

Description of larva and pupa of the genus *Deretus* (Coleoptera: Tenebrionidae) with key to the larvae of the tribe Helopini*

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Abstract. Larva and pupa of *Deretus spinicollis* Schawaller, 2004 are described and illustrated for the first time. The systematic position of the genus *Deretus* Gahan, 1900 is discussed and an updated key to larvae for known Palaearctic genera within the tribe Helopini is given.

Key words. Coleoptera, Tenebrionidae, Helopini, *Deretus*, larva, pupa, description, Yemen, Socotra

Introduction

Presently, 45 genera of Helopini (Coleoptera: Tenebrionidae) are known in the world fauna, comprising roughly more than seven hundred species in the Palaearctic region (here we use regions as defined by LÖBL et al. 2008), roughly 80 described species from America (Nearctic and Neotropical regions) and three species in other regions (CHAMPION 1884–1893; GEBIEN 1942, 1943; LÖBL et al. 2008; STEINER 2009). However, larvae of only 11 species belonging to nine genera (NABOZHENKO & GURGENIDZE 2006) and pupae belonging to two genera (STEINER 1995; BOUCHARD & STEINER 2004; CHERNEY 2005) have been described so far. There are several historical papers with individual descriptions of Helopini larvae (e.g. WATERHOUSE 1836). But the most important are recent papers systematically focused on Palaearctic larvae of Helopini, which gave descriptions of several species and comparative analyses and keys to subtribes and generic groups of Helopini based on larvae (BYZOVA & GILYAROV 1956; GILYAROV & SVETOVA 1963; BYZOVA et al. 1964; CHERNEY 2005; NABOZHENKO & GURGENIDZE 2006).

This paper presents the descriptions of the larva and pupa of *Deretus spinicollis* Schawaller, 2004 and it is the first description of immature stages of the genus *Deretus* Gahan, 1900. The

* Results of the biodiversity research of darkling beetles on Socotra Island. Part II.

description is based on material collected under biodiversity research projects conducted by the research team of Mendel University in Brno (Czech Republic) (for more details see also PURCHART & SCHAWALLER 2012). The paper is a follow-up to an earlier contribution (PURCHART 2012) devoted to the genus *Deretus*.

Material and methods

Seven larvae and three pupae of *Deretus spinicollis* Schawaller, 2004 used for the descriptions were collected by J. Hájek and J. Bezděk on November 12 2010 in the Skant area of the Haghier Mts. (Socotra Island, Yemen) at an altitude of 1400 m in rotten wood of large old fallen trees. Only one member of the genus *Deretus* is known from this area (PURCHART 2012).

Material used in this paper is deposited in the collection of the National Museum in Prague (Czech Republic) and in authors' collections.

Measurements of pupae: as the head of pupae is hypognathous, the body length is comprised of two numbers, the first is the total length from the apex of urogomphi to anterior margin of pronotum, and the second is the total length of head from its posterior margin to anterior margin of labrum. Body width is the greatest abdominal width, including lateral processes.

