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A description of the pupae of *Quedius fumatus* (STEPHENS), *Q. humeralis* STEPHENS, *Q. mesomelinus* (MARSHAM) and *Q. fuliginosus* (GRAVENHORST) (*Coleoptera*: *Staphylinidae*: *Staphylininae*)

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ABSTRACT. The pupae of *Quedius fumatus* (STEPHENS, 1833), *Q. humeralis* STEPHENS, 1832 and *Q. mesomelinus* (MARSHAM, 1802) are being described and illustrated for the first time. The poorly known pupa of *Quedius fuliginosus* (GRAVENHORST, 1802) is also described and figured. Diagnostic characters of pupae of the genus *Quedius* are as follows: pronotum bearing 0 or 2 spines, lateral margins of abdomen with 7 pairs of spines, terminal abdominal segment with 4 sharp spines in female and 2 spines in male. Diagnostic characters of the examined pupae include: pronotum chaetotaxy, body measurements, length and structure of spines, presence or absence of protuberances on hind tibiae and structure of spiracles. An identification key to the known pupae of the Polish *Staphylininae* is also presented.

Key words: entomology, morophology, pupa, *Quedius, Coleoptera, Staphylinidae, Staphylininae.*

INTRODUCTION

Within the genus *Quedius* STEPH. only a few pupae were described (VERHOEFF 1918, VORIS 1939, SAALAS 1917, STANIEC 1996). However, their descriptions in most cases are superficial and without illustrations. The authors most often consider the total length, width, number of setae on pronotum and abdomen as their diagnostic characters. However, the above features may be inadequate in the case of pupae of closely related species, e. g. members of the same subgenus. In that case also some following morphological details should be considered: struc-

ture of spiracles, structure and length of setae, length of antenae, length of hind legs and measurements of other body. The morphology of the pupae of some other genera of the subfamily *Staphylininae* included in the key presented below was studied by MANK (1923), SZUJECKI (1960, 1965) and BOHÁC (1982).

Quedius (*Raphirus*) *fumatus* and *Q.* (*Raphirus*) *humeralis* are generally distributed in southern and Central Europe. They were also recorded from Great Britan, Denmark and southern Scandinavia. The latter species is also known from the Caucasus. Both are rare in Poland, known from a few localities each. *Q. fumatus* is definded as an eurytopic, hygrophilous and humicolous species. It occurs in humid deciduous forests under bark, in rotting trunks, leaf-litter and moss. *Q. humeralis* is known as a eurytopic, silvicolous and humicolous beetle. It occurs in forests, in moist places, in moss, leaf-litter and plant remains. *Q.* (*Quedius*) *fuliginosus* (GRAVENHORST, 1802) is a widely distributed Palearctic species. In Poland it is common, occurring probably in all the area. It is definded as a eutrytopic, hygrophilous, humicolous and phytodetriticolous species. It inhabits moist places in woodland as well as open areas. It occurs under bark, in moss, under stones, in plant remains and in moles' nests. *Q.* (*Microsaurus*) *mesomelinus* (MARSHAM, 1802) is a common, widely distributed cosmopolitan species. In Poland it occurs probably in all the area. It is definded as an ubiquistic, pholeophilous, phyllodetriticolous and xylodetriticolous species. It leads probably a subterranean life, occurs in plant remains in the cellars, sheds, mines, caves, moles' nests and hollows of the trees (BURAKOWSKI et al. 1980, KOCH 1989). Of the above-mentioned species only the pupa of *Q. fuliginosus* is described in the available literature (VERHOEFF 1918). However, the description is very superficial and without illustrations.

MATERIAL EXAMINED

Quedius fumatus: 9 pupae (5 females, 4 males), *Q. humeralis*: 5 pupae (2 females, 3 males), *Q. mesomelinus*: 3 pupae (2 females, 1 male), *Q. fuliginosus*: 4 pupae (2 females, 2 males). The pupae of *Q. fumatus, Q. humeralis* and *Q. fuliginisus* were collected together with the adults in Kazimierz Dolny (SE Poland, Lubelska Upland), in shaded, humid, deciduous forests. They were obtained by sifting leaf litter in very deep and wet loess ravine. The pupae of *Q. mesomelinus* were collected together with the larvae and adults in Milejów near Lublin (SE Poland, Lubelska Upland). They were collected in a cellar under rotten carrot. Three pupae of *Q. fumatus,* two of *Q. humeralis,* one of *Q. fuliginosus* and one of *Q. mesomelinus* were kept alive until the emergence of adults. They were determined by the author.

