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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)

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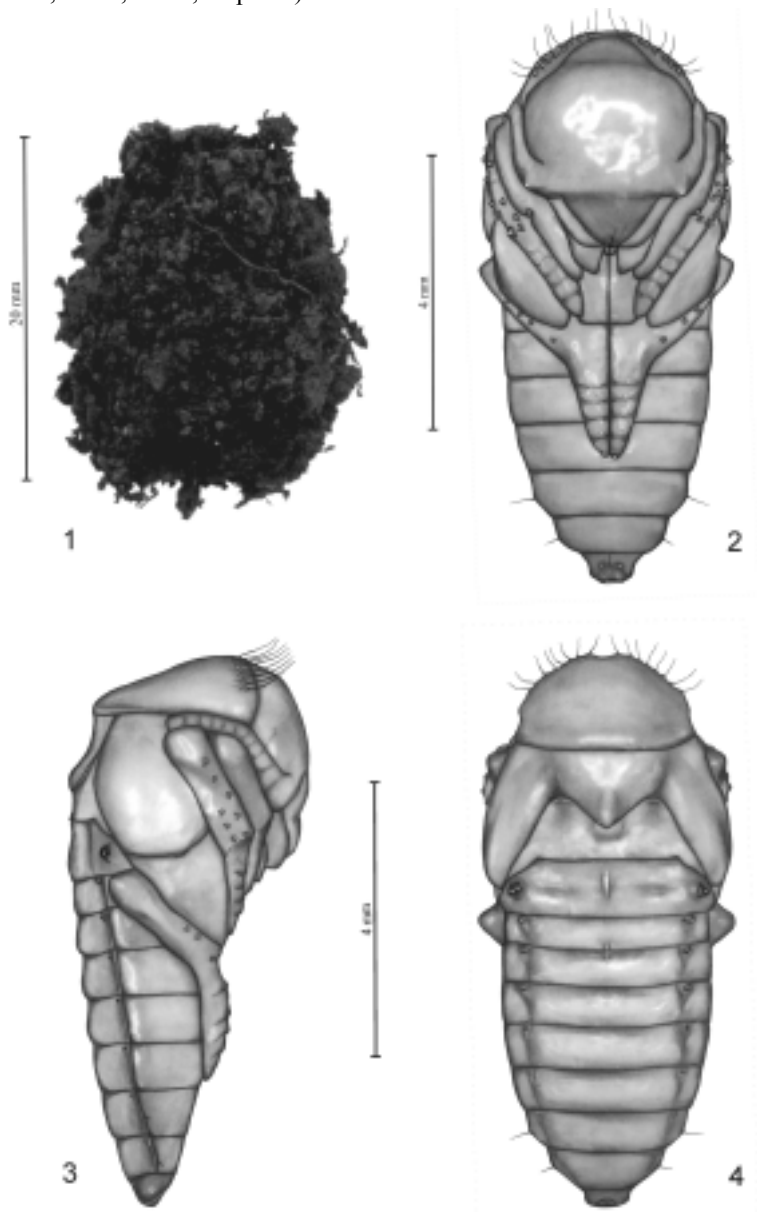
ABSTRACT. The cocoon, pupa of *Ontholestes murinus* (LINNAEUS, 1758), and pupa of *Philonthus rectangulus* SHARP, 1874 have been described and illustrated for the first time. The differences between the female and male pupa of *Ph. rectangulus* are presented. Some characters of the *Philonthus succicola* THOMSON, 1860 male pupa are described as a supplement to its previous description. The differences between the pupae of the three species are listed.

Key words: entomology, Coleoptera, Staphylinidae, *Ontholestes*, *Philonthus murinus*, *Philonthus rectangulus*, *Philonthus succicola* morphology, pupa.

