



A new troglobitic *Tychobythinus* from Sicily (Coleoptera, Staphylinidae, Pselaphinae)

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Abstract

A new troglobitic Pselaphinae, *Tychobythinus villasmundi* **sp. nov.**, is described from Villasmundo Cave (Melilli, Syracuse province, Sicily). Major diagnostic features are illustrated based on both male and female specimens. The new species shows some adaptations to cave life, such as pale brown colour, setation consisting of long and flattened setae and suberect shorter setae, absence of wings, anophthalmy, and elongated legs and antennae. It can be easily separated from the related taxa by the different structure of the aedeagus. *Tychobythinus villasmundi* **sp. nov.** is known only from Villasmundo Cave, a limestone cave in the south-eastern Sicily.

Key words: Goniaceritae, Bythinini, *Tychobythinus villasmundi* **sp. nov.**, Limestone cave, Biospeleology, Nature reserve

Introduction

An extensive field work over the last year allowed the discovery of a new troglobitic species of Pselaphinae, which is described here. The new species belongs to *Tychobythinus* Ganglbauer, 1896, a large holarctic genus of the tribe Bythinini, with 91 taxa (87 species and 4 subspecies) known from the Palaearctic region (Schülke & Smetana 2015; Poggi & Magrini 2015; Hlaváč & Faille 2018).

Four species of *Tychobythinus* are known from Sicily. They include, in addition to the present new species: 1) *Tychobythinus glabratus* (Rye 1870), widely distributed in Western Europe, and reported in Sicily only for Peloritani Mountains (Sabella 1998); 2) *Tychobythinus effeminatus* Sabella, 1999, strictly endogean and endemic of Sicily, known only for Mount San Giuliano (Erice, Trapani), and 3) *Tychobythinus molarensis* Sabella, Grasso & Spena, 2012, a troglobitic species from Molara cave (Palermo province).

Materials and methods

Notes on sampling environment. The Villasmundo Cave (cadastral number SiSr7032, IGM Sheet 274 IV SE, 15°06'22.3"E, 37°13'17.2"N) is located in the eastern part of Sicily in Melilli territory, Syracuse province (Italy), within the Strict Nature Reserve "Complesso Speleologico Villasmundo-S. Alfio" (Fig. 1).

The reserve, which includes a buffer zone and a core area consisting of three caves, is managed by CUTGANA (Centro Universitario per la Tutela e la Gestione degli Ambienti Naturali e degli Agroecosistemi) of Catania University, and was established in 1998 in order to protect one of the most important karst systems of the hyblean area. The reserve is also part of the Special Area of Conservation (SAC) ITA090024 "Cozzo Ogliastri" (1.600 ha), and extends for about 70 hectares.

The entrances of the three caves, Villasmundo, Alfio e del Vaso, are along the banks of Caugno Rio stream and their access is limited to experienced speleologists for only scientific purposes.

Villasmundo Cave develops in the upper part of the Monti Climiti Formation, consisting of calcarenites to calcirudites with detritic-organogenic characteristics (Lower-Middle Miocene 25-12 My). The cave opens at an altitude of 130 m a.s.l. with a hole 1.5 m wide and 0.8 m high, at the base of the right bank of the stream “Cugno di Rio”. With a total length of 2.5 kilometers, Villasmundo is a succession of tunnels, sinkholes and pits (Fig. 2) with morphologies that suggest their formation in predominantly vadose conditions. It ends with a terminal lake 52 meters deep.

