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# Hidden in the cracks: new cryptic species of minute moss beetles and rove beetles from supralittoral habitats on Sant'Antioco Island (Sardinia, Italy) (Coleoptera: Hydraenidae, Staphylinidae)

C. HERNANDO & L. FANCELLO

**Abstract**

*Ochthebius* (*Cobalius*) *neptunus* sp.n. (Coleoptera: Hydraenidae: Ochthebiinae) and *Carpelimus* (*Trogophloeus*) *sulcitanus* sp.n. (Coleoptera: Staphylinidae: Oxytelinae) are described. So far, both species are known only from cracks in the rocky shores on the northwestern shore of Sant'Antioco Island (SW of Sardinia, Italy).

**Key words**: Coleoptera, Hydraenidae, Ochthebiinae, *Ochthebius*, *Cobalius*, Staphylinidae, Oxytelinae, *Carpelimus*, *Trogophloeus*, new species, taxonomy, supralittoral, Sant'Antioco, Sardinia, Italy.

## Introduction

Recent sampling on the rocky coast of the island of Sant'Antioco (southwest of Sardinia, Italy) has led to the discovery of a new apterous species of Hydraenidae (*Ochthebius* subgenus *Cobalius* REY, 1886) and a new brachypterous species of Staphylinidae (*Carpelimus* subgenus *Trogophloeus* MANNERHEIM, 1830). Both species are described below.

The species of *Cobalius* mainly inhabit supralittoral rockpools in the western Palearctic, including the Mediterranean Sea, the Black Sea, the Atlantic Ocean and Macaronesia, the only exception being *Ochthebius serratus* ROSENHAUER, 1856, which is found in saltwater streams in southern Spain and Morocco (JÄCH 1989, VILLASTRIGO et al. 2020, 2022). *Cobalius* is currently divided into three species groups (*O. algicola* WOLLASTON, 1871, *O. biltoni* JÄCH & DELGADO, 2017, *O. lejolisii* MULSANT & REY, 1861), plus two species (*O. anzar* VILLASTRIGO et al., 2020 and *O. serratus*) that are not assigned to any group but are well-characterized morphologically and genetically (VILLASTRIGO et al. 2020). The *O. biltoni* species group was established by VILLASTRIGO et al. (2020) and currently consists of three species: *O. biltoni* from Sicily, *O. evae* VILLASTRIGO et al., 2020 from the Moroccan Atlantic coast and the southern Iberian Mediterranean coast, and *O. cortomaltese* VILLASTRIGO et al., 2020 from Malta (VILLASTRIGO et al. 2020).

The rove beetle genus *Carpelimus* LEACH, 1819, is represented by about 400 species worldwide (NEWTON 2022). These beetles are usually found very close to the water's edge in rivers, wetlands, estuaries, saltmarshes or under detritus on sandy beaches (MOORE & LEGNER 1976, JÄCH 1998, HAMMOND 2000, LOTT 2003, 2009). With few documented exceptions (COIFFAIT 1982), all species in this genus have well-developed wings and good flight capabilities, and they can even take flight directly from the water's surface (MOORE 1972).

## Material and methods

Dissections were carried out using standard techniques. The aedeagi of both species and the spermatheca of *Carpelimus* were dissected from the abdomen of specimen previously softened in hot water for five minutes. After the examination, the aedeagi were mounted on a transparent co-polyester card (Vivak®) in dimethyl hydantoin formaldehyde (DMHF) resin and fixed on the

same pin under the specimens. The morphology was examined using a Leica M125 C stereomicroscope. Habitus images were taken with a Canon EOS R digital camera equipped with a Canon MP-E 65 mm f/2.8 1–5 macro lens attached. The aedeagus, sternites and spermatheca were photographed with a digital camera (Canon EOS 50D) attached to a compound microscope (Zeiss Axiostar plus). Serial images were stacked using Helicon Focus 8.2.3 software. Measurements were taken with a linear ocular micrometer.

The label data are quoted verbatim; a backslash '\' indicates a line break.