INTRODUTION

Among about 1300 species of *Philonthus* and 31 species of *Ontholestes* described in the world, actually only the pupae of over 20 species and 1 species are known, respectively (VERHOEFF 1918, MANK 1923, VORIS 1939, SZUJECKI 1965, TAWFIK et al. 1976a, b, c, PRINS 1984, BYRNE 1993, STANIEC 1999, 2001, 2002, 2003, in press). However, even the existing descriptions are often fragmentary and require detailed supplements. In order to determine the pupae of individual species correctly, as well as the species of other closely related genera, the following diagnostic, morphological features should be considered**:** measurements, general view of the body, number, structure and length of setiform projec-

tions 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, in press).



1-4. *Ontholestes murinus*. 1 – cocoon; 2 - ventral aspect of pupa; 3 - lateral aspect of pupa; 4 - dorsal aspect of pupa

Ontholestes murinus and *Philonthus rectangulus* are the widely distributed rove-beetles. The first eurytopic, stercoricolous and phytodetriticolous staphylinid occurs in Europe, Russia, Georgia, Armenia, Turkey, Iran, Kazakhstan, Kyrgyzstan, China, and Canada. The second one is a ubiquistic, phyto- and zoodetriticolous species, known from Canary Islands, Madeira, Azores, Europe, Turkey, Kazakhstan, Afghanistan, Nepal, Bhutan, Thailand, Indonesia, New Guinea, Society Islands, China, Korea, Japan, Taiwan, Hawaii, New Zealand, Canada, USA, and Chile. In Poland both species are common and similar in their habitat requirements. They inhabit rotten plant remains, compost heaps, mammal excrements and carrion where they mainly prey on larvae of *Diptera* and other insects (BURAKOWSKI at al. 1980, KOCH 1989, HERMAN 2001). The general information on *Ph. succicola* (distribution, environmental preferences) was given by STANIEC (1999).

The morphology of the immature stages of the mentioned species is poorly known. PAULIAN (1941), POTOTSKAYA (1967) and KASULE (1970) provided some information on the larva, and HINTON (1981) on the egg of *Ontholestes murinus*. Only the first larval instar of *Philonthus rectangulus* has been described hitherto (BOLLER 1983). However, even the existing descriptions usually are far from being complete. The pupae of *O. murinus* and *Philonthus rectangulus* have not been described up to date. In the case of *Ph. succicola* actually only the female pupa (on the base of 3 specimens) has been described (STANIEC 1999).

MATERIALS AND METHODS

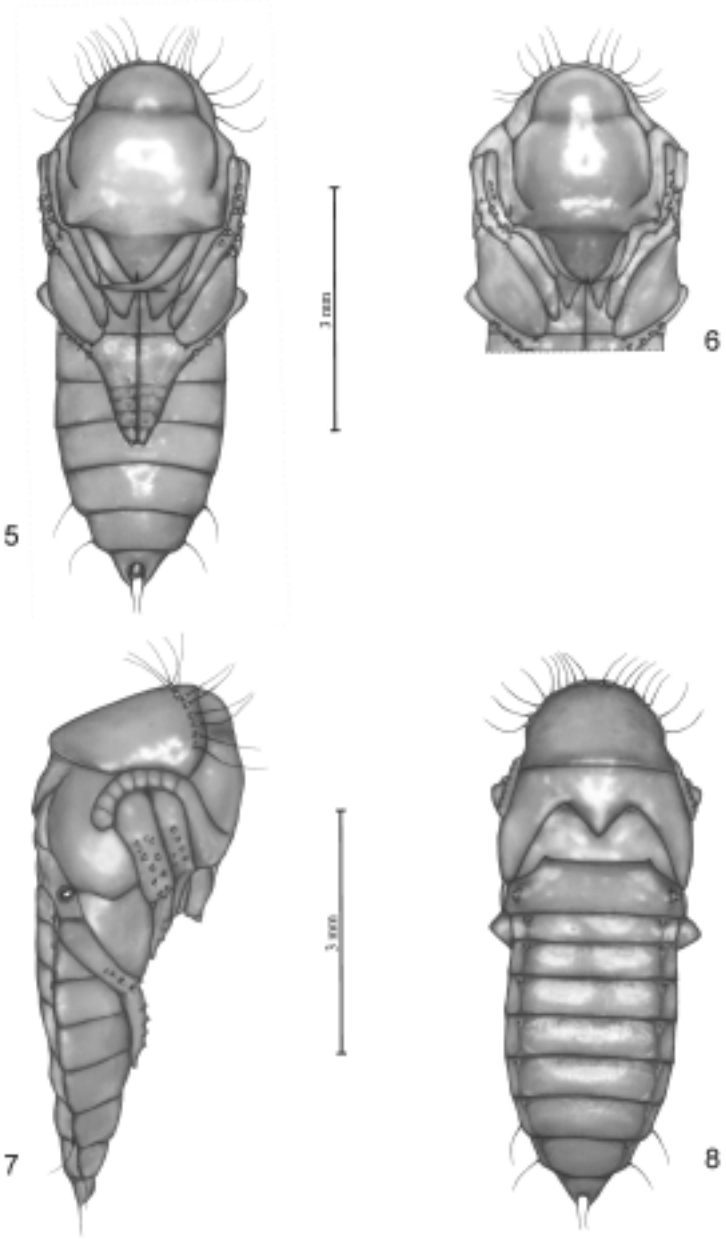
Seven mature larvae and one pupa of *Ontholestes murinus,* 10 mature larvae, 26 pupae, 3 adults of *Philonthus rectangulus*, 9 mature larvae, 6 male pupae, and 2 adults of *Philonthus succicola* were collected by the author in Milejów (SE Poland, Wyżyna Lubelska Upland) on the 1st of August 2003. They were obtained by sifting rotten plant remains in the garden. Four larvae of *O. murinus*, three of *Ph. rectangulus* and 2 of *Ph. succicola* were reared (T = 20 °C ± 2) to pupation (3-7th August) and coming out of the adults (12-18th August). Then the species was identified by the author. The total drawings were made using alive pupae. For more detailed studies, fragments of exuviae of pupae were used.