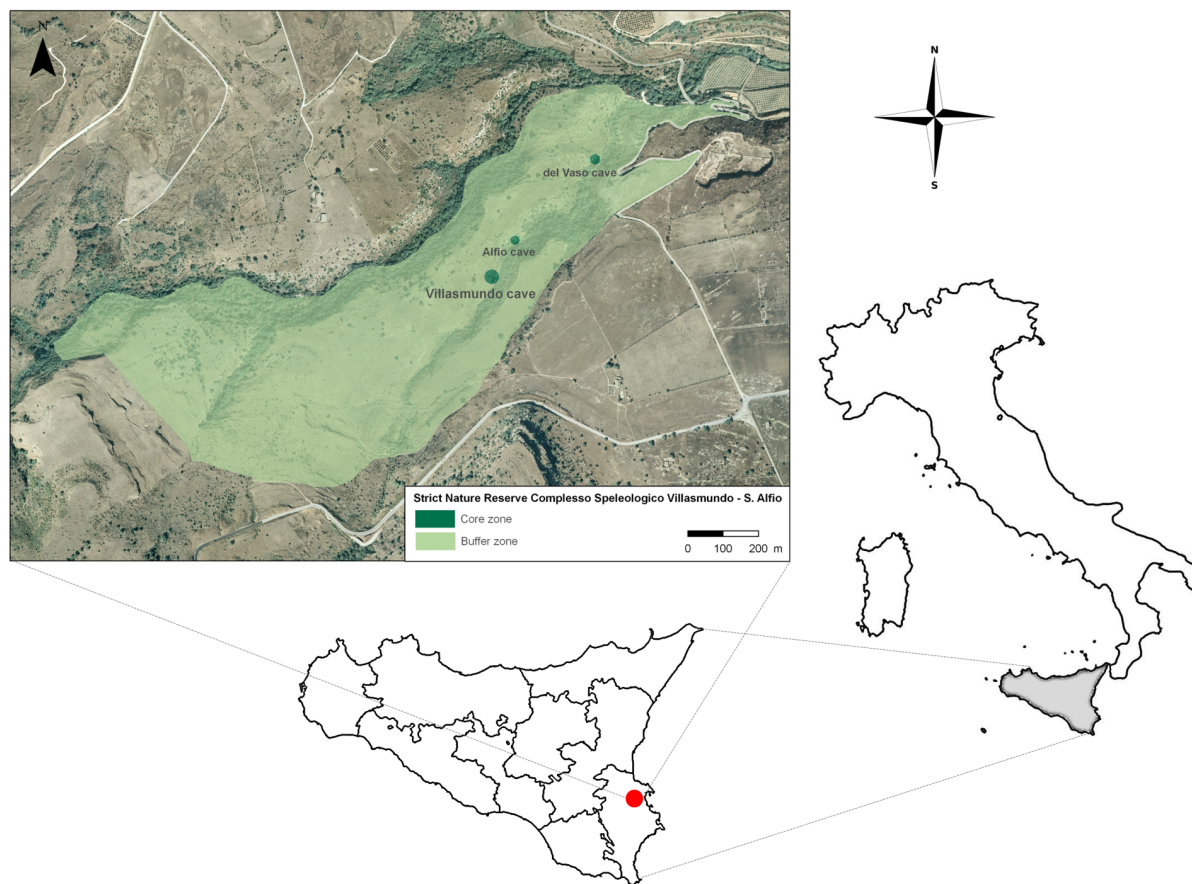


FIGURE 1. Location map of Strict Nature Reserve “Complesso Speleologico Villasmundo-S. Alfio”.

Permanent active streams still affect a large part of the cave, but in the branches abandoned by water flow a remarkable collection of concretions exists (Fig. 3). These manifest as speleothems of great scientific value such as stalactites, stalagmites, and columns. The Villasmundo cave, protected under European Habitat Directive 43/92, corresponds to 8310 habitat “Caves not open to the public”. It also a geosite since 2015. No faunal investigations have ever been conducted within the cave. The only species reported so far is the Isopod *Armadillium decorum* Brandt, 1833 (Caruso 1998), but since the end of 2017 a more in-depth biospeleological research is underway.