The type specimens of the two new species are deposited in the following collections:

| | |
|---|---|
| CHC | Coll. C. Hernando, Badalona, Catalonia, Spain |
| LFC | Coll. L. Fancello, Cagliari, Sardinia, Italy |
| MCNB | Museum of Natural Sciences of Barcelona, Catalonia, Spain |
| MSNG | Natural History Museum Giacomo Doria, Genova, Italy |
| NMW | Naturhistorisches Museum Wien, Vienna, Austria |

### *Ochthebius* (*Cobalius*) *neptunus* sp.n.

TYPE LOCALITY: Rocky shore of Nido dei Passeri, 39°4'14.5"N 8°21'8.7"E, Calasetta, Sant'Antioco Island SW of Sardinia, Italy (Figs. 3–5).

TYPE MATERIAL: **Holotype** ♂ (NMW): "IT.[ALY] Sardinia, Calasetta \ Sant'Antioco Island \ In cracks on the rocky shore \ Nido dei Passeri \ 39°4'14.5"N 8°21'8.7"E \ L. Fancello leg. 14-IV-2024".

DESCRIPTION: Habitus as in Fig. 1. Length: 1.90 mm; width: 0.62 mm. Body color black, appendages dark brown.

Head: Dorsal surface very rugose with dense, irregular setiferous punctures bearing short thick whitish hook-shaped semi-erect setae. Clypeal suture shallow, weakly arched; surface of clypeus and labrum less rugose. Labrum very sparsely punctate bearing very short, sparse setae; anterior margin of labrum weakly incised. Vertex with two foveae and an ocellus behind each fovea. Eyes prominent, larger than in the other species of the group.

Pronotum trapezoidal, elongate, lateral margins straight posteriorly, regularly arched anteriorly; margins very irregularly denticulate, with broad denticles. Surface covered with large setiferous punctures of varying size; the interior of these punctures is coarse, spaces between punctures smooth and shiny, with relatively short, erect hook-shaped setae. Anterior angles obtuse, posterior angles rounded, with a very narrow hyaline band on the anterior and posterior margins; lateral longitudinal depressions very shallow.

Elytra elongate, subparallel-sided; margins weakly serrate along entire length, with shallow irregular denticles, more apparent basally. Surface with regular series of well-impressed setiferous punctures, with relatively short, whitish robust hook-like semi-erect setae; surface between punctures smooth and shiny, with weakly impressed transverse striae. Hind wings absent.

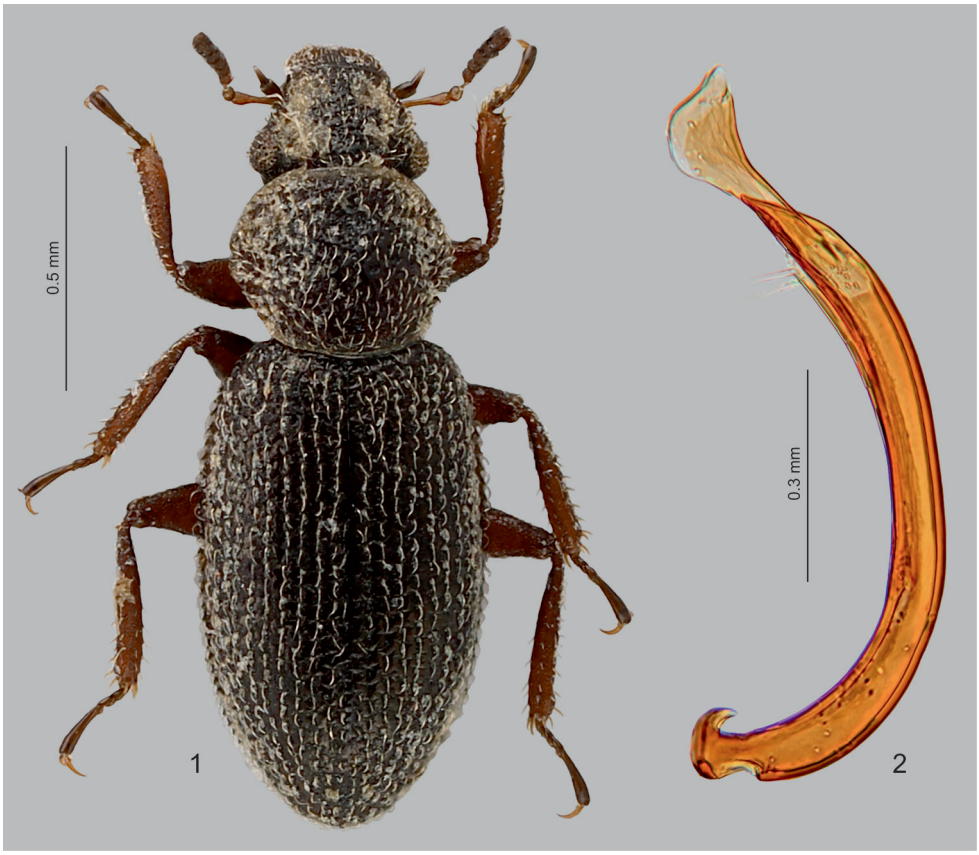
Legs short and robust, with rows of strong short spines, without natatorial setae.