DESCRIPTION OF THE PUPA OF THE GENUS *QUEDIUS* STEPHENS, 1829

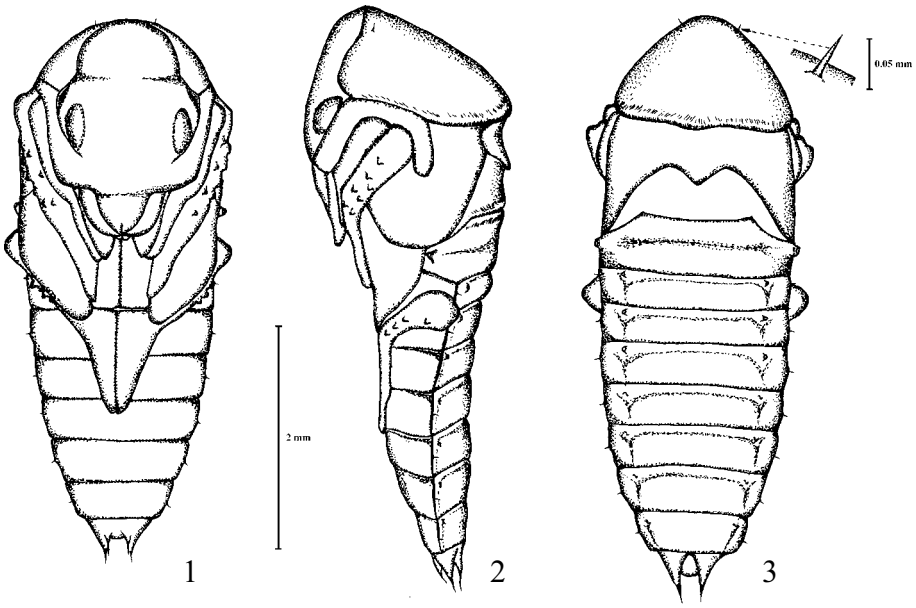
Pupa of obtect type, strongly sclerotized, colour from dark yellow just after pupation to reddish brown with darker edges, becoming almost black, except for

lighter wings just before emergence of imago. Head directed ventrally towards thorax, usually distinctly longer than broad. Antennae curved, usually protrude (slightly or distinctly) beyond apex of mid. Anterior margin of pronotum with one pair of spines or without spines. Pronotum often as long as broad, rarely sligthly broader than long. Mesonotum distinctly broader than long. Metanotum narrower than mesonotum, with anterior margin deeply bisinuate, forming two angles directed anteriad. Wings extending to ventral side; hind margin of shortened elytra well visible at lateral view only. Tibiae and tarsi directed obliquely to middle of body. Mid tibiae with several protuberances, hind tibiae with or without protuberances. Hind tarsi distinctly or slightly protrude beyond posterior margin of the 3rd visible (actually 5th) abdominal sternite. Posterior margin of metanotum slightly indented or almost straight. Abdomen (distinctly or slightly) dorso-ventrally flattened; with 9 tergites and 7 sternites visible; narrowed below tergite III or IV. Abdominal tergite I distinctly longer than others. Segments II-VIII each bearing a pair of spines (all 7 pairs), situated at middle of lateral margin. Terminal segment markedly sexually dimorphic, with four spines in female and only two terminal spines on abdominal process in male (Figs 7, 8). Abdominl tergites I-IV with tuberculate, functional spiracles, first pair situated more laterally than the rest; tergite V-VIII with externally visible, but apparently atrophied spiracles.