Material examined: *Ontholestes murinus* - 5 pupae (2 mm); *Philonthus rectangulus* - 29 pupae (16 mm); *Philonthus succicola* - 6 pupae (all mm).

DESCRIPTIONS

Ontholestes murinus (LINNAEUS, 1758)

Before the pupation a mature larva constructs in soil a broadly oval cocoon about 20 mm long and 15-16 mm wide (Fig. 1).

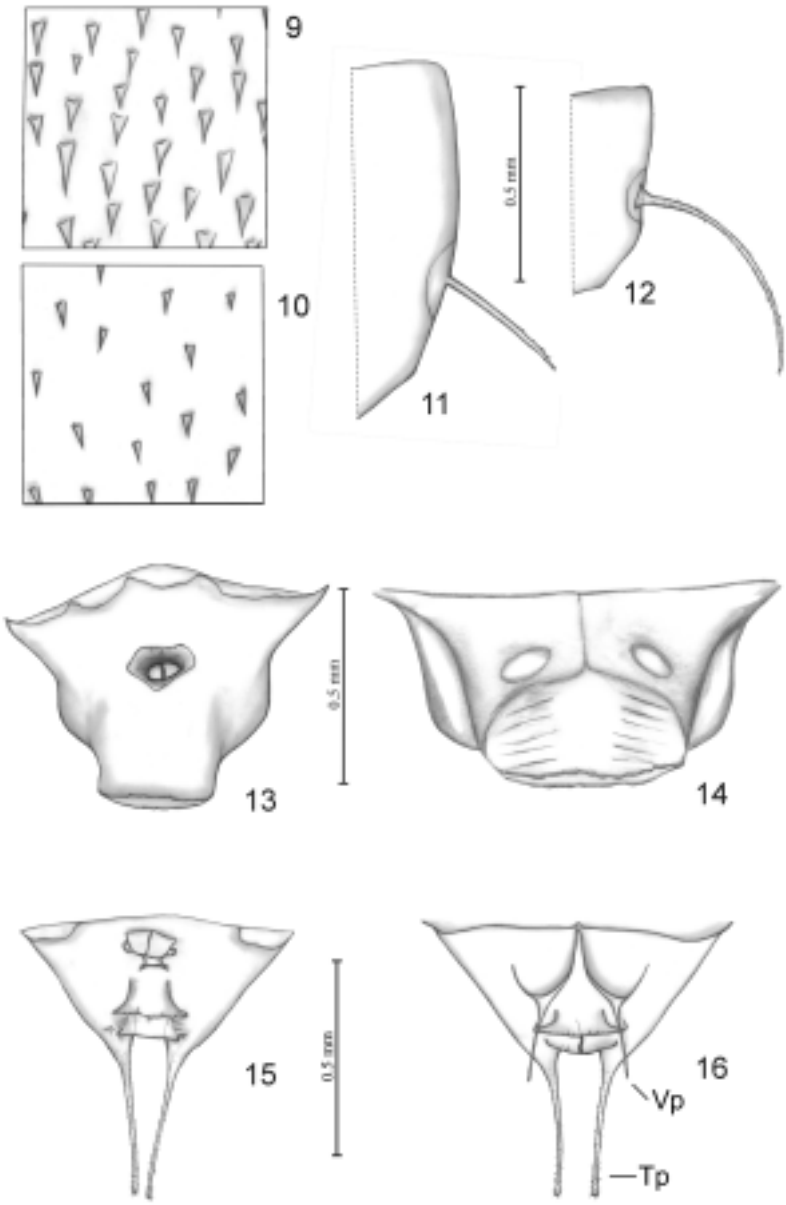


5-6. Pupa of *Philonthus rectangulus*. 5 - ventral aspect of male pupa; 6 – anterior part of female pupa (ventral aspect); 7 - lateral aspect; 8 - dorsal aspect

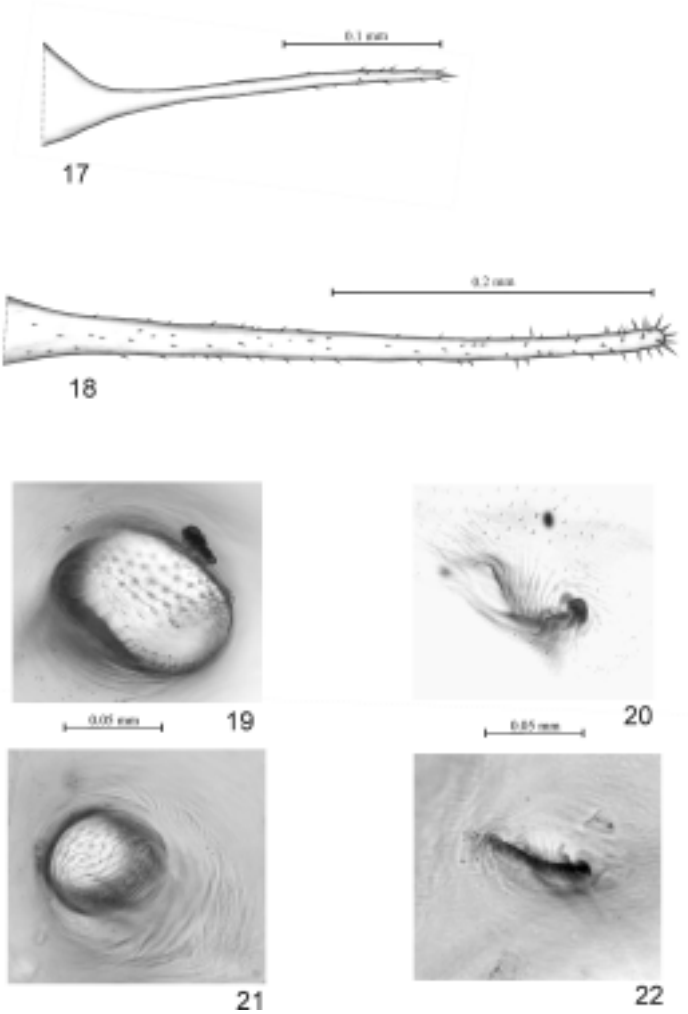
Pupa. Body length: 8.63-9.25 mm (mean 9.03 mm); width in widest place (between hind knees): 4.00-4.50 mm (mean 4.30 mm); head width (between eyes): 2.70-3.00 mm (mean 2.79 mm); head length: 2.38-2.75 mm (mean 2.57 mm); pronotum width in widest place: 2.80-3.00 mm (mean 2.97 mm), about 1.1 times as broad (at the base) as long; body relatively stocky. Colour yellowish brown with darker edges, turning into almost black just before emergence of imago. Labrum 1.9 times as wide at the base as long (Fig. 2). Antennae relatively short, reaching knee of middle legs (Fig. 3). Pronotum usually with 13 or 15-16 relatively short setiform projections (looking from ventral side 7/8, 9/8, 8/8, 8/7, 7/6 projections on sides). Wings reaching posterior margin of the 1st (actually 3rd) well visible abdominal sternite. Hind tarsi protruding half of length of 4th (actually 6th) well visible abdominal sternite (Fig. 2). Abdomen narrowed below sternite IV (Fig. 4). Abdominal tergite I about twice longer than the second tergite. Abdominal tergites with the microstructure as in Fig. 9. Each of abdominal segments VII and VIII bearing a pair of setiform projections. Setiform projections with sparse, tiny cuticular processes occurring in their apical parts. Abdominal segment VIII about 2.3 times as long as setiform projections (Fig. 11). Terminal segment markedly sexually dimorphic (Figs 13, 14). Abdominal sternite IX of female pupa without ventral prolongation and terminal abdominal prolongation (Fig.14). Abdominal tergites I-IV with tuberculate, functional spiracles (Fig. 19), first pair situated more laterally than the rest (Figs 3, 4); tergites V-VIII with externally visible but apparently atrophied spiracles (Fig. 20).

