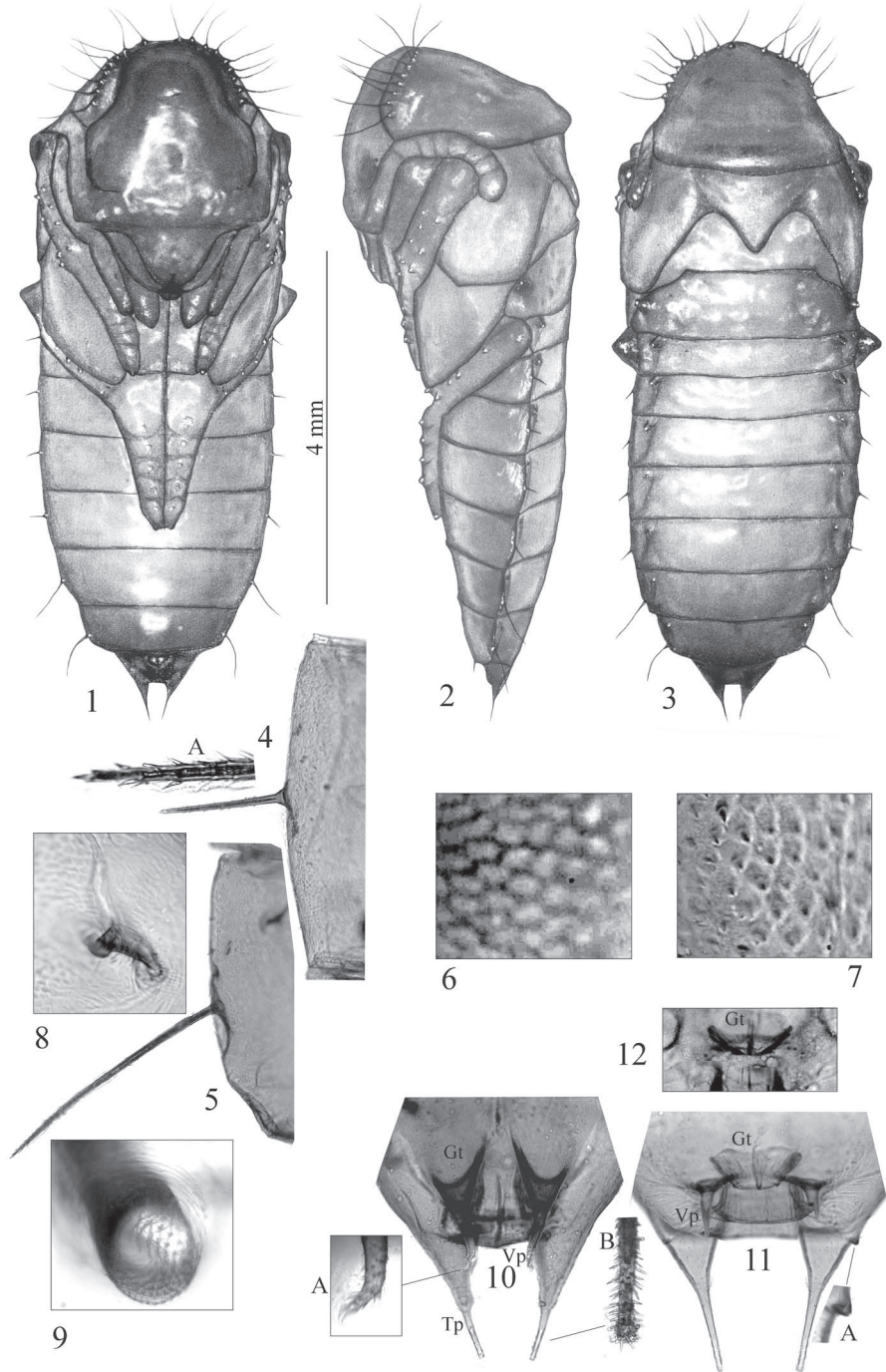
Material examined: *P. politus* - 10 pupae (5♂♂, 5♀♀), reared from adults in the laboratory; *G. astutus* - 10 pupae (6♂♂, 4♀♀), reared from adults in the laboratory; *Q. cinctus* - 11 pupae (9♂♂, 2♀♀), reared from larvae collected in the field.

DESCRIPTION

Philonthus politus (LINNÉ, 1758)

(Figs 1-12)

1-12 (see next page). Pupa of *Philonthus politus*. 1 - ventral aspect; 2 - lateral aspect; 3 - dorsal aspect; 4 - lateral margin of abdominal segment IV with setiform projection and its detailed structure (4A); 5 - lateral margin of abdominal segment VII; 6 - microstructure of abdominal tergites in the vicinity of spiracles; 7 - microstructure of central part of abdominal tergites; 8 - atrophied spiracle of abdominal segment V; 9 - functional spiracle of abdominal segment III; 10 - terminal sternite of female pupa with detailed structure of apical part of ventral prolongation (Vp) (10A) and terminal prolongation (Tp) (10B) (Gt - gonotheca); 11, 12 - terminal sternite of male pupa with short thorn-like ventral prolongation (Vp) (11) and without ventral prolongation (12) (Gt - gonotheca, 11A - bump laterally)