PUPAE OF THE EXAMINED SPECIES

1. *Quedius fumatus* (STEPHENS, 1833)

Body length (without abdominal process) 4.8-5.0 mm, width in widest place (between knees of hind legs) 2.1-2.3 mm, colour reddish brown. Head about 1.3 times as long as broad, width of head (between eyes) 1.2-1.3 mm (Figs 1-3). Antennae distinctly protrude beyond apex of mid tibia. Anterior margin of pronotum bearing 2 very short spines - length 45 μm each (Fig. 4). Pronotum almost as long as broad - width 1.6-1.7, length 1.5-1.6 mm. Mesonotum about 1.7 times as broad as long. Posterior margin of metanotum slightly indented. Mid and hind tibiae each with well visible outlines of protuberances. Hind tarsi slightly protrude beyond posterior margin of the 3rd visible (actually 5th) abdominal sternite. Abdomen distictly flattened dorsoventrally, narrowed below tergite IV. Abdominal tergite I 1.6 times longer than the second. Spines on abdominal segments II-VIII very short (similar to those on pronotum) - length 54 μm; medial segments (III-VI) 7.3 times as long as spines (Fig. 15). Functional and atrophied spiracles as in figs 19, 20. Terminal segment with sexual dimorphism marked similarly as in other examined species (Figs 7, 8).



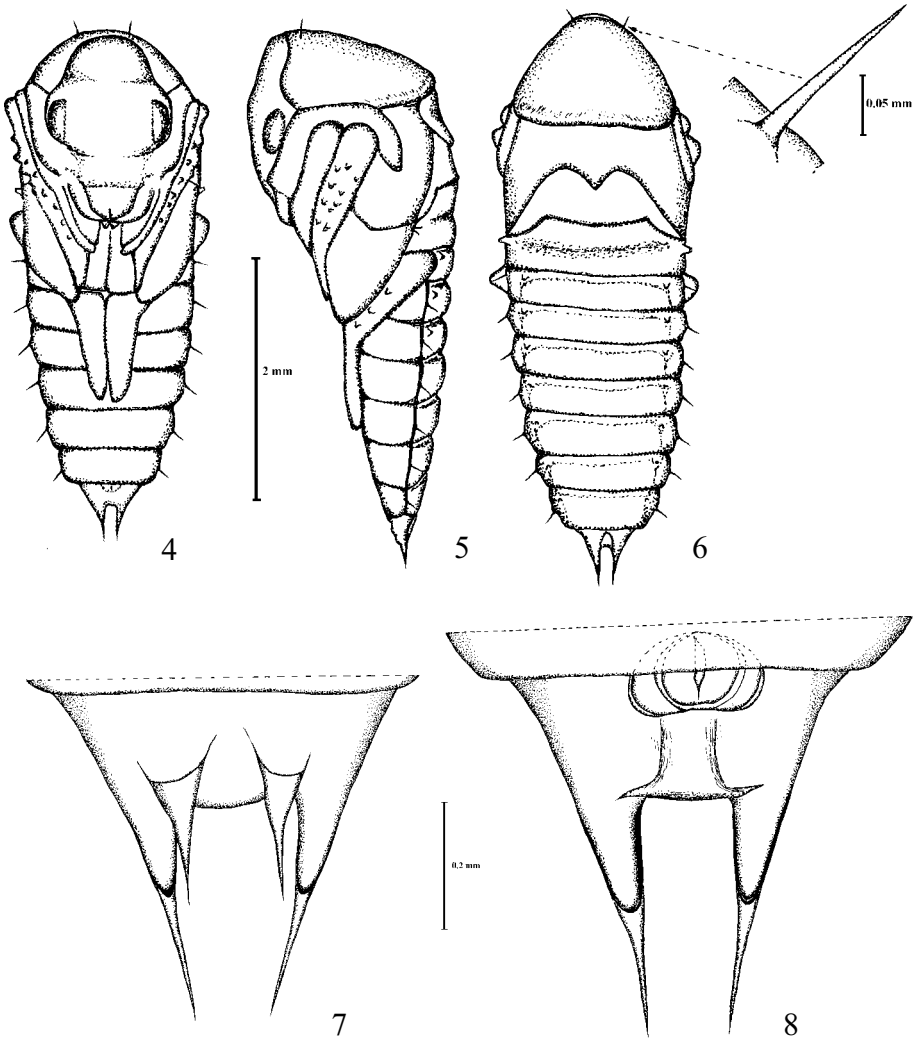
1-3. Pupa of *Quedius fumatus* (STEPH.): 1 - ventral view, 2 - lateral view, 3 - dorsal view