Aedeagus (Fig. 2): Median lobe slightly curved in lateral view, apical part enlarged, apex pointed. Distal lobe broad, dorsal margin concave, ventral margin strongly convex, apex hyaline. Parameres inserted near the basal third of the median lobe, not reaching its apex.

Female unknown.

DIFFERENTIAL DIAGNOSIS: The new species is easily separated from all other species of the *O. biltoni* group by the following characteristics: 1) body larger and more robust (1.90 mm long, whereas in the three other species the length ranges from 1.56–1.66 mm); 2) pronotum more

elongate and with larger dorsal punctures; 3) setae on the dorsal surface longer, semi-erect; 4) eyes larger and more prominent; 5) aedeagal distal lobe with strongly convex ventral margin. For illustrations of *O. biltoni*, *O. evae* and *O. cortomaltese*, see JÄCH & DELGADO (2017), SABATELLI et al. (2018), and VILLASTRIGO et al. (2020).




Figs. 1–2: *Ochthebius neptunus*: 1) habitus in dorsal view, 2) aedeagus in lateral view.

HABITAT NOTES: The holotype was collected in the supralittoral zone (Fig. 3), hidden inside a rocky crevice near the seashore (Figs. 4–5). It was extracted by repeatedly splashing water with a bucket onto the rock, causing the specimen to be washed into a rockpool below the crack, where it was captured with a net. Despite considerable efforts, no additional specimen was found in any of the other crevices or in the surrounding rockpools. The associated beetles collected in the crevices include an undescribed brachypterous species of the genus *Carpelimus* (Staphylinidae) described below, which appears to be similarly adapted to this habitat, and some specimens of *Holoparamecus* (*Tomyrium*) *bertouti* AUBÉ, 1861 (Endomychidae).

DISTRIBUTION: So far known only from the type locality (Fig. 6).

ETYMOLOGY: Named after Neptune (Latin: Neptunus), the Roman god of freshwater and the sea. Proper noun in apposition.




Figs. 3–5: Habitat of *Ochthebius neptunus* and *Carpelimus sulcitanus*: 3) overview, 4) full view of the crack, 5) close up. The yellow arrows indicate the crevice from which the holotype of *O. neptunus* has been washed out.