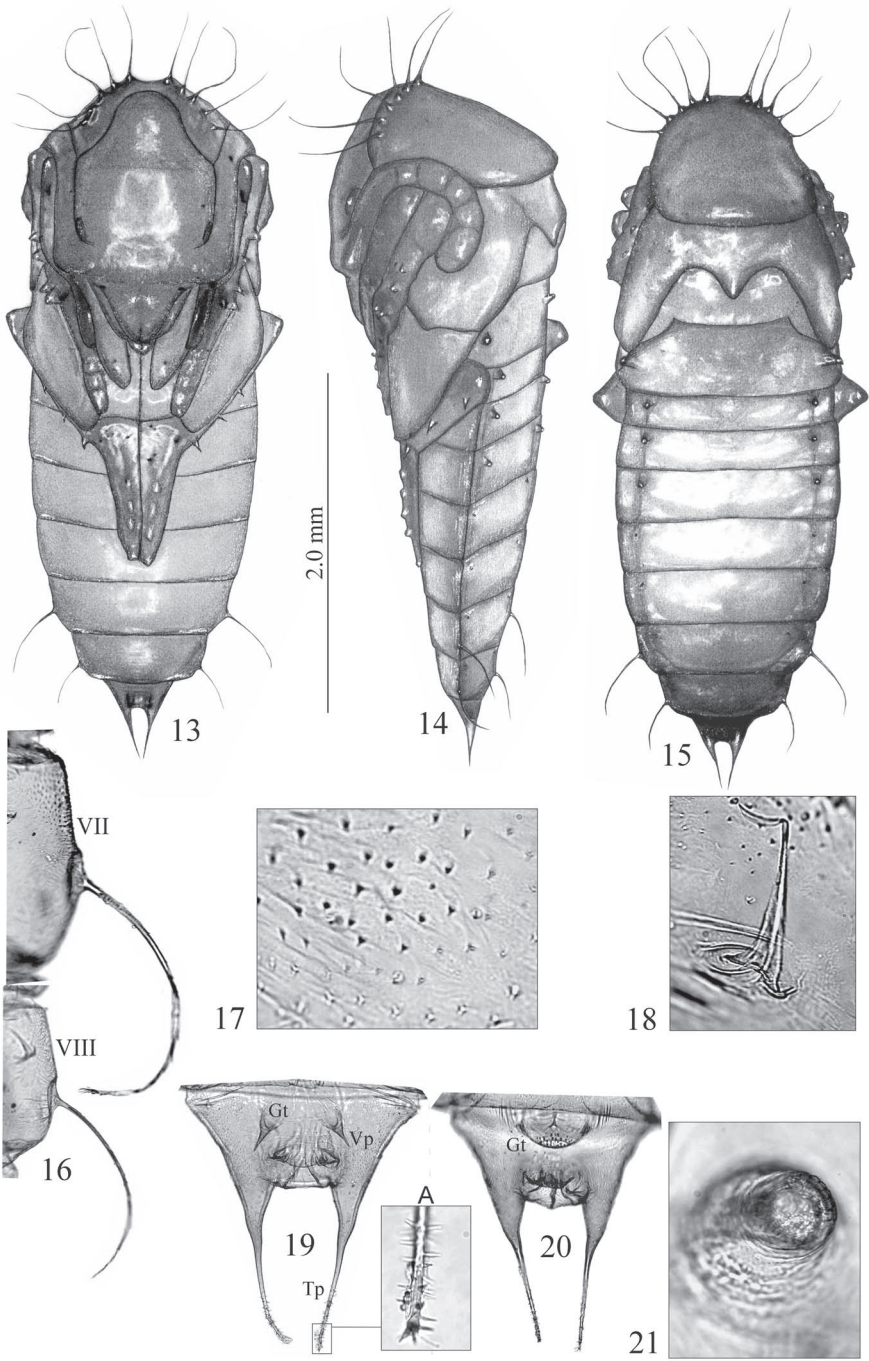
Body length (without abdominal process): 6.88-7.56 mm (mean 7.22 mm); body width in the widest place (between hind knees): 2.96-3.24 mm (mean 3.14 mm); head width between eyes: 1.82-2.16 mm (mean 1.98 mm); pronotum width in the widest place: 2.13-2.39 mm (mean 2.26 mm), about as broad (at the base) as long; body stocky. Colour from yellow just after pupation to yellowish-brown with darker edges becoming almost black, just before emergence of imago. Head directed ventrally towards thorax about 1.1 times as long as wide (Figs 1-3). Antennae curved, slightly protruding beyond apex of mid tibia, reaching about two five of elytra length. Margin of pronotum with 15-22 projections (looking from ventral side 8/9, 11/9, 11/11, 9/8, 9/9, 10/10, 11/9, 10/11, 8/7, 8/8 projections on sides in individuals). Wings extending to ventral side, slightly protruding beyond the posterior margin of 1st (morphologically 3rd) clearly visible from ventral side, abdominal segment (Figs 1, 2). Tibiae and tarsi directed obliquely to the middle of the body. Each middle tibiae with 9 or 10 outlines of protuberances, hind tibiae with 5 clearly visible protuberances. Tarsi of hind legs reaching at least the half of length of 4th (morphologically 6th) well visible from ventral side abdominal segment (Figs 1, 2). Abdomen with 9 segments, moderately and gradually widened from segment II to segment V and narrowed to the terminal segment of the body (Fig. 3). Abdominal tergite I 1.8 times longer than tergite II. Abdominal tergites with reticulate microstructure in the vicinity of spiracles (Fig. 6), remaining surface of abdominal segments with microstructure as in Fig. 7. Abdominal segments III-VIII each bearing a pair of setiform projections on sides. All setiform projections with tiny processes occurring on the greater part (Figs 4, 5). Setiform projections on segments III-VI short, 2.6 times shorter than segments (Fig. 4); setiform projections on segments VII, VIII long, only 1.1 times shorter than segments (Fig. 5). Terminal sternite with well marked sexual dimorphism; female pupa with double gonotheca (Gt) and well-developed two ventral prolongations (Figs 10, 10A); male pupa with single gonotheca and a pair of short thorn-like protuberances (Fig. 11) or without protuberances (Fig. 12); ventral and terminal prolongation with numerous, sharp cuticular processes (Figs 10A, 10B); base of each terminal prolongation with small bump laterally (Fig. 11A). Abdominal tergites I-IV with tuberculate, functional spiracles (Fig. 9), the first pair situated more laterally than the rest, moderately protruding (Fig. 3); tergites V-VIII with externally visible, but apparently atrophied spiracles (Fig. 8).