2. *Quedius humeralis* STEPHENS, 1832

Body length 3.9-4.5 mm, width 1.7-1.9 mm, colour dark yellow to yellowish brown. Head about 1.3 times as long as broad, width 1.0-1.1 mm (Figs 4-6). Antennae distinctly protrude beyond the apex of tibia of the second pair of legs, reach the middle of the width of elytra. Anterior margin of pronotum bearing 2 short spines - length 144 µm each (Fig. 6). Pronotum almost as long as wide - width 1.3-1.4, length 1.2-1.3 mm. Mesonotum about 1.6 times as broad as long. Posterior margin of metanotum slightly indented. Mid and hind tibiae each with protuberances. Hind tarsi distinctly protrude beyond half length of the 4th visible (actually 6th) abdominal sternite. Abdomen flattened dorsoventrally, narrowed below tergite III. Abdominal tergite I 1.6 times as long as the second. Spines on segments II-VIII similar to those on pronotum - length about 152 µm, medial abdominal segments (III-VI) each 2.8 times as long as spines (Fig. 16). Functional and atrophied spiracles as in figs 21, 22. Terminal segment with sexual dimorphism as in figs 7, 8.

3. *Quedius mesomelinus* (MARSHAM, 1802)

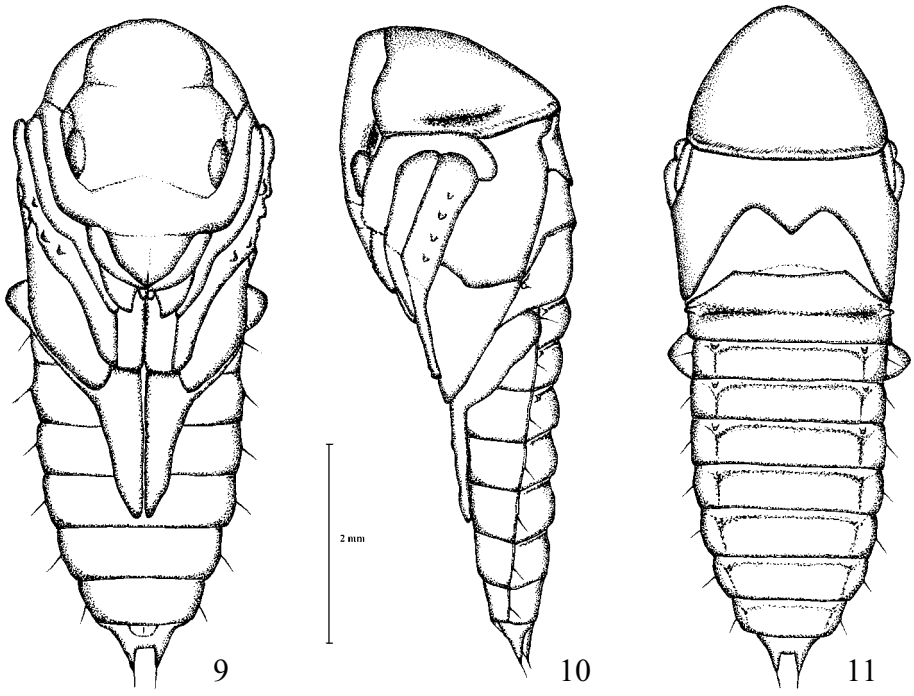
Body length 5.9-6.4 mm, width 2.5-2.6 mm, colour dark yellow to reddish brown. Head 1.4 times as long as broad, width 1.4-1.6 mm (Figs 9-11). Antennae