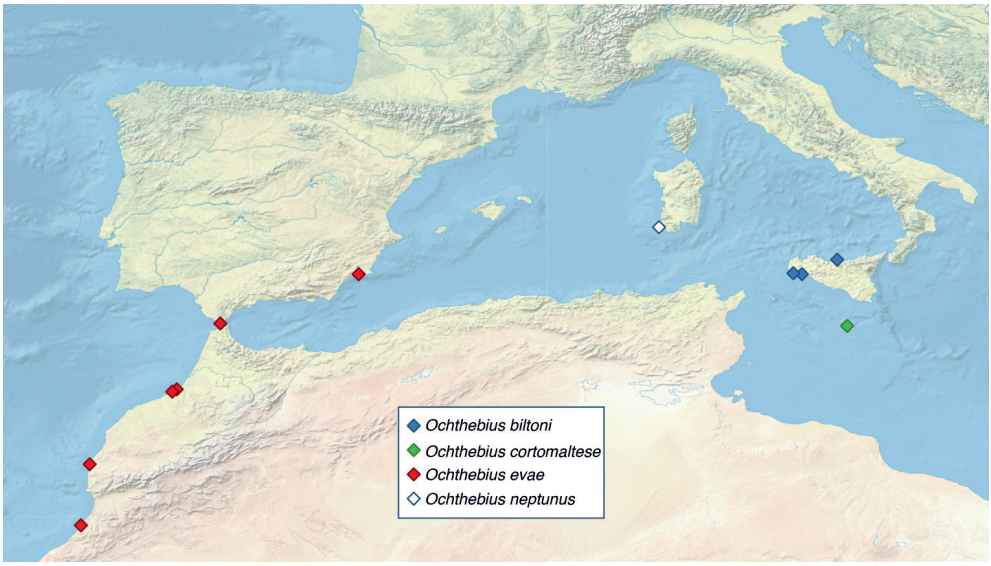



Fig. 6: Geographical distribution of the species of the *Ochthebius biltoni* group.

### *Carpelimus* (*Trogophloeus*) *sulcitanus* sp.n.

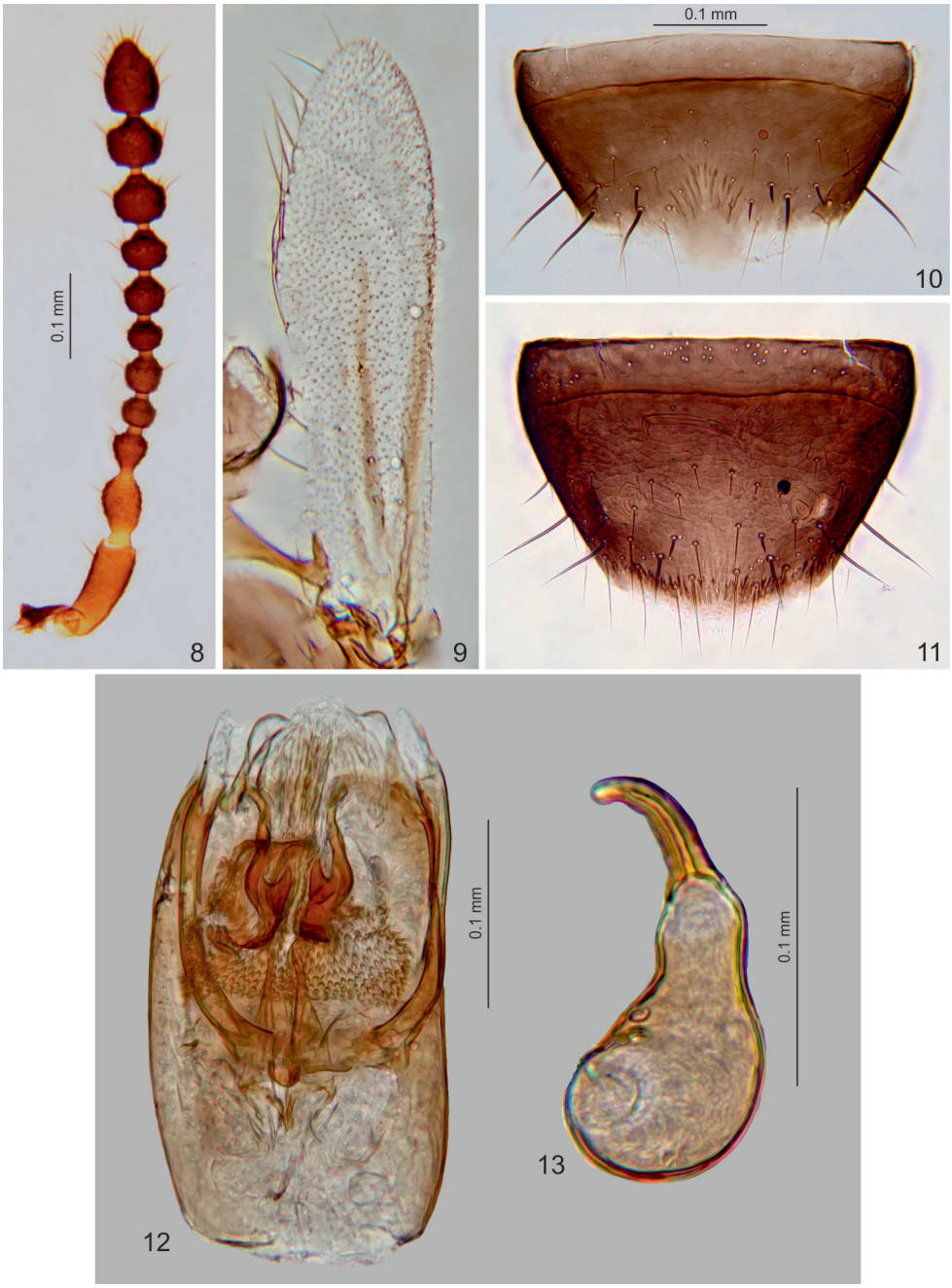
TYPE LOCALITY: Rocky coast at Spiaggia Grande, 39º5'15.7"N 8º21'25.7"E, south of Calasetta, Sant'Antioco Island SW of Sardinia, Italy (Figs. 14–16).