***Gabrius astutus* (ERICHSON, 1840)**

(Figs 13-21)

Body length (without abdominal process): 3.52-3.80 mm (mean 3.66 mm); body width in the widest place (between hind knees): 1.60-1.74 mm (mean 1.68 mm); head width between eyes: 0.82-0.88 mm (mean 0.85 mm); head length: 1.41-1.50 mm (1.46

13-21 (see next page). Pupa of *Gabrius astutus*. 13 - ventral aspect; 14 - lateral aspect; 15 - dorsal aspect; 16 - lateral margin of abdominal segments VII and VIII; 17 - microstructure of abdominal segments; 18 - atrophied spiracle of abdominal segment VI; 19 - terminal sternite of female pupa with detailed structure of apical part of terminal prolongation (Tp) (19A) (Gt - gonotheca, Vp - ventral prolongation); 20 - terminal sternite of male pupa (Gt - gonotheca); 21 - functional spiracle of abdominal segment III



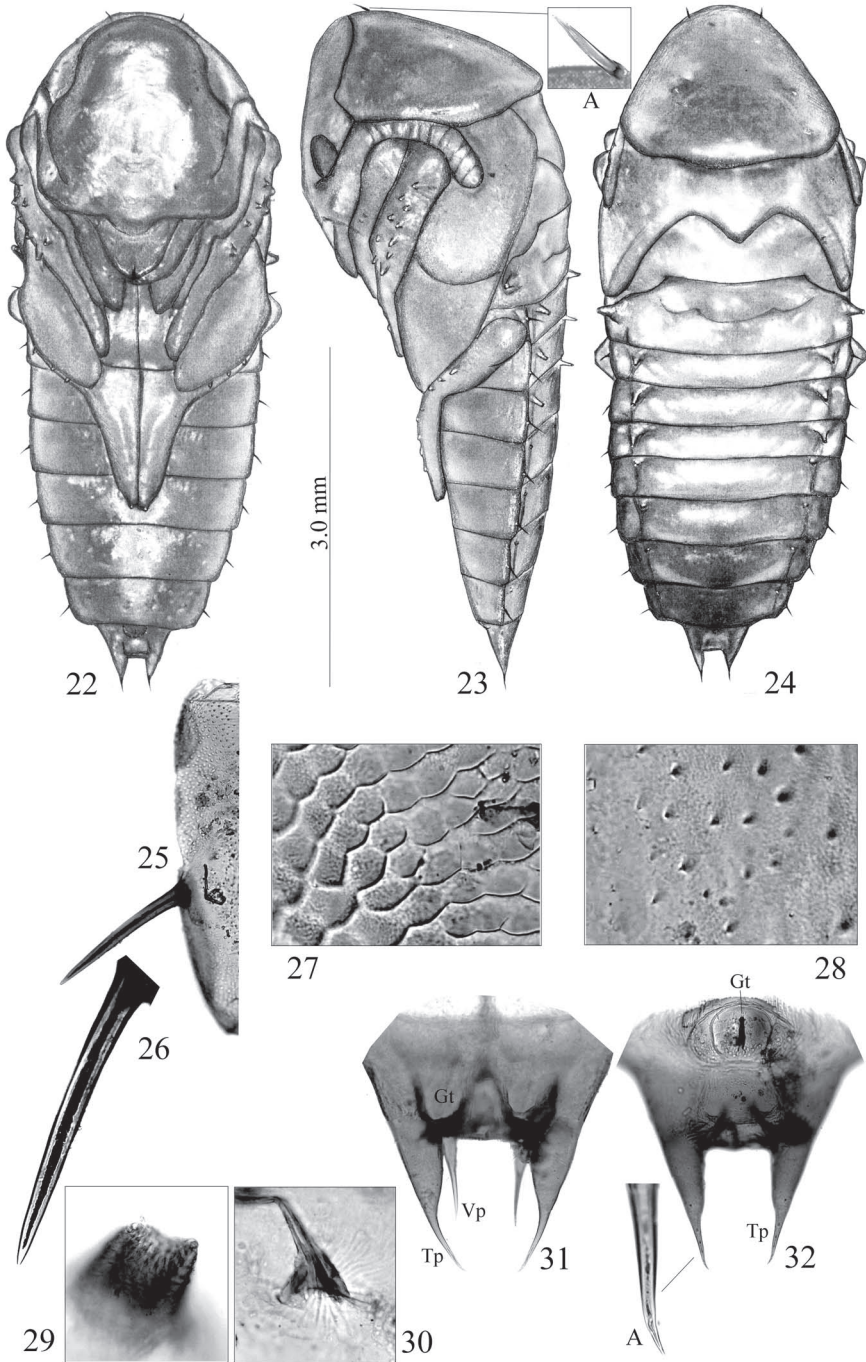
mm); pronotum width in the widest place: 0.98-1.04 mm (mean 1.01 mm); pronotum length: 0.56-0.75 mm (0.67 mm), 1.1 times as long as wide at the base; body rather slender relatively. Colour from yellow just after pupation to dark beige with darker edges becoming almost black, just before emergence of imago. Head directed ventrally towards thorax about 1.3 times as long as wide (Figs 13, 14). Antennae curved, relatively long, distinctly protruding beyond apex of mid tibia, reaching about three five of elytra length (measured from the base). margin of pronotum with 10 or 11 projections (looking from ventral side 5/5, 5/5, 5/5, 5/5, 5/5, 5/5, 6/5, 5/6, 5/6 projections on sides in examined individuals). Wings extending to ventral side, distinctly protruding beyond posterior margin of 1st (morphologically 3rd) clearly visible from ventral side, abdominal segment (Figs 13, 14). Tibiae and tarsi directed obliquely to the middle of the body. Each middle tibiae with 4 outlines of protuberances, hind tibiae with 3 clearly visible protuberances. Tarsi of hind legs reaching at least the half of length of 4th well visible from ventral side abdominal segment (morphologically 6th) (Figs 13, 14). Abdomen with 9 segments, moderately and gradually widened from segment II to segment IV and then narrowed to the terminal segment