4-8. Pupa of *Quedius humeralis* STEPH.: 4 - ventral view, 5 - lateral view, 6 - dorsal view, 7 - terminal segment of female, ventral view, 8 - terminal segment of male, ventral view

slightly protrude beyond apex of mid tibia. Anterior margin of pronotum without spines. Pronotum almost as long as wide - length 1.8-1.9 mm, width 2.0 mm. Mesonotum 1.5 times broader than long. Posterior margin of metanotum slightly indented. Only mid tibiae with well visible outlines of protuberances. Hind tarsi distinctly protrude beyond half of length of the 4th visible (actually 6th) abdominal sternite. Abdomen flattened dorsoventrally, narrowed below tergite IV.

Abdominal tergite I 1.9 times as long as the second. Spines on segments II-VIII long - length 192-224 μm, medial abdominal segments (III-VI) each about 2.4 times as long as spines (Fig. 17). Functional and atrophied spiracles as in figs 23, 24. Terminal segment with sexual dimorphism marked similarly as in figs 7, 8.

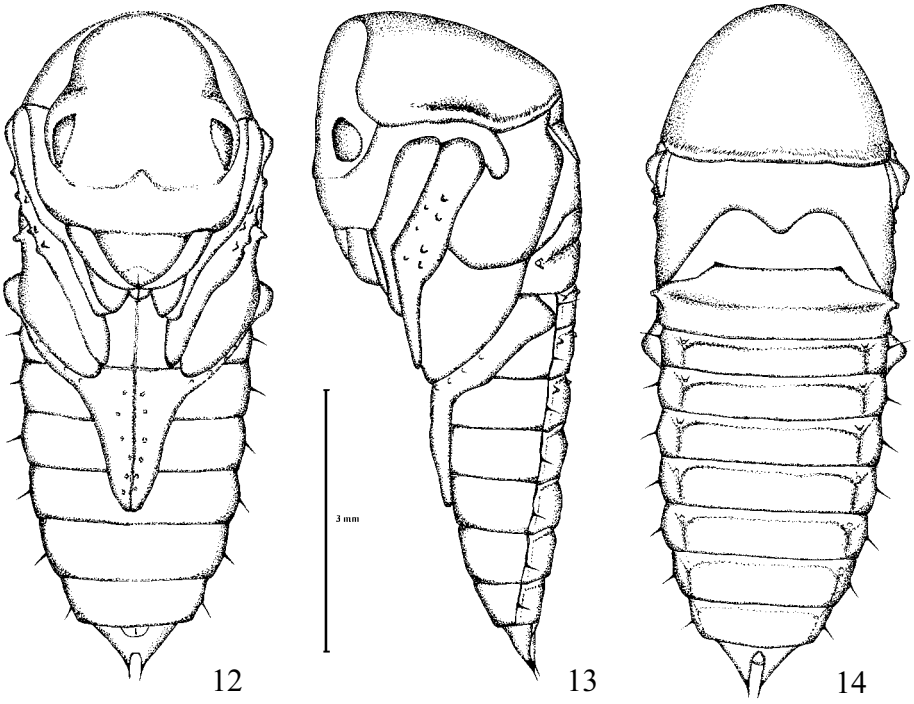


9-11. Pupa of *Quedius mesomelinus* (MARSH.): 9 - ventral view, 10 - lateral view, 11 - dorsal view

4. *Quedius fuliginosus* (GRAVENHORST,1802)

Length 6.8-7.0 mm, width 2.8-2.9 mm, colour reddish brown, body relatively broad and stocky (Figs 12-14). Head 1.2 times longer than broad, width 1.8-1.9 mm. Antennae distinctly protrude beyond the apex of mid tibia. Anterior margin of pronotum without spines. Pronotum slightly broader than long (about 1.1 times) - width 2.3-2.5 mm, length 2.0-2.3 mm. Mesonotum 1.9 times broader than long. Posterior margin of metanotum almost straight. Mid and hind tibiae with protuberances. Hind tarsi distinctly protrude beyond half of length of the 4th visible (actually 6th) abdominal sternite. Abdomen slightly flattened dorsoventrally, narrowed below tergite IV. Abdominal tergite I 2 times longer than the

second. Spines on segments II-VIII short - length 128 µm, medial abdominal segments (III-VI) each 3 times as long as spines (Fig. 18). Spiracles as in figs 25, 26. Terminal segment with sexual dimorphism marked similarly as in figs 7, 8.