Morphology

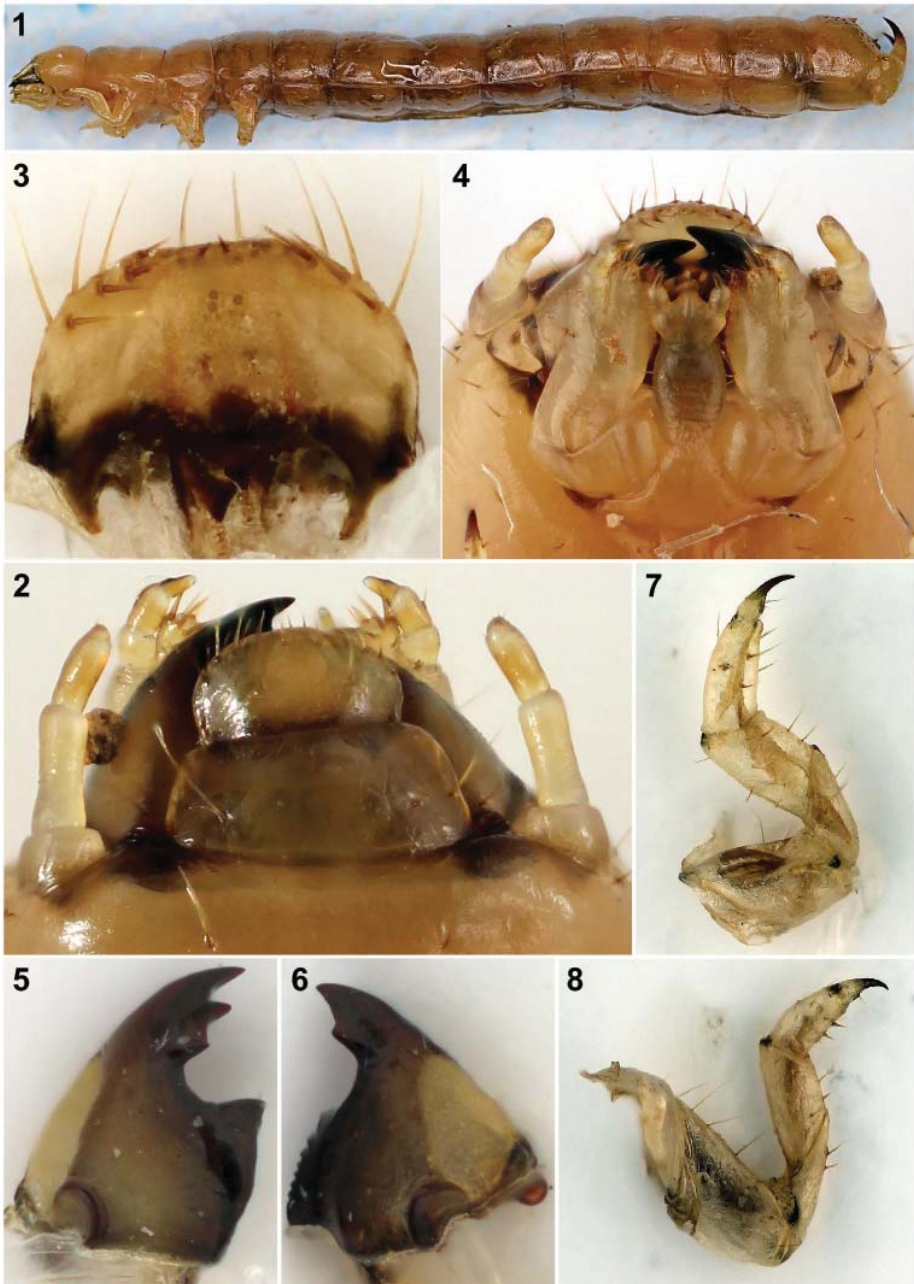
Deretus spinicollis Schawaller, 2004

(Figs. 1–16)

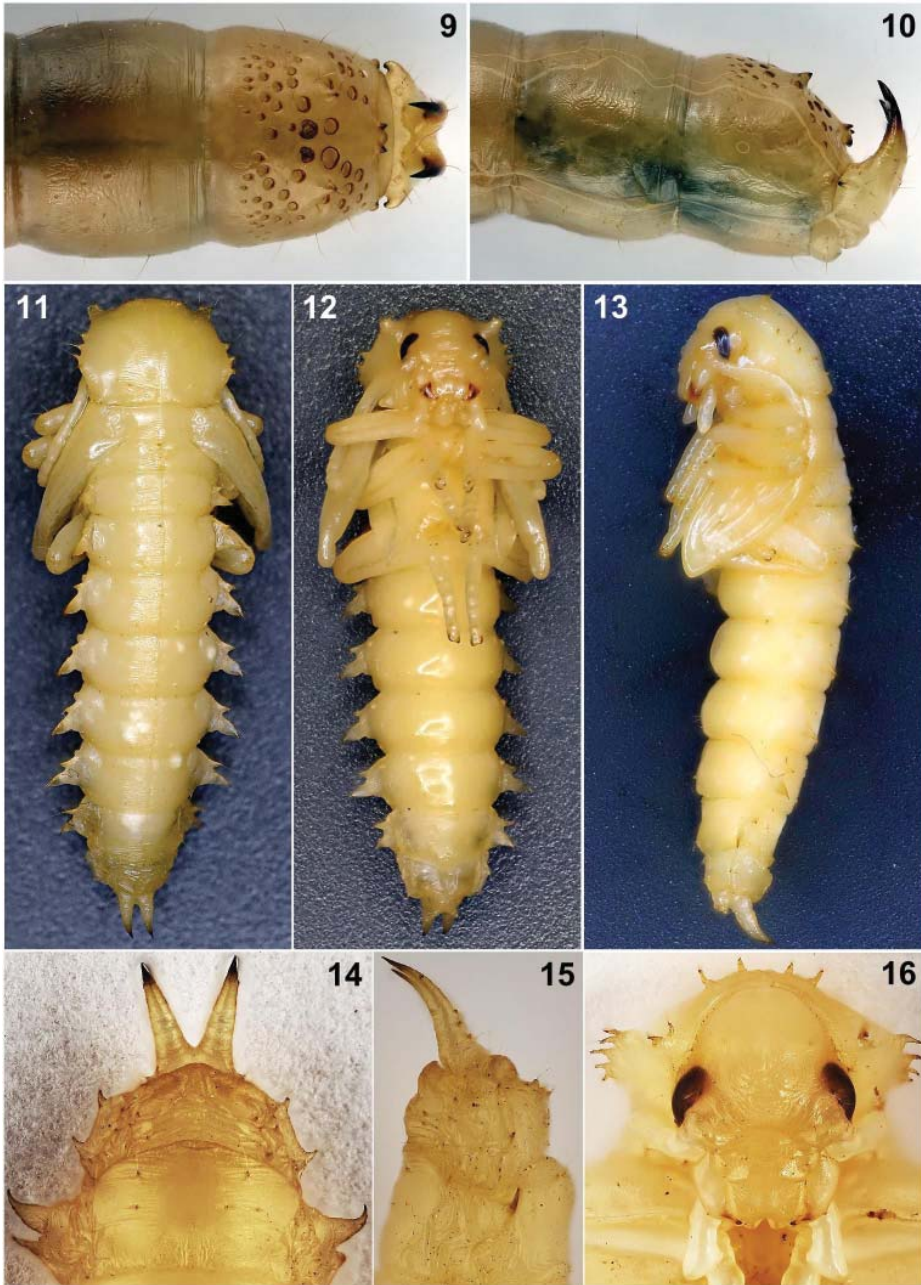
Larva. The description is based on a later instar larva 26 mm long, 2.8 mm wide, head capsule 2.3 mm broad.