of the body (Fig. 15). Abdominal tergite I almost twice longer than tergite II. Surface of abdominal segments with microstructure as in Fig. 17. Abdominal segments VII and VIII each bearing on sides a pair of curved, distinctly longer than segments, setiform projections. All setiform projections with tiny processes occurring mainly on the apical part. Terminal sternite with well marked sexual dimorphism; female pupa with double gonotheca (Gt) and well-developed two ventral, short relatively, sharpened prolongations (Fig. 19); male pupa with single gonotheca (Fig. 20); terminal prolongation of both pupae relatively long with numerous, sharp cuticular processes (Figs 19, 19A, 20). Abdominal tergites I-IV with tuberculate, functional spiracles (Fig. 21), the first pair situated more laterally than the rest, moderately protruding and directed towards sides (Fig. 15); tergites V-VIII with externally visible, but apparently atrophied spiracles (Fig. 18).

***Quedius cinctus* (PAYKULL, 1790)**

(Figs 22-32)

Body length (without abdominal process): 5.15-6.05 mm (mean 5.70 mm); body width in the widest place (between hind knees): 2.11-2.50 mm (mean 2.38 mm); head width between eyes: 1.33-1.66 mm (mean 1.50 mm); pronotum width in the widest place: 1.69-1.95 mm (mean 1.87 mm), about as broad as long (at the base); body relatively stocky. Colour from light yellow just after pupation to reddish brown with darker edges becoming almost black, except for lighter wings, just before emergence of imago.

22-32 (see next page). Pupa of *Quedius cinctus*. 22 - ventral aspect; 23 - lateral aspect; 24 - dorsal aspect; 25 - lateral margin of abdominal segments VII; 26 - detailed structure of abdominal spines; 27 - microstructure of the abdominal tergites in the vicinity of spiracles; 28 - microstructure of central part of abdominal tergites; 29 - functional spiracle of abdominal segment III; 30 - atrophied spiracle of abdominal segment V; 31 - terminal sternite of female pupa with terminal (Tp) and ventral prolongation (Vp) and structure of gonotheca (Gt); 32 - terminal sternite of male pupa with structure of gonotheca (Gt) and detailed terminal prolongation (Tp) (A)