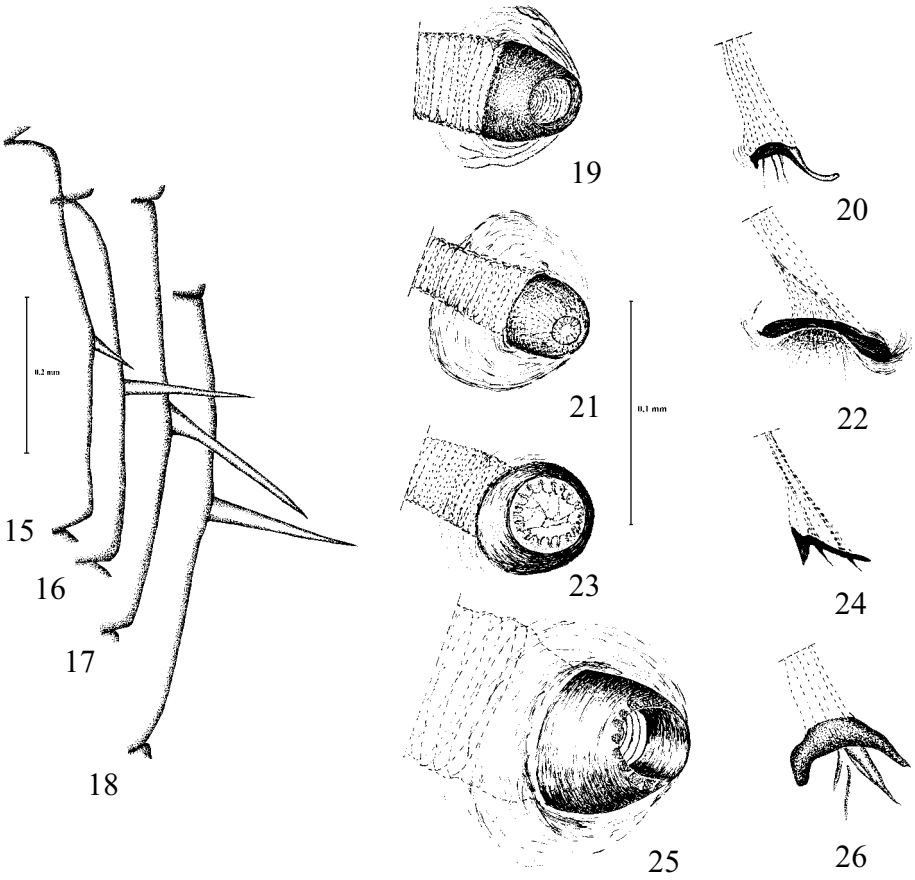


12-14. Pupa of *Quedius fuliginosus* (GRAV.): 12 - ventral view, 13 - lateral view, 14 - dorsal view

DIAGNOSIS:

Characters that distinguish the pupa of the genus *Quedius* from the related genera are follows: (1) Anterior margin of pronotum bearing one pair of spines or without spines, (2) lateral margins of the abdominal segments II-VIII each with short or long spines (all 7 pairs), (3) abdominal segment IX with two terminal sharp spines in male and four in female pupa, (4) posterior margin of metanotum often slightly indented.

The following characters distinguish the examined pupae as well as other known pupae of the genus *Quedius*: (A) measurements - body length and width, head width, length to width ratio of pronotum and metanotum, length ratio of first and second abdominal tergite, length of antenae and hind legs, (B) presence or lack of a pair of spines at anterior margin of pronotum, length of spines, (C) length and detailed structure of spines on abdomen, (D) structure of functional and atrophied spiracles.