TYPE MATERIAL: **Holotype** ♂ (NMW): "IT.[ALY] Sardinia, Calasetta / Sant'Antioco Island \ In cracks on the rocky shore \ near Spiaggia Grande \ 39º5'15.7"N 8º21'25.7"E \ C. Hernando leg. 31-III-2024". **Paratypes**: 2 ♂♂, 12 ♀♀ (CHC: 13, MCNB: 1): same data as holotype; 13 exs. (LFC: 12, MSNG: 1): "IT.[ALY] Sardinia, Calasetta \ Sant'Antioco Island \ In cracks on the rocky shore \ Nido dei Passeri \ 39°4'14.5"N 8°21'8.7"E \ L. Fancello leg. 15-IV-2024; 9 exs. (LFC): same locality and collector, but "28-IV-2024"; 3 exs. (LFC): same locality and collector, but "5-V-2024"; 2 exs. (LFC): same locality and collector, but "23-IV-2024".

DESCRIPTION: Habitus as in Fig. 7. Length: 2.68 mm. Body colour entirely black, maxillary palps light brown, antennae dark brown, legs with dark brown femora, tibiae and tarsi light brown. Dorsal surface covered by dense and short recumbent grey pubescence.

Head transverse, slightly wider than long (0.35/0.31 mm), with wide basal portion; neck constriction prominent; temples well-developed, round; eyes small, not very prominent, barely protruding from the lateral margin of the head; diameter of eye in dorsal view about twice as long as temple; surface densely shagreened, except at the neck, which is distinctly microreticulate; frons with two well-marked longitudinal lateral grooves; pubescence very dense, short and recumbent, with some semi-erect setae at the base. Antennae (Fig. 8) 0.61 mm long; first antennomere much longer than wide (0.1/0.04 mm) cylindrical in shape; antennomere 2 globular, longer than wide (0.07/0.03 mm); antennomere 3 pyriform, slightly longer than wide (0.04/0.03); antennomere 4 transverse, slightly wider than long (0.03/0.02); antennomere 5 transverse, slightly longer than wide (0.04/0.03); antennomere 6 transverse and distinctly smaller than the anterior and posterior antennomeres (0.02/0.03); antennomeres 7–8 transverse, slightly wider than long (0.04/0.05); antennomeres 9–10 subquadrate, slightly wider than long (0.05/0.06); terminal antennomere longer than wide (0.07/0.06 mm), oval; three apical antennomeres more massive than previous ones, forming a loose club.

Fig. 7: Habitus of *Carpelimus sulcitanus*, holotype.




Figs. 8–13: *Carpelimus sulcitanus*: 8) antenna, 9) left wing in dorsal view, 10) male sternite VIII, 11) female sternite VIII, 12) aedeagus in ventral view, 13) spermatheca.


Figs. 14–16: Habitat of *Carpelimus sulcitanus* at the type locality: 14) overview, 15–16) close ups. The yellow arrows in the overview indicate the exact sampling site, and in the close ups, they point to the crevices where the specimens were captured.