Head directed ventrally towards thorax about 1.2 times as long as wide (Figs 22-24). Antennae curved, distinctly protruding beyond apex of mid tibia, reaching almost half of elytra length. Pronotum with 2 tiny, weekly visible spines at anterior margin (length of each spine about 114 μm). Wings extending to ventral side, distinctly protruding beyond the posterior margin of 1st (morphologically 3rd) clearly visible from ventral side, abdominal segment (Figs 22-24). Tibiae and tarsi directed obliquely to the middle of the body. Each middle tibiae with 8-10 outlines of protuberances, hind tibiae with 3 clearly visible protuberances. Tarsi of hind legs reaching at least the half of length of 4th (looking from ventral side) (morphologically 6th) well visible segment abdominal segment (Figs 22, 23). Abdomen with 9 segments, moderately and gradually narrowed from segment I to the terminal segment of the body (Fig. 24). Abdominal tergite I 2.1 times longer than tergite II. Abdominal tergites with reticulate microstructure in the vicinity of spiracles (Fig. 27), remaining surface of abdominal segments with microstructure as in Fig. 28. Abdominal segments II-VIII each bearing a pair of spines (all 7 pairs) on sides; spines with smooth surface, about 2.0-2.2 times shorter than applicable segments (Figs 22-26). Abdominal sternite IX (terminal) markedly sexually dimorphic (Figs 31, 32); female gonotheca (Gt) double (Fig. 31) with two long ventral prolongations (Vp), usually longer than terminal abdominal prolongation (Tp), male gonotheca single (Fig. 32), without ventral prolongation, all prolongation with smooth surface. Abdominal tergites I-IV with tuberculate, distinctly extending beyond outline of body, functional spiracles (Figs 24, 29), spiracles of segment I longer and situated more laterally than other; tergites V-VIII with externally clearly visible but apparently atrophied spiracles (Figs 24, 30).

CONCLUDING REMARKS

Some morphological characters of the known species of *Philonthus*, *Gabrius* and *Quedius* pupae with the references, including pupae of *Ph. politus*, *G. astutus* and *Q. cinctus* are presented in table 1 and 2 respectively.

The pupa of *Ph. politus* (P.p.) is very similar in morphology and biotope preferences to the pupae of *Ph. succicola* (P.s.) (STANIEC 1999b, 2004) and *Ph. tenuicornis* (P.t.) (STANIEC & PIETRYKOWSKA 2005a). The differences include: the structure of atrophied spiracles (Fig. 8 - P. p.; Fig. 10 - P.s.; Fig. 18 - P.t.), length of antennae (Fig. 2 - P.p.; Fig. 5 - P. t.), hind legs length (Fig. 1 - P.p.; Fig. 1 - P.s., Fig. 4 - P.t.).

The clearly differences between pupae of *Gabrius astutus* (G.a.) and *G. splendidulus* (G.s.) (PIETRYKOWSKA-TUDRUJ & STANIEC 2007), the only known pupa in this genus, are following: body length (G.a. - 3.5-3.8 mm, G.s. - 2.6-2.9 mm), number of setiform projections on pronotum (G.a. - 10-11; G.s. - 7-9), antennae length (Fig. 14 - G.a.; Fig. 3 - G.s.), hind legs length (Fig. 13 - G.a.; Fig. 2 - G.s.), structure of ventral prolongations of female sternite IX (Fig. 19 - G.a.; Fig. 25, 25A - G.s.), the structure of the atrophied spiracles (Fig. 18 - G.a.; Fig. 32 - G.s.) and habitats (G.a. - banks of mountain, fast flowing rivers and streams in forests, in gravel, damp moss, under stones, rotten plants; G.s. - under bark of rotting and laying on the ground tree trunk, in moist

Table 1. Some diagnostic characters of the known pupae of *Philonthus* and *Gabrieus* species (s.p. - setiform projections; ? - no data; A - distinctly not reaching half of elytra length; B - reaching or slightly protruding beyond half of elytra length; C - reaching almost two thirds of elytra length; a - reaching or slightly protruding anterior margin of 4th (morphologically 6th) clearly visible abdominal segment; b - reaching half of length of 4th (morphologically 6th) clearly visible abdominal segment; c - distinctly protruding half of length of 4th (morphologically 6th) clearly visible abdominal segment; d - reaching posterior margin of 4th (morphologically 6th) clearly visible abdominal segment [measurements in mm].