Philonthus rectangulus Sharp, 1874

Measurements of male and female pupae of *Ph. rectangulus* have been presented in Table 1. Colour from dark yellow just after pupation, yellowish brown with darker edges in older pupae to almost black just before emergence of imago. Body relatively slender. Head 1.3 times (in female) or 1.2 times (in male) as long as wide, distinctly wider in male than in female pupa. Labrum 1.6 times as wide as long at the base; mandible crossed only in male pupa (Fig 5, 6). Antennae reaching almost half of length of shortened elytra (Fig. 7). Pronotum almost as long as wide, with 13-17 in female pupa or 14-21 in male pupa setiform projections (looking from ventral side 6/7, 7/6, 7/7, 8/7, 7/8, 8/8, 8/9, 9/8, 10/10, 10/11 projections on sides). Wings distinctly protruding posterior margin of the 1st (actually 3rd) well visible abdominal sternite. Hind tarsi reaching half of length of 4th (actually 6th) well visible abdominal sternite (Figs 5, 7). Abdominal tergite I about twice longer than the second tergite. Abdomen narrowed on the level of segment II and III, then widened to sternite IV, and finally narrowed to the terminal below sternite IV (Fig. 8). Abdominal with the microstructure as in Fig. 10. Each of abdominal segments VII and VIII bearing a pair of setiform projections distinctly longer than segments; setiform projections with numerous, tiny cuticular processes occurring on the whole length of projections (Figs 5, 8, 12).



9-16. Pupa. Microstructure of abdominal tergite VI of *Ontholestes murinus* (9) and *Philonthus rectangulus* (10). Lateral margin of abdominal segment VIII of *O. murinus* (11) and *P. rectangulus* (12). 13-16. Terminal sternite. *O. murinus* 13 – male, 14 - female; *P. rectangulus*: 15 – male, 16 - female (Vp- - ventral prolongation, Tp – terminal prolongation)



17-22. Pupa. *Philonthus rectangulus*, ventral abdominal prolongation in female (17), terminal abdominal prolongation (18). Functional (19, 21) and atrophied (20, 22) spiracles in pupa of *Ontholestes murinus* (19, 20) and *P. rectangulus* (21, 22)

Terminal segment markedly sexually dimorphic (Figs 15, 16). Abdominal sternite IX with ventral prolongation (female pupa) and terminal abdominal prolongation (Figs 17, 18). Abdominal tergites I-IV with tuberculate, functional spiracles as in Fig. 21. First pair moderately protruding, situated more laterally than the rest (Figs 7, 8). Tergites V-VIII with externally visible but apparently atrophied spiracles (Fig. 22). The more important differences between the female and male pupa of *Ph. rectangulus* are presented in table 1.