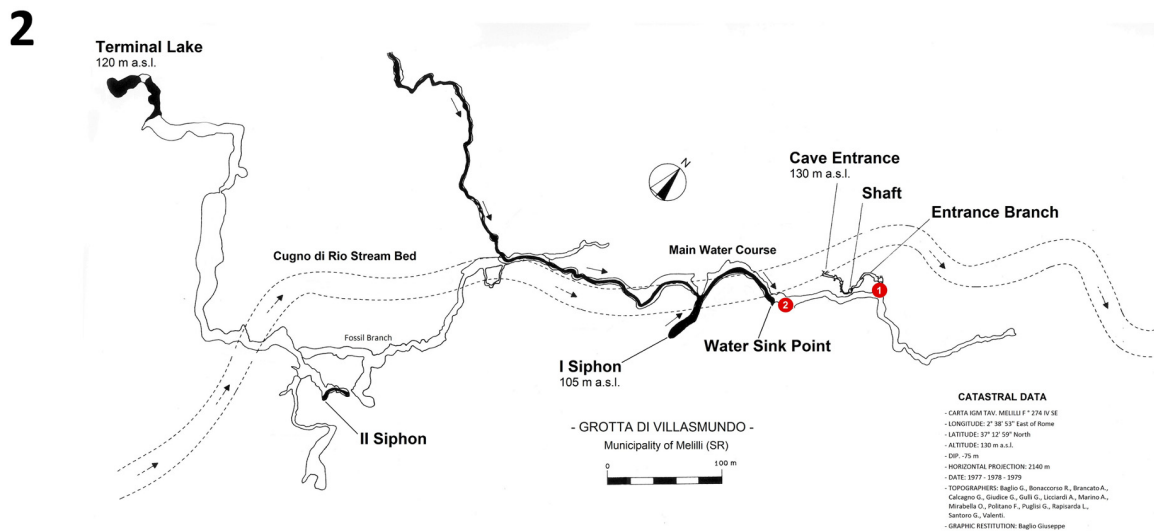
The specimens of the new species were collected on-site in a small room rich in organic matter at the end of the branch entry (Fig. 4). They were found under stones on the cave floor (Fig. 2, point n. 1) and along the clay deposits presents in the main gallery (Fig. 2, point n. 2), where baits had been previously placed (cheese). Additional specimens were also found into a pitfall trap, which was located at the second collection point. Specimens were collected by using soft tweezers and directly transferred to 70% ethanol.

During collection, temperature and humidity were measured using mobile instrument (175-H2 Datalogger), which were respectively of 18.1°C and 95.3% within the sampling area.

Measurements. The body length is measured from the anterior clypeal margin to the posterior margin of the last visible abdominal tergite. The length and width of the body parts were measured between points of maximum extension, e.g. the head length is measured between the anterior clypeal margin and the posterior margin of the neck; the head width includes the eyes, the elytral length along the suture line, and the elytral width is the total width of the two elytra taken together. The abdominal tergites are numbered based on order of visibility. Morphological terminology follows Chandler (2001), except that the abdominal sternites are termed ventrites here.

Aedeagus of holotype and telisternite of a female paratype were mounted in Canada balsam. A camera lucida mounted on a Leica DMLB stereomicroscope was used for drawings, while photos were made using a Leica digital camera mounted on Leica DMLB stereomicroscope, using software CombineZ.

The holotype and the paratypes are deposited in Sabella collection, University of Catania (acronym DBUC).



FIGURES 2–4. 2. Topography of the Villasmundo cave (from Centro Speleologico Etneo 1998, modified). The two red dots indicate the sampling points where *T. villasmundi* sp. nov. was collected. 3. Speleothemes and stream in Villasmundo cave (Ph. F. Fiorenza). 4. One of the spots where *T. villasmundi* sp. nov. was collected (Ph. F. Leone).

Taxonomy

Tychobythinus villasmundi Sabella, Amore and Nicolosi sp. nov.

(Figs. 5–13)

Type material. Holotype: ITALY: Sicily Region: Melilli (SR), Villasmundo Cave, 16.IX.2017, 1 ♂, G. Nicolosi leg. (DBUC). **Paratypes:** ITALY: Sicily Region: 2 ♀♀, same data of holotype (DBUC); 1 ♀, same locality, 31.V.2018, G. Nicolosi leg. (DBUC); 2 ♀♀, same locality, 05.VII.2018, G. Nicolosi leg. (DBUC); 3 ♀♀, same locality, 29.VII.2018, G. Nicolosi leg. (DBUC); 2 ♀♀, same locality, 11.X.2018, trap 7, G. Nicolosi leg. (DBUC); 1 ♂ and 2 ♀♀, same locality, 26.X.2018, trap 7, G. Nicolosi leg. (DBUC); 1 ♀, same locality, 27.XI.2018, trap 7, G. Nicolosi leg. (DBUC).

Description. Male: Length 1.25–1.30 mm, apterous and anophthalmous. Entirely pale brown with lighter antennae, palpi, and legs. Pubescence consists of long and flattened setae (length: 0.07–0.08 mm) on head, pronotum, elytra and abdomen, other suberect shorter setae (length: 0.03–0.04 mm) on antennae, and legs, and thin fluff on apical segment of maxillary palpi.