Species	Number of pairs of s.p. on abdomen	Number of s.p. on pronotum	Antennae length	Hind legs length	Body length	References
<i>Ph. albipes</i>	6	8	B	a	3.4-3.5	STANIEC (2002)
<i>Ph. cyanipennis.</i>	6	16	?	?	?	MANK (1923)
<i>Ph. cognatus</i>	6	16	B	c	4.6-5.2	SZUJECKI (1965)
<i>Ph. corvinus</i>	6	9-11	B	c/b	4.5-5.2	STANIEC (2003b)
<i>Ph. decorus</i>	6	22-24	?	?	?	VERHOEFF (1918)
<i>Ph. fumarius</i>	2	9-11	C	c	5.4-5.5	STANIEC & PIETRYKOWSKA-TUDRUJ (2008b)
<i>Ph. lepidus</i>	6	8-13	C	b/c	3.4-4.6	STANIEC & KITOWSKI (2004)
<i>Ph. longicornis</i>	6	10	?	c	5.2-6.6	MANK (1923), TAWFIK at al. (1976c)
<i>Ph. micans</i>	6	10-11	C	b	3.8-4.1	STANIEC (2003b)
<i>Ph. misor</i>	2	10	?	a	4.1-4.3	TAWFIK at al. (1976a)
<i>Ph. nigrita</i>	2	9-12	C	c	4.6-5.4	STANIEC (2001); STANIEC & PIETRYKOWSKA-TUDRUJ (2008a)
<i>Ph. politus</i>	6	15-22	A	b	6.8-7.5	the present study
<i>Ph. punctus</i>	2	14-17	B	b	5.9-6.6	STANIEC (2003b)
<i>Ph. quisquiliarius</i>	2	10	B	a	3.9-4.3	HAFEZ (1939) STANIEC (2001)
<i>Ph. rectangulus</i>	2	13-21	B	b	5.8-6.8	STANIEC (2004)
<i>Ph. rubripennis</i>	6	10-12	C	a/b	3.6-4.2	STANIEC & PIETRYKOWSKA-TUDRUJ (2007)
<i>Ph. sanamus</i>	2 (very short)	10	B	b	6.0	BYRNE (1993)
<i>Ph. sericans</i>	6	6	A	a/b	3.5	MANK (1923)
<i>Ph. succicola</i>	6	18-20 or 22	A	d	7.0-8.5	STANIEC (1999b) STANIEC (2004)
<i>Ph. tenuicornis</i>	6	16-20	B	a	6.8-7.6	STANIEC & PIETRYKOWSKA (2005a)
<i>Ph. umbratilis</i>	6	9-12	C	c/b	4.6-4.9	STANIEC & KITOWSKI (2004)
<i>Ph. varians</i>	6	10-11	C	d	4.3-4.4	STANIEC (2002)
<i>G. astutus</i>	2	10-11	C	b	3.5-3.8	the present study
<i>G. splendidulus</i>	2	7-9	A	a	2.6-2.9	PIETRYKOWSKA-TUDRUJ & STANIEC (2007)

wood dust of deciduous trees) (BURAKOWSKI *et al.*, 1980; KOCH 1989, PIETRYKOWSKA-TUDRUJ & STANIEC 2007).

The pupa of *Q. cinctus* (Q.c.) is most similar in morphology to the pupa of *Q. humeralis* (Q.h.) (STANIEC 1999a). The differences concern: body length (Q.c. - 5.1-6.0 mm; Q.h. -3.9-4.5 mm), the structure of the atrophied spracles (Fig. 30 - Q.c.; Fig. 22 - Q.h.) and inhabiting bitopes (Q.c. - gardens, fields, various organic debris; Q.h. - forests, moist places, moss, leaf-litter).

Table 2. Some diagnostic characters of the known pupae of *Quedius* species (m.s. - micro spine; c.p - cuticular processes; ? - no data; A - distinctly not reaching half of elytra length; B - reaching or slightly protruding beyond half of elytra length; a - reaching or slightly protruding anterior margin of 4th (morphologically 6th) segment; b - reaching half of length of 4th (morphologically 6th) segment; c - distinctly protruding half of length of 4th (morphologically 6th) segment; [measurements in mm].

Species	Number of pairs of spines on abdomen\ spine surface	Occurrence a pair of m.s. on pronotum\ measurements [µm]	Antennae length	Hind legs length	Body length	References
<i>Quedius brevicornis</i>	7\smooth	absent	A	b	6.9-8.3	DRUGMAND (1988), STANIEC (2003a)
<i>Q. brevis</i>	7\smooth	absent	A	b	6.9-7.7	PIETRYKOWSKA-TUDRUJ & STANIEC (2006)
<i>Q. capucinus</i>	7\?	present\?	A	b	5.0-6.0	VORIS (1939)
<i>Q. cruentus</i>	7\smooth	absent	A	a	5.4-6.4	STANIEC & PIETRYKOWSKA (2005b)
<i>Q. curtipennis</i>	7\?	absent	A	c	3.2	OUTERRELO (1978)
<i>Q. cinctus</i>	7\ smooth	present\114	B/A	c	5.1-6.0	the present study
<i>Q. fuliginosus</i>	7\smooth	absent	A	c	6.8-7.0	STANIEC (1999a)
<i>Q. fumatus</i>	7\smooth	present\45	B	a	4.8-5.0	STANIEC (1999a)
<i>Q. humeralis</i>	7\smooth	present\144	B	c	3.9-4.5	STANIEC (1999a)
<i>Q. microps</i>	7\smooth	absent	A	b	5.1-5.6	PIETRYKOWSKA-TUDRUJ & STANIEC (2006)
<i>Q. mesomelinus</i>	7\smooth	absent	A	c	5.9-6.4	STANIEC (1999a)
<i>Q. molochinus</i>	7\?	absent	?	?	7.0	VORIS (1939)
<i>Q. plagiatus</i> (=laevigatus)	7\c.p.	present\?	A	a	5.5-6.0	SAALAS (1917), STANIEC (1996)
<i>Q. spelaeus spelaeus</i>	7\?	absent	A	b	7.3	MOSELEY <i>at al.</i> (2006)

Below we proposed morphological diagnosis for the mentioned above genera.