Table 1. The morphological differences between the female and male pupa of *Philonthus rectangulus* (* - number specimens examined, Nsp - number of setiform projections on pronotum, measurements in mm).

Character	Female		Male	
	*13		16	
	Range of diameter	Mean	Range of diameter	mean
Body length	5.75-6.38	6.01	6.38-6.83	6.60
Head width	1.40-1.47	1.42	1.75-1.96	1.86
Head length	1.75-1.83	1.78	2.1-2.31	2.2
Pronotum width	1.72-1.88	1.79	1.89-2.10	1.98
Max. body width	2.43-2.58	2.51	2.63-2.80	2.73
Nsp	13-17	15	14-21	17
Mandibles	Crossed		Not crossed	
Structure of abdominal sternite IX	With double gonotheca and 2 ventral prolongations		With single gonotheca and without ventral prolongations	

Table 2. Some differences in morphological structure between the pupae of *Ontholestes murinus*, *Philonthus rectangulus*, and *P. succicola* (* - number specimens examined).

Character	Species		
	O. murinus	*Ph. rectangulus*	*Ph. succicola*
	*5	29	9
Cocoon	Present	Absent	Absent
Body length	8.63-9.25 mm	5.75-6.83 mm	7.00-8.50 mm
Head width	2.70-3.00 mm	1.40-1.96	1.80-2.50 mm;
Pronotum width	2.80-3.00 mm	1.72-2.10	2.0-2.60 mm
Max. body width	4.00-4.50 mm	2.43-2.80	3.1-3.75 mm
Number of setiform projections on pronotum	13 or 15-16	13-21	18-20 or 22
Mandibles in male	Not crossed	Crossed	Crossed
Number of setiform projections on abdomen sides	2 pairs	2 pairs	6 pairs
Terminal projection of abdomen	Absent	Present	Present
Apex of antennae	Reaching knee of middle legs	Reaching beyond knee of middle legs	Reaching beyond knee of middle legs

Philonthus succicola THOMSON, 1860

(supplement to the previous description [STANIEC 1999])

Pupa of male. Body length: 8.25-8.50 mm (mean 8.40 mm); width in widest place (between hind knees): 3.58-3.75 mm (mean 3.66 mm); head width (between eyes): 2.48-2.50 mm; head length: 2.38-2.50 mm (mean 2.46 mm); pronotum width in widest place: 2.50-2.60 mm (mean 2.54 mm); mandibles crossed similar as Fig. 5. Pronotum with 18-20 or 22 setiform projections (looking from ventral side 10/8, 9/10, 10/9, 10/10, 9/11, 10/12 projections on sides).

CONCLUDING REMARKS

The three species mentioned above are similar in habitat requirements, and their immature development stages are often found together. It might also refer to their pupae. In order to distinguish between the pupae of *O. murinus*, *Ph. rectangulus* and *Ph. succicola*, some important morphological features are listed below (Table 2).

The only pupa from the genus *Ontholestes* GANGLBAUER, 1895 that has been described is the pupa of *O. cingulatus* GRAVENHORST, 1802 (VORIS 1939), the species occurring in Canada and USA. Nevertheless, the description is very cursory, brief, without illustrations and not taking into consideration most of morphological details. Despite this fact some features of exterior appearance of both pupae can be compared. The pupa of *O. cingulata* (except from bigger body size - 12-14 mm) has on average more setiform projections on pronotum (14-18) than the pupa of *O. murinus* (13 or 15-16). Moreover, the following essential similarities (perhaps these are features typical of generic level) can be: in both pupae – the presence of 2 pairs of rather short spines (setiform projections) on the sides of abdomen (one pair for each segment VII and VIII) and the lack of terminal prolongations (spines) on the segment IX.

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