Head (Figs. 6–7) wider (0.30 mm) than long (0.235–0.240 mm) slightly narrower than pronotum. Frontal lobe wider (0.15 mm) than long (0.075 mm) with subparallel, protruding and sharp sides; antennal tubercle protruding. Frons between antennal tubercles with large median sulcus reaching the anterior edge of vertexal foveae. Sides of frontal region with some punctures. Clypeal carina well-defined, equally visible in dorsal as well in lateral view, extends to ocular region. Tempora rounded, convex occipital region traversed by median longitudinal sulcus reaching over posterior edge of vertexal foveae, late wide and well-impressed. Gular region (Figs 8–9) behind labium with deep and broad impression margined posteriorly by transverse ridge projecting on each side of head. This ridge with long and acute median process, projecting ventrally, and bearing tuft of setae on the tip. Base of the gular region with two long and sturdy medians bristles. Antennae (Fig. 10) 0.635–0.640 mm long, scape more than 3.5 times longer (0.175–0.185 mm) than wide (0.05 mm), narrowed and flattened with protruding and sharp medial margin in basal third, wider in middle. Pedicel ovoid, slightly asymmetric, about one and a half times longer than wide, slightly tighter than scape, and distinctly wider than funicular segments. Antennomere III longer than wide and slightly narrowed at base; antennomere IV as long as wide, antennomere V longer than wide, antennomeres VI–VII subequal and as long as wide, antennomere VIII wider than long. Antennal club consisting of last three antennomeres which are broaden progressively from IX to XI. Antennomere IX slightly wider than long, antennomere X distinctly wider than long, antennomere XI distinctly longer than wide and twice as long as combined length of antennomeres IX and X. Maxillary palpi with palpomere II elongated and gradually expanded from base to apex, its surface covered by 4–6 tubercles concentrated in the distal portion. Palpomere III slightly longer than wide, its surface with 2–3 tubercles; last palpomere about 4 times as long (0.24 mm) as wide (0.06 mm), widest in basal third, lateral margin slightly curved and sinuate in middle.

Pronotum slightly wider (0.31 mm) than long (0.30 mm), widest near basal third, anteriorly slightly tapered with sinuate sides, posteriorly more tapered with straight sides. Its dorsal surface shiny with some rare and faint punctures. Pleural carina oblique, well-defined. Two well impressed antebasal lateral fovea linked by the antebasal sulcus. Tegument between pronotal posterior margin and antebasal sulcus rough, it makes difficult to recognize median antebasal fovea. Metaventricle with median egg-shaped impression beginning from its posterior margin and extending just before mesocoxal cavities, and bearing for its entire length a median longitudinal carina. Base of mesocoxal cavities with pubescent pit on each side.

Elytra distinctly wider (0.55 mm) than long (0.49 mm), convex, sides slightly rounded from base to the apex, widest near middle. Humeral calli strongly reduced. Dorsal surface shiny with only some superficial punctures. Each elytron with two basal foveae, subhumeral fovea well-defined. Both, marginal and sutural striae reaching elytral apex, discal striae lacking.

Abdomen normally shaped without particular characters.

Legs relatively long and thin. Protrochanters with 1–2 tubercles on ventral surface, protibiae slightly flattened and sinuate in distal third, tarsomere II of protarsi slightly dilated. Meso and metatrochanters simple; femora simple, mesotibiae simple, length of metatibiae: 0.45–0.46 mm, slightly enlarged and sinuate in the distal third.

Aedeagus (Fig. 12) 0.24–0.25 mm long, ovoid with relatively short parameres, that are convergent and with narrow apex, each bearing two subapical setae. Internal sac with 2 big and long teeth and 3 smaller spines.