The *Philonthus* genus pupa. **1.** Colour usually from yellowish-brown to reddish-brown, usually strongly sclerotized. **2.** Anterior margin of pronotum with 8-22 setiform, slightly bent projections. **3.** Each fore, middle and hind tibiae with protuberances. **4.** Abdominal segments III-VIII or only VII-VIII each bearing a pair of setiform projections on sides, setiform on segments III-VI distinctly shorter, whereas on segments VII and VIII longer than segments and curved. **4.** All setiform projections on the body, terminal and ventral prolongation (in female) on segment IX with cuticular micro processes. **5.** Body length: 3.4-8.5 mm.

The *Gabrius* genus pupa. **1.** Colour from yellow just after pupation to dark beige, moderately sclerotized. **2.** Anterior margin of pronotum with 7-11 setiform projections, these lateral usually strongly curved. **3.** Each fore, middle and hind tibiae with protuberances. **4.** Abdominal segments VII-VIII each bearing a pair of usually curved setiform projections on sides, distinctly longer than segment. **5.** All setiform projections on the body and terminal prolongation on segment IX with cuticular micro processes. **6.** Body length: 2.6-3.8 mm.

The *Quedius* genus pupa. **1.** Colour from dark yellow just after pupation to reddish brown, always very strongly sclerotized. **2.** Anterior margin of pronotum without setiform projections or with 2 micro spines (length: 45-144 μm). **3.** Only middle and hind tibiae with protuberances. **4.** Abdominal segments II-VIII each bearing a pair of straight spines of equal length on sides. **5.** All spines, ventral prolongation (in female pupa) and terminal prolongation on segment IX smooth (only one species - *Q. plagiatus*, has surface of spines with micro cuticular processes). **6.** Body length: 3.2-8.3 mm.

REFERENCES

- BORDONI, A., 1981. Descrizione della pupa del *Quedius (Microsaurus) fulgidus* (F.) raccolta nel Napoletano (Col. Staphylinidae). Atti del Circolo B. G. Duns Scoto di Roccarainola, **7**: 13-20.
- BURAKOWSKI, B., MROCKOWSKI, 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**(2): 229-234.
- DRUGMAND, D., 1989. Description de la nymphe de *Quedius (Microsaurus) brevicornis* (THOMSON, 1860) (Coleoptera, Staphylinidae, Staphylininae). Bull. Ann. Soc. Roy. Belge Entomol., **124**(1988): 325-328.
- HAFEZ, M., 1939. The life history of *Philonthus quisquiliarius* GYLLH. (Coleoptera: Staphylinidae). Bull. Soc. Fouad Entomol., **23**: 302-310.
- HERMAN, L. H., 2001. Catalog of the Staphylinidae (Insecta: Coleoptera). 1758 to the end of the second Millennium. VI. Staphylininae group (Part 3). Bulle. Amer. Mus. Nat. Hist., **265**: 3021-3839.
- KOCH, K., 1989. Die Käfer Mitteleuropas. Ökologie, 1. Goecke & Evers Verlag, Krefeld: 440 pp.
- MANK, H. G., 1923. The biology of the Staphylinidae. Ann. Ent. Soc. Amer., **16**: 220-37.
- MOSELEY, M., KLIMASZEWSKI, J., MAJKA, Ch. G., 2006. Description of the pupa and observations on the distribution, ecology, and life history of *Quedius spelaeus spelaeus* HORN (Coleoptera: Staphylinidae) in Nova Scotia, Canada. Zootaxa, **1226**: 61-68.
- OUTERLO, R., 1978. Description de la pupa de *Quedius* (s. str.) *curtipennis* BERNH. (Col. Staphylinidae). Nouv. Rev. Entomol., **8**(3): 281-283.
- PIETRYKOWSKA-TUDRUJ, E., STANIEC, B., 2006. The pupae of *Quedius brevis* ERICHSON, 1840 and *Quedius microps* (GRAVENHORST, 1847) (Coleoptera: Staphylinidae). Genus, Wrocław, **17**(4): 483-492.