Body (Fig. 1). Brownish-yellow with blackish mandibles; cuticle sclerotized, with shiny and weakly rugose surface of tergites and sternites.

Head (Figs. 2–6). Prognathous, oval, slightly tilted downward; seams very weakly visible; vertex with two and forehead with four long erect setae. Clypeus convex in lateral view, transverse, trapezoidal and with two long setae on each side, anterior margin somewhat hollowed. Labrum transverse, its dorsal surface slightly convex in lateral view, with eight marginal and two discal setae; marginal setae form three groups (3+2+3); discal setae slightly longer than marginal. Epipharynx with ten long marginal and two short discal setae; marginal setae form three groups (4+2+4); basal part with two longitudinal rows of brush-like setae. Antennae trimerous; antennomere I wider than long; antennomere II two to three times longer than the first one, slightly narrowed in middle; antennomere III slender, with four setae apically. Mandibles asymmetrical, strongly sclerotized apically and at molar part; both mandibles in dorsal view with long seta at their base and two setae laterally; mandible apices distinctly bifid (bidentate); left mandible with triangular tooth between apical tooth and molar part dorsally. Maxilla consisting of primary cardo, stipes, maxillary palpus and lacinia; the latter with two rows of short and thick setae on its inner margin; maxillary palpus three-segmented, bearing several long setae, all segments longer than wide, with last segment sub-conical. Labium with distinct prementum, mentum and submentum; prementum centrally with pair of long setae; ligula with two short thick setae; mentum subcylindrical, slightly widened in middle, with



Figs. 1–8. *Deretus spinicollis* Schawaller, 2004; larva. 1 – habitus in lateral view; 2 – clypeus, labrum and antennae in dorsal view; 3 – epipharynx in ventral view; 4 – head in ventral view; 5 – left mandible; 6 – right mandible; 7 – front leg; 8 – mid leg.



Figs. 9–16. *Deretus spinicollis* Schawaller, 2004; 9–10 – larva; 11–16 – pupa. 9 – abdominal segments 7–9 in dorsal view; 10 – same in lateral view. 11 – habitus in dorsal view; 12 – same in ventral view; 13 – same in lateral view; 14 – abdominal segments 7–9 in dorsal view; 15 – same in lateral view; 16 – head.

three pairs of long setae situated latero-medially and close to anterior and posterior margin respectively; submentum centrally with a pair of setae.

Thorax. Prothorax slightly longer than wide; mesothorax approx. twice as broad as long; metathorax approximately 1.5 times broader than long; prothorax with two pairs of setae situated close to anterior margin; meso- and metathorax with a pair of setae situated centro-laterally; all thoracic segments with four to seven setae laterally.