15-18. Lateral margin of abdominal segment V with spine of pupa.: 15 - *Quedius fumatus*, 16 - *Quedius humeralis*, 17 - *Quedius mesomelinus*, 18 - *Quedius fuliginosus.* 19-26. Functional (19, 21, 23, 25) and atrophied (20, 22, 24, 26) spiracles of pupa.: *Quedius fumatus* (19,20), *Quedius humeralis* (21, 22), *Quedius mesomelinus* (23, 24) *and Quedius fuliginosus* (25, 26)

DISCUSSION

The opinion that in pupa of *Q. fuliginosus* there occur 8 pairs of spines on abdominal segments I-VIII and one or two pairs on segment IX (VERHOEFF 1918) should be modified. Actually there are 7 pairs of such spines located on abdominal segments II-VIII and one or two pairs on the ninth.

In the light of the results presented above, VORIS' report (1939), describing the pupa of *Q. molochinus* (GRAVENHORST*)* with 5 pairs of spines on abdominal segments IV-VIII and one or two on the terminal segment is controversial. According to the present observations, the abdomen of the pupa of members of to the genus *Quedius* bears 7 pairs of spines (usually partly broken) located on

segments II-VIII and one or two pairs on the ninth. With respect to it, the morphology of the pupae of the genus *Quedius* should be confirmed with further detailed studies.

A key to the identification of the known Polish *Staphylininae* (VERHOEFF 1918, MANK 1923, VORIS 1939, SZUJECKI 1960, 1965, EGHTEDAR 1970, TAWFIK & al. 1976, BOHÁC 1982, STANIEC 1996) including the pupae of *Q. fumatus, Q. humeralis, Q. mesomelinus* and *Q. fuliginosus* is given below.

KEY TO THE KNOWN PUPAE OF POLISH *STAPHYLININAE*
(Pupa of obtect type with well visible hind margins of shortened elytra)

1. Anterior margin of pronotum bearing 0 or 2 spines. Lateral margin of abdomen with 7 pairs of spines located on the abdominal segments II-VIII ..... 2 (*Quedius*)
-. Anterior margin of pronotum bearing more than 2 setiform projections. Lateral margin of the abdomen with 0, 2 or 6 pairs of setiform projections .... 6.
2. Anterior margin of pronotum with 2 spines ..... 3.
-. Anterior margin of pronotum without spines ..... 5.
3. Body length 3.9-5.0 mm, head width 1.0-1.3 mm, surface of abdominal spines smooth ..... 4.
-. Body length 5.5-6.0 mm, head width 1.5-1.6, body width 2.0-2.2 mm, surface of abdominal spines with numerous protuberances, hind tarsi almost reaching hind margin of 3 rd visible abdoinal sternite, colour dark yellow. Pupae always occur under the bark of trees ..... *Quedius plagiatus* MANN.
4. Body length 3.9-4.5 mm, head width 1.0-1.1 mm, body width 1.7-1.9 mm. Pronotum: width 1.3-1.4 mm, length 1.2-1.3 mm. A pair of spines on pronotum well visible; length 144 µm each. Hind tarsi distinctly protrude beyond half length of the 4th visible abdominal sternite. Medial abdominal segments (III-VI) each about 2.8 times as long as lateral abdominal spines. Colour dark yellow to yllowish brown ..... *Quedius humeralis* STEPH.
-. Body length 4.7-5.0 mm, head width 1.2-1.3, body width 2.1.-2.3 mm. Pronotum: width 1.6-1.7 mm, length 1.5-1.6 mm. A pair of spines on pronotum very short; length 45 µm each. Hind tarsi slightly protrude beyond posterior margin of the 3rd visible abdominal sternite. Medial abdominal segments (III-VI) each about 7.3 times as long as lateral abdominal spines. Colour reddish brown ..... *Quedius fumatus* (STEPH.)
5. Body length 5.9-6.4 mm, head width 1.4-1.6, body width 2.5.-2.6 mm. Pronotum: width 2.0 mm, length 1.8-1.9 mm. Antennae slightly protrude beyond the apex of mid tibiae. Mesonotum 1.5 times broader than long. Spines on segments II-VIII long - length 192-224 µm, medial abdominal segments (III-VI) each about 2.4 times as long as spines .... *Quedius mesomelinus* (MARSH.)