- , 2007. The pupae of *Gabrius splendidulus* (GRAVENHORST, 1802) and *Neobisnius villosulus* (STEPHENS, 1833) (Coleoptera: Staphylinidae). Genus, Wrocław, **18**(3): 351-358.
- SAALAS, U., 1917. Die Fichtenkäfer Finnlands. Studien über die Entwicklungsstadien, Lebensweise und geographische Verbreitung der an *Picea excelsa* LINK. lebenden Coleopteren nebst einer Larvenbestimmungstabelle. Allgemeiner Teil und Spezieller Teil I. - Ann. Acad. Scient. Fennicae, Ser. A., **8**: (1), 543 + 9 Tafeln und 1 Karte.
- STANIEC, B., 1996. Morphology of the pupa of *Quedius plagiatus* MANNERHEIM (Coleoptera: Staphylinidae). Pol. Pismo Entomol., **65**: 113-118.
- , 1999a. A description of the pupae of *Quedius fumatus* (STEPHENS), *Q. humeralis* STEPHENS, *Q. mesomelinus* (MARSHAM) and *Q. fuliginosus* (GRAVENHORST) (Coleoptera: Staphylinidae: Staphylininae). Genus, Wrocław, **10**: 47-57.
- , 1999b. A description of the pupa of *Philonthus succicola* THOMSON, 1860 (Coleoptera: Staphylinidae). Pol. Pismo Entomol., **68**: 41-46.
- , 2001. A description of the pupae of *Philonthus quisquiliarius* (GYLL.) and *Ph. nigrita* (GRAV.) (Coleoptera: Staphylinidae). Pol. Pismo Entomol., **70**: 39-49.
- , 2002. A description of the pupae of *Philonthus albipes* (GRAVENHORST, 1802) and *Ph. varians* (PAYKULL, 1789) (Coleoptera: Staphylinidae: Staphylininae). Genus, Wrocław, **13**(3): 337-343.
- , 2003a. Morphology of the mature larva and pupa of *Quedius brevicornis* (THOMSON, 1860) (Coleoptera: Staphylinidae). Ann. Zool. Warszawa, **53**(4): 673-680.
- , 2003b. Description of the pupae of *Philonthus corvinus* ERICHSON, 1839, *Ph. micans* (GRAVENHORST, 1802) and *Ph. punctus* (GRAVENHORST, 1802) (Coleoptera: Staphylinidae). Genus, Wrocław, **14**(1): 15-26.
- , 2004. The pupae of *Ontholestes murinus* (LINNAEUS, 1758), *Philonthus rectangulus* SHARP, 1874 and a supplement to the pupal morphology of *Philonthus succicola* THOMSON, 1860 (Coleoptera: Staphylinidae). Genus, Wrocław, **15**(1): 37-46.
- STANIEC, B., KITOWSKI, I., 2004. A description of the pupae of *Philonthus umbriatilis* (GRAVENHORST, 1802), *Ph. lepidus* (GRAVENHORST, 1802) and *Bisnius* (= *Philonthus* sensu lato) *nitidulus* (GRAVENHORST, 1802) (Coleoptera: Staphylinidae). Genus, Wrocław, **15**(1): 47-58.
- STANIEC, B., PIETRYKOWSKA, E., 2005a. The pupae of *Gyroyhypnus fracticornis* (MÜLLER, 1776) and *Philonthus tenuicornis* Mulsant & REY, 1853 (Coleoptera: Staphylinidae: Staphylininae). Genus, Wrocław, **16**(3): 331-339.
- , 2005b. The pupae of *Tasgius* (= *Ocyopus* sensu lato) *melanarius* (HERR, 1839) and *Quedius cruentus* (OLIVIER, 1795) (Coleoptera: Staphylinidae). Genus, Wrocław, **16**(1): 19-28.
- , 2007. Developmental stages of *Philonthus rubripennis* STEPHENS, 1832 (Coleoptera, Staphylinidae, Staphylininae) with comments of its biology. D. Entomol. Zeitschr., **54**(1): 95-113.
- , 2008a. Morphology of developmental stages and notes on biology of *Philonthus nigrita* (GRAVENHORST, 1806) (Coleoptera, Staphylinidae) – a stenotopic species inhabiting of *Sphagnum* peatbogs. D. Entomol. Zeitschr., **55**(1): 167-183.
- , 2008b. Morphology of developmental stages of *Philonthus fumarius* (GRAVENHORST, 1806) (Coleoptera, Staphylinidae) with notes on biology. Acta Zool. Acad. Sci. Hung., **54**(3): 213-234.
- SZUJECKI, A., 1965. Obserwacje nad rozwojem i biologią *Philonthus fuscipennis* MANN. (Coleoptera, Staphylinidae). Fragmenta Faunistica, **12**(11): 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. Entomol. Egypte, **60**: 345-356.
- , 1976b. Life-history of the Staphylinid *Philonthus turbidus* ER. Bull. Soc. Entomol. Egypte, **60**: 357-366.
- , 1976c. On the bionomics of *Philonthus longicornis* STEPH. (Coleoptera: Staphylinidae). Bull. Soc. Entomol. Egypte, **60**: 379-387.
- VERHOEFF, K. W., 1918. Studien Über die Organisation der Staphyloidea. III. Zur Kenntnis der Staphyliniden-Pappen. Zeit. Wiss. Insekt. Biol., **14**: 42-47, 167-171.
- VORIS, R., 1939. Immature Staphylinids of the Genus *Quedius* (Coleoptera: Staphylinidae). Entomol. News, **50**(6): 151-155, 188-190.