Legs (Figs. 7–8). Forelegs somewhat longer and stouter than mid- and hindlegs; trochanter elongated, covered with differing number of strong setae; femur and tibiotarsus covered sparsely with varying number of spines and setae; claws brown apically, their length about half length of tibiotarsus.

Abdomen (Figs. 9–10). Abdominal tergites 1–7 with several setae dorso-laterally; cuticle very slightly wrinkled transversally; spiracles small, more or less circular, slightly longer than wide; abdominal tergite 8 with large deep rounded holes, with two small spines situated dorso-laterally, with one small tooth in posterior corners and with relatively large and somewhat bidentate protuberance in the middle of posterior margin, this protuberance is smooth and bears two spines at its base projecting back obliquely upward; abdominal tergite 9 transverse in dorsal view, apically rounded and with 12 setae forming three groups (5+2+5) – two well separated groups of setae situated laterally and one group of setae situated in the middle of apex; abdominal tergite 9 also with prominent, projecting urogomphi apically strongly sclerotized, vertical and slightly bent forward, with three setae situated dorsally, one seta situated dorso-laterally on the outer side of each urogomphus and one seta situated at anterior base of each, lateral parts of abdominal tergite 9 also with one small projecting tooth horizontal and bent forward.

Pupa. Body (Figs. 11–13). Body length 16.5–18.2 (2.5–2.8) mm, body width 5.4–5.6 mm (n=3), white with darker apices of spines on lateral processes and urogomphi, with brown claws and mandible apices and with black eyes; body very sparsely setose, setae whitish-yellow; lateral processes of abdominal tergites well developed, bearing two fine setae; abdominal tergite 9 with pair of reflexed urogomphi.

Head (Fig. 16). Smooth, concealed (not visible in dorsal view), with two setae on forehead, with further two setae between eyes and with two setae behind each eye, the latter with two setae on its anterior margin; clypeus transversely wrinkled with two setae on each side; labrum smooth, sparsely setose.

Thorax. Pronotum transverse, slightly transversely wrinkled and with strongly protruded anterior angles, each with one to two spines, anterior pronotal margin with 4 spines, sides of pronotum slightly convex, with three to five spines in middle, posterior angles of pronotum with one spine, each half of pronotum with one spine situated before posterior pronotal margin, all pronotal spines bearing one seta; hypomeron smooth and glabrous; elytral and metathoracic wing sheaths glabrous, the latter shorter apically; mesonotum slightly longer than metanotum, both shorter than first abdominal tergum, meso- and metanota with two pairs of setae; meso- and metaventrite glabrous, the latter slightly longer than metacoxa.

Abdomen (Figs. 14–15). Abdominal spiracles ovate, present on segments 1–6; tergites 1–8 with 4–5 pairs of setae, tergite 8 also with two tubercles laterally, each bearing one seta; lateral processes of abdominal segments 1–7 with two apically sclerotized spines with one seta

before each spine; abdominal ventrite 2 glabrous, ventrite 3 with one pair of setae, ventrites 4–6 with five pairs of setae and ventrites 7–8 with three pairs of setae; tergite 9 with one pair of strongly developed, apically sclerotized urogomphi with several setae at base.

Legs. Same colour as body; procoxae with one to two setae; femora sparsely covered with several setae; tibiae and tarsi glabrous, the latter with brown claws.

Remarks. Spines on lateral processes of the abdomen and urogomphi on abdominal tergite 9 present in pupae of *Deretus spinicollis* serve as antipredator devices (STEINER 1995; BOUCHARD & STEINER 2004). Such structures, together with protective setae, spines as well as cryptic, aposematic and mimetic colours and shapes form a group of passive antipredator device and can be found in many insect pupae (BOUCHARD & STEINER 2004). In some cases also non-passive antipredator devices as stridulatory organs or so called ‘gin traps’ can be observed (HINTON 1955). In tenebrionid pupae, both these defence mechanisms can be observed frequently. The list of known tenebrionid pupae possessing antipredator devices is presented by BOUCHARD & STEINER (2004). According to this list, pupae of the genus *Helops* Fabricius, 1775 and *Tarpela* Bates, 1870 are the only known representatives of the tribe Helopini with antipredator structures. *Helops* possess the same structures as *Deretus*, while in *Tarpela* pupae gin traps and paired urogomphi are present.