-. Body length 6.8-7.0 mm, head width 1.8-1.9, body width 2.8.-2.9 mm. Pronotum: width 2.3-2.5 mm, length 2.0-2.3 mm. Antennae distinctly protrude beyond the apex of mid tibiae. Mesonotum 1.9 times broader than long. Spines on segments II-VIII short - length 128 µm, medial abdominal segments (III-VI) each 3 times as long as spines .... *Quedius fuliginosus* (GRAV.)

6. Lateral margins of abdomen with 6 pairs of setiform projections located on abdominal segments III-VIII ..... 7 (*Philonthus*)

-. Lateral margins of abdomen with 0 or 2 pairs of setiform projections ..... 9.

7. Anterior margin of pronotum with more than 10 setiform projections ..... 8.

-. Anterior margin of pronotum with 10 setiform projections. Body length 5.2-6.7 mm, body width 2.3-2.8 mm ..... *Philonthus longicornis* STEPH.

8. Anterior margin of pronotum with 16 setiform projections. Body length 7.0-8.0 mm ..... *Philonthus cognatus* STEPH. *(Ph. fuscipennis* MANNH.)

-. Anterior margin of pronotum with 22-24 setiform projections .... *Philonthus decorus* (GRAV.)

9. Lateral margins of abdomen without setiform projections. Anterior margin of pronotum with 20 setiform projections. Body length 10.0 mm .... *Staphylinus erythropterus* L.

-. Lateral margins of abdomen bearing 2 pairs of setiform projections ..... 10.

10. Anterior margin of pronotum with 18 setiform projections ..... 11.

-. Anterior margin of pronotum with more than 18 setiform projections ..... 12.

11. Body length about 8.0 mm. Pronotum as long as broad. Colour dark brown. ..... *Ocypus nero* (FALD.) *semialatus* MÜLL. (*O. similis* (F.))

-. Body length about 11.0 mm. Ratio of length to width of pronotum 3 : 3.5. Colour yellowish brown ..... *Ocypus fuscatus* (GRAV.)

12. Anterior margin of pronotum with 20 setiform projections. Body length 7.5 mm ..... *Abemus chloropterus* (PANZER)

-. Anterior margin of pronotum with more than 20 setiform projections ..... 13.

13. Anterior margin of pronotum with 26 setiform projections. Body length 14.7 mm ..... *Staphylinus caesareus* CEDERHJELM

-. Anterior margin of pronotum with 27 setiform projections .... *Ocypus aeneocephalus* (DEGEER)

REFERENCES

BOHÁC, J., 1982. The larval characters of Czechoslovak species of the genera *Abemus* MULS. et REY, *Staphylinus* L. and *Ocypus* SAM. (*Staphylinidae, Coleoptera*). Stud. Ceskoslovenské Akad. Ved, **4**: 1-96, pls 1-27.

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

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

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

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

SALAAS, U., 1917. Die Fiehtenkäfer Finlands, Studien über die Entwicklungsstudien, Lebensweise und geographische Verbreitung der an *Picea excelsa* Link lebeden Coleopteren nebst einer Larvenbestimmungstabelle. Ann. Acad. Fenn. (A), **8**(1), 457 pp.

STANIEC, B., 1996. Morphology of the pupa of *Quedius plagiatus* MANNERHEIM (*Coleoptera: Staphylinidae*). Pol. Pismo Ent., **65**: 113-118.

SZUJECKI, A., 1960. The pupa of *Staphylinus erythropterus* L. (*Coleoptera*, *Staphylinidae*). Pol. Pismo Ent., **30**: 423-426.

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., 1976. 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 *Staphylinoidea*. III. Zur Kenntnis der *Staphylinidea*-Puppen. Zeit. wiss. Insektenbiol., **14**: 167-171.

VORIS, R., 1939. Immature Staphylinids of the Genus *Quedius* (*Coleoptera*: *Staphylinidae*). Ent. News, 50, **6**: 151-155.