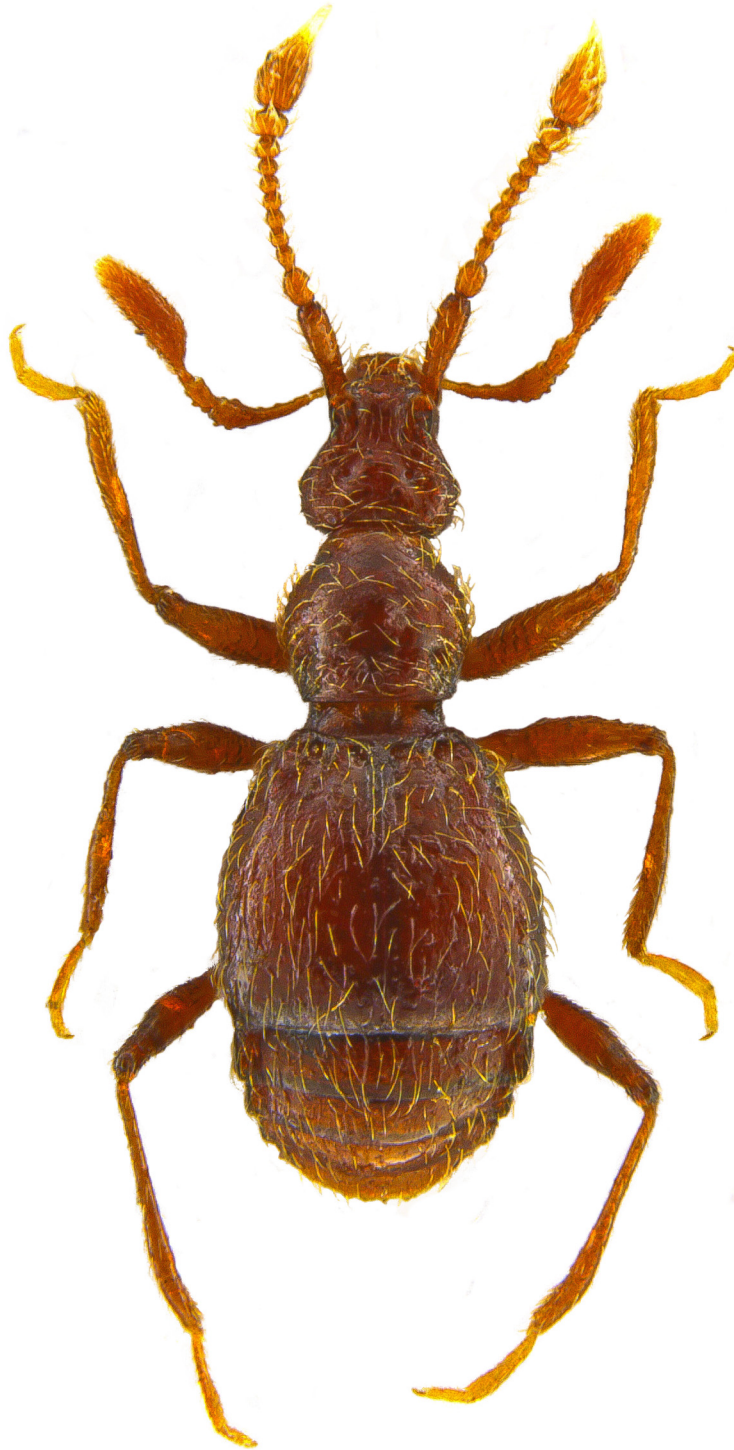


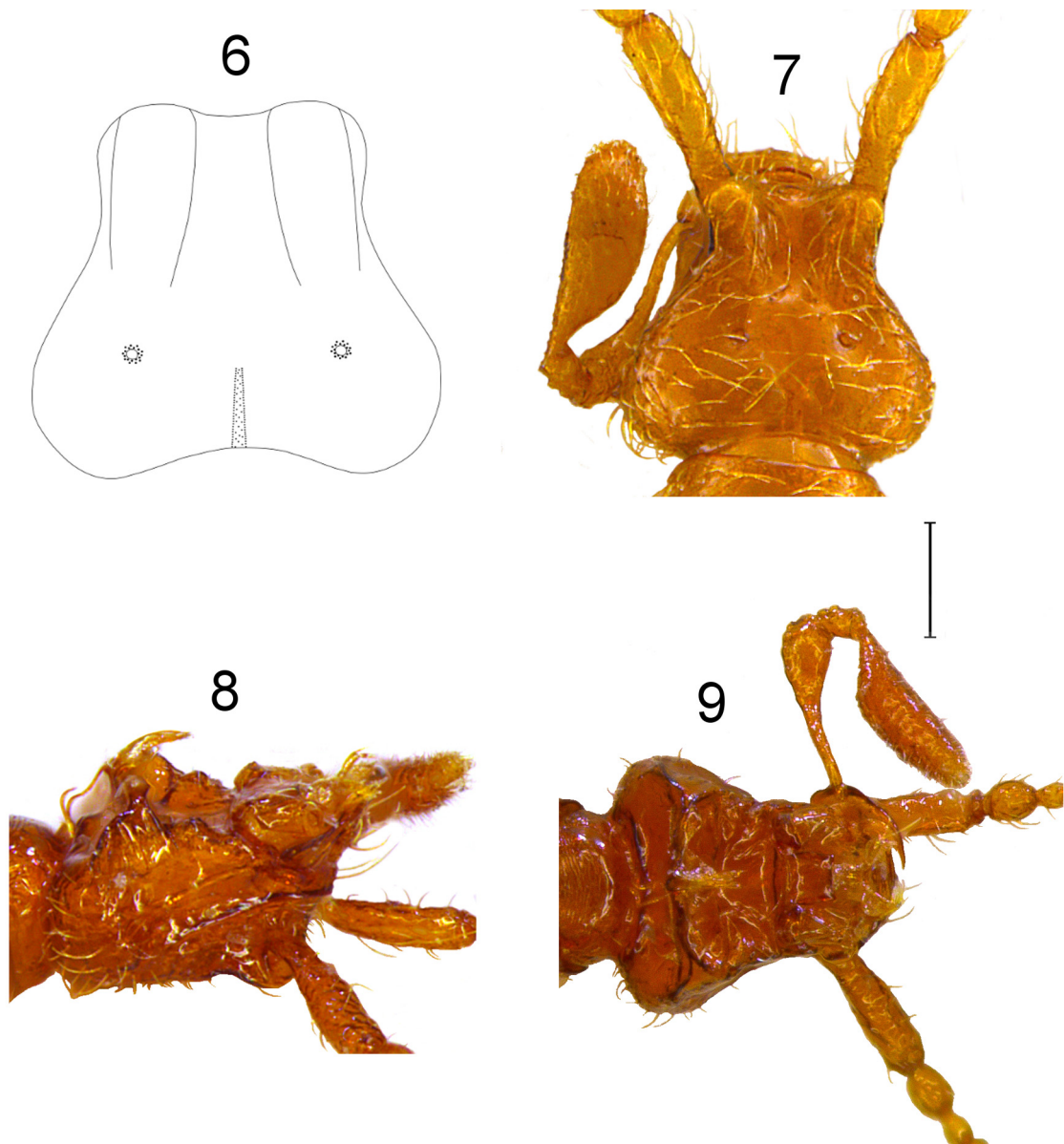
FIGURE 5. *Tychobythinus villasmundi* sp. nov. Paratype female, habitus, dorsal view (Ph. A. Marletta).

Female: Similar to male (Fig. 5), length 1.25–1.45 mm, head slightly wider (0.25–0.26 mm) than long (0.23–0.24 mm), gular region unmodified, slightly convex. Maxillary palpi with surface of palpomere II covered by 12–16 tubercles (Fig. 11). Metaventricle lacking median impression; legs with protibiae, tarsomere II of protarsi, and metatibiae unmodified. Telisternite as in Fig. 13.

Discussion. *T. villasmundi* sp. nov. differs from all other *Tychobythinus* species by its aedeagal and exoskeleton features. However, it shows affinities with *Tychobythinus* species from North Africa which belong to two distinct groups (Sabella *et al.* 2014). Since their external morphology is closely related to their biology, it is not necessary they really represent two homogeneous phyletic lineages.

The aedeagus of *T. villasmundi* **sp. nov.** is comparable with the species belonging to the *Tychobythinus algiricus* group (Sabella *et al.* 2014; *Chiasmatoxythus* *sensu* Jeannel 1956), especially to *T. algiricus* (Raffray 1871), which is widespread in the Maghreb (Tunisia, northern Algeria and Morocco). However, all the species in this group are macro or microphthalmous, whereas *T. villasmundi* is anophthalmous.

Because of troglitic adaptations, *T. villasmundi* can be also compared with the species belonging to the *Tychobythinus theryi* group (Sabella *et al.* 2013; *Anopsibythus* *sensu* Jeannel 1956) and, especially with the wingless and eyeless *T. theryi* (Guillebeau 1894), known only from three females from Saint Charles (northern Algeria), and *T. normandi* (Jeannel 1956), which is known only from a single male from Philippeville (old name of Skikda) in northern Algeria.