Pronotum wider than long (0.36/0.3 mm); markedly narrowed basally; lateral margins regularly curved. Surface of pronotum densely shagreened; coarsely sculptured; disc with two diffuse symmetrical depressions; pubescence very dense, short and recumbent; with four long erect setae, two next to anterior angles and two approximately in the median part of the lateral margins.

Elytra relatively short (0.35 mm); maximum width (0.48 mm). Surface strongly and closely densely punctate; pubescence very dense and recumbent, clearly shorter than head and pronotum. Brachypterous, metathoracic wings (Fig. 9) reduced to small membranes, without defined venation.

Abdomen with fine, moderately dense punctation; surface with well impressed microsculpture; pubescence long and recumbent. Male sternite VIII (Fig. 10) transverse, with microreticulate surface, posterior margin membranous and protruding in the middle, with a group of short longitudinal striae located in the median part of the posterior margin.

Legs short and robust, with some erect setae. Claws long and robust, strongly curved.

Aedeagus (Fig. 12): In ventral view, the endophallus is provided with a pair of bifurcated, strongly sclerotized and robust structures located in its anterior part; the central part is occupied by a sac profusely covered with small spines; basal part with two triangular structures.

Sexual Dimorphism: Sternite VIII (Fig. 11) more elongate than in males, microreticulation on the surface more pronounced; posterior margin membranous area narrower than in males, and regularly curved along its entire length; short longitudinal striae distributed along the entire posterior margin; setation similar to that of the male, but there more long apical setae in the female. Spermatheca as in Fig. 13.

DIFFERENTIAL DIAGNOSIS: This species belongs to the *Carpelimus halophilus* species group (GILDENKOV 2015). However, it is clearly distinguished from all other species of the group by the shape and internal structure of the aedeagus. Based on the general body shape, surface microsculpture, and the shape of the aedeagus, it appears to be most closely related to *C. halophilus* (KIESENWETTER, 1844), from which it distinctly differs in the smaller and less prominent eyes, much shorter elytra, poorly developed wings, and markedly different internal aedeagal structures. For illustrations of *C. halophilus* see TRONQUET (2006) and GILDENKOV (2015).

HABITAT NOTES: All specimens, adults and larvae, were discovered in the supralittoral zone, hidden in rocky crevices near the seashore (Figs. 3–5, 14–16); see above, under *Ochthebius neptunus* for further collecting details. Some specimens were observed moving very slowly over the rocks near the rockpools after they had been washed out from the cracks. A similar behaviour has been described for the omaliine rove beetle *Micralymma marinum* (STRØM, 1783) from the North Atlantic coast (SHARP 1915). The specificity of this habitat, together with the fact that the species is brachypterous, and the presence of larvae indicate that the entire life cycle of this species takes place inside these crevices, which suggests a high level of adaptation to this particular habitat. The associated beetle fauna extracted from these cracks was limited to the single specimen of *Ochthebius* (*Cobalius*) *neptunus* (Hydraenidae) described above, and some specimens of *Holoparamecus* (*Tomyrium*) *bertouti* (Endomychidae).

DISTRIBUTION: At present, this species is known only from two localities along the rocky coast of the northwestern part of the island of Sant'Antioco (SW Sardinia, Italy) (Fig. 17).

DISCUSSION: Many species of *Carpelimus* have been documented on stranded seaweeds in marine coasts around the world. However, these species are also found in other types of saline habitats, which are not strictly marine. In the checklist of the world's coastal staphylinids (FRANK & AHN 2011), only one species of the genus, *C. lucidus* (CAMERON, 1944) from Zanzibar, is included. This species has been found in seaweeds (CAMERON 1944). Most likely, *C. sulcitanus* is a truly coastal species as well. Its habitat (rocky coastal crevices very close to the sea), the presence of larvae, and the reduced wings that do not allow the adults to fly, suggest a high degree of specialization for this type of habitat.

ETYMOLOGY: Named in reference to the Archipelago of Sulcis (Latin: Sulcitanae insulae), to which the island of Sant'Antioco belongs. The name is used as an adjective.


Fig. 17: Geographical distribution of *Carpelimus sulcitanus*.

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