Structures present in pupae seem to be very useful for phylogeny of Tenebrionidae. However, as only few representatives have been studied so far, there is no doubt that more taxonomic, ecological and behavioural studies are needed to fully understand their phylogenetic and evolutionary importance (BOUCHARD & STEINER 2004).

Comparative analysis

Presently, two subtribes of Palearctic Helopini are recognized – subtribe *Cylindrinotina* and *Helopina* (NABOZHENKO 2005; NABOZHENKO & GURGENIDZE 2006). According to LÖBL et al. (2008) *Deretus* belongs to the subtribe *Helopina*. So far this placement could not be confirmed based on larvae. Results of this study, however clearly show that its placement in the subtribe *Helopina* is justified, as the larvae of *Deretus spinicollis* have no protuberances at the base of urogomphi. The presence of small cylinder-shaped or cone-shaped protuberances is on the other hand a key character for the larvae of the subtribe *Cylindrinotina*. Three morphological types of Helopini larvae were distinguished (NABOZHENKO 2005a, b): ‘helopoid’, ‘nalassoid’ and ‘cylindrinotoid’. These three types correlate with adults’ characters and have been used for classification and phylogeny of the tribe. It is appropriate to distinguish four larval types that show the main phylogenetic branches of the tribe Helopini: ‘helopoid’ and ‘hedyphanoid’ of the subtribe *Helopina* and ‘nalassoid’ and ‘cylindrinotoid’ of the subtribe *Cylindrinotina* (see the key below). Results of this study show that the genus *Deretus* can be included in ‘helopoid’ branch of the tribe Helopini. Its larvae did not lose some structures during specialization as did *Hedyphanes* Fischer von Waldheim, 1820. Larvae of *Hedyphanes* live in soils of arid landscapes and have no protuberances and spines on sternite 8, unlike many other genera of the subtribe *Helopina*. Other known larvae of *Helopina* (*Helops*, *Proboticus* Seidlitz, 1896, *Deretus*) possess such characters and most of their species are associated with wood biotopes.

Generally, the tribe Helopini developed from the sylvan mode of life to the existence in open semi-desert landscapes (NABOZHENKO 2005b). Adults of many species live in trees and their larvae are soil dwellers, e.g. North American *Helops* or *Tarpela* (STEINER 1999; STEINER 2009). Only several species (*Deretus* and Palearctic *Helops*) inhabit wood as adults and larvae (BYZOVA & GILYAROV 1956; PURCHART 2012).

Key to subtribes and generic groups of the tribe Helopini based on larvae

[Modified key based on GILYAROV & SVETOVA (1963); NABOZHENKO & GURGENIDZE (2006); for authors and years of descriptions of the genera of Cyldrinatorina see LÖBL et al. (2008)]

1. Abdominal segment 9 with small cylinder-shaped or cone-shaped protuberances at base of urogomphi. Subtribe **Cylindrinatorina** 2
 - Abdominal segment 9 without small cylinder-shaped or cone-shaped protuberances at base of urogomphi. Subtribe **Helopina** 3
2. Labrum with 8 marginal and 2 discal setae on dorsal side.
 - **Nalassus group of genera** [*Nalassus*, *Zophohelops*, *Xanthomus*]
 - Labrum with 10 marginal and 2 discal setae on dorsal side.
 - **Cylindrinatorus group of genera** [*Odocnemis* (*Heloponotus*), *Cylindrinatorus*]
3. Abdominal tergite 8 without spines or protuberances (hedyphanoid type).
 - **Hedyphanes** Fischer von Waldheim, 1820
 - Abdominal tergite 8 with spines and protuberances (helopoid type). 4
4. Unpaired protuberance on abdominal tergite 8 with one distinct, strongly sclerotized apex. Surface of this protuberance bumpy. Large holes only on surface of abdominal tergite 8. Labrum with about 18–20 marginal and 6 discal setae. **Probaticus** Seidlitz, 1896
 - Unpaired protuberance on abdominal tergite 8 with two distinct apices or only somewhat bidentate apex. Surface of this protuberance smooth. 5
5. Whole surface of abdominal tergite 8 and partly surface of abdominal tergite 7 covered by large, deep and rounded holes. Labrum with 10 marginal and 4 discal setae. Large bifid protuberance of tergite 8 without spines. **Helops** Fabricius, 1775
 - Only surface of abdominal tergite 8 covered by large deep rounded holes. Labrum with 8 marginal and 2 discal setae. Large protuberance of tergite 8 with 2 short spines.
 - **Deretus** Gahan, 1900

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