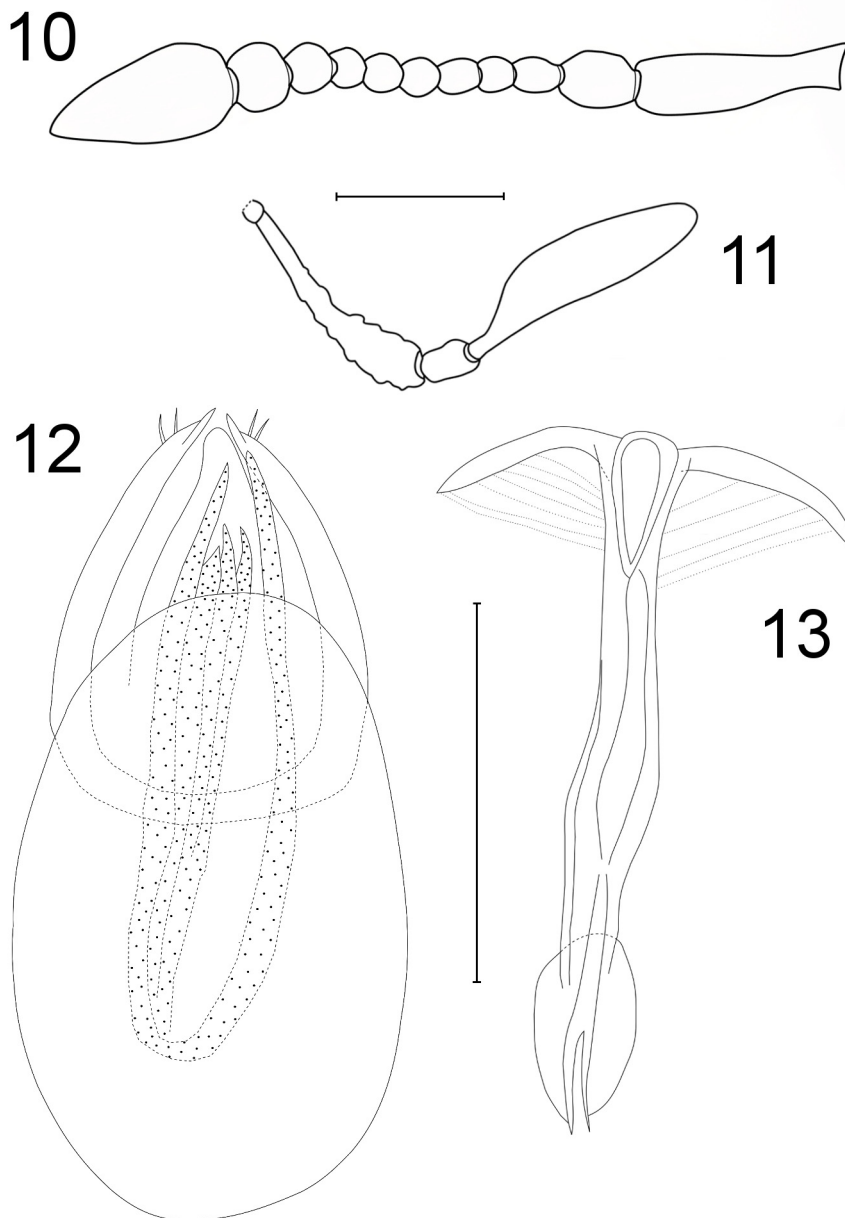


FIGURES 6–9. *Tychobythinus villasmundi* **sp. nov.** 6. Head in dorsal view, schematic drawing. 7. Holotype male, head, dorsal view (Ph. A. Marletta). 8. Holotype male, head, lateral view (Ph. A. Marletta). 9. Holotype male, head, ventral view (Ph. A. Marletta). Scale: 0.1 mm.

Tychobythinus villasmundi **sp. nov.** can be easily distinguished from *T. theryi* by its shiny tegument of dorsal surface (slightly but distinctly punctuate in *T. theryi*), the wider frontal lobe (0.15 mm in *T. villasmundi* **sp. nov.** versus 0.125–0.13 mm in *T. theryi*), longer antennae (0.63–0.64 mm in *T. villasmundi* **sp. nov.**, versus 0.55–0.56

mm in *T. theryi*), and by the presence of less tubercles on the palpomere II (12–16 in *T. villasmundi* **sp. nov.** against 24–30 in *T. theryi*).

Tychobythinus villasmundi **sp. nov.** differs from *T. normandi* mainly by the features on the tempora (rounded in *Tychobythinus villasmundi*, angulated and dug in *T. normandi*). From both species the new species differs by the structure of aedeagus.



FIGURES 10–13. *Tychobythinus villasmundi* **sp. nov.** 10. Holotype male, left antenna. 11. Paratype female, right maxillary palpus. 12. Holotype male, aedeagus, dorsal view. 13. Paratype female, telisternite, dorsal view. Scale: 0.1 mm.

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