Schiffermuelleria sempronas sp. n., a brilliant moth living in old olive trees in Crete (Lepidoptera, Oecophoridae)

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Schiffermuelleria sempronas **sp. n.** from the Greek island of Crete is described new to science. The new species is characteristic both in the DNA barcode region and the morphology of the genitalia. The ecology of the species as well as its taxonomic position is discussed.

Key words: Lepidoptera, Oecophoridae, *Schiffermuelleria sempronas*, new species, olive trees, Crete.

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Introduction

The large Greek island, Crete, has an isolated position in the Aegean Sea. It is situated about 100 km from mainland Greece and about 200 km from Turkey. The island is mountainous with peaks reaching to above 2000 meters above sea level. The flora is rich with about 10 % endemic vascular plant species (Ruckdeschel 2007). The knowledge of the island's fauna of Microlepidoptera is fragmentary (Karsholt & Huemer 2017). Many additional discoveries, resulting from ongoing studies of museum collections as well as future inventories are to be expected. The discovery reported here was made during an effort to increase the knowledge of Cretan Lepidoptera in general and Microlepidoptera in particular. The new species described below appears to have no close relative in Europe or elsewhere and thus is a significant addition to the biodiversity of Crete.

Material and methods

Adults were netted from the cavities or trunks of old olive trees. The moths were easily disturbed from the trees or flew actively during the sunny hours of the day. Specimens were collected singly in vials and killed with ammonia or ethyl acetate. After pinning the moths, the wings were spread on the plastazote bottom layer in plastic boxes. The boxes, 12 x 8 x 2 cm, were used for transportation. Dissections of the genitalia followed Robinson (1976) and were made using a Leica MZ6 stereomicroscope. Photos of the genitalia were taken through a Leica 6000B microscope using a Leica DFC 420 digital camera. The adult was photographed using Microptics photographic system with an MP-E 65 mm objective. The digital images were edited with Adobe Photoshop CC 2019. DNA barcodes refer to a 658 base-pair long fragment of the mitochondrial cy-

tochrome c oxidase subunit I (COI). Legs from three specimens were prepared according to the prescribed standards and processed at the Canadian Centre for DNA Barcoding (CCDB, Biodiversity Institute of Ontario, University of Guelph) to obtain DNA barcodes. A Neighbour joining dendrogram was constructed in MEGA7 (Kumar *et al.* 2016) based on COI sequences from 12 species additional to the one described here, mined from BOLD (Ratnasingham & Hebert 2007). *Pleurota bicostella* (Clerck, 1759) was chosen as outgroup. The Kimura 2-parameter model (Kimura 1980) of nucleotide substitution was used, and 1000 bootstrap replications were performed.

Depository of examined material; KBE (Collection of Kai Berggren, Kristiansand, Norway); KGE (Collection of Keld Gregersen, Sorø, Denmark); NHMO (Natural History Museum, University of Oslo, Norway); ZMUC (Zoological Museum, Natural History Museum of Denmark, Copenhagen, Denmark).

***Schiffermuelleria sempronas* Aarvik & Berggren sp. n.** Figures 1, 4, 5, 6.

Type material. *Holotype* ♂, GREECE: Crete, Chania Province: Sempronas, 35.382215°N 23.812985°E, 610 m.a.s.l., 3–14.V.2022, L. Aarvik & K. Berggren leg., genitalia on slide NHMO 4170, coll. NHMO. *Paratypes* 10♂♂, 2♀♀, with the same data as the holotype, genitalia slide (♂) NHMO 4169, genitalia slide (♀) 4168, coll. NHMO; 12♂♂, 3♀♀, same data, genitalia slides (♂) KBE 14695, (♂) KBE 14696, (♀) KBE 14697, coll. KBE; 1♂, same data, coll. KGE; 1♂, same data, coll. ZMUC.

Diagnosis. Externally *Schiffermuelleria sempronas* sp. n. (Figure 1) is easily separated from the two European congeners, *S. schaefferella* (Linnaeus, 1758) (Figure 2) and *S. grandis* (Desvignes, 1842) (Figure 3), by its black basal part of the forewing. In *S. schaefferella* and *S. grandis* the forewing base is for the greater part orange. In the male genitalia there are a number of distinguishing traits, e.g. the bilobate uncus, the rod-like medial process of the gnathos, the straight dorsal edge of the valva and the long and slender phallus and juxta arms. In the female genitalia the sclerites around the ostium differ from the corresponding structures in *S. schaefferella* and *S. grandis*. In addition, *S. sempronas* sp. n. has the posterior part of the ductus bursae sclerotized (membranous in *S. schaefferella* and *S. grandis*).

Description. Male (Figure 1). Wingspan 11.5–13.0 mm. Labial palp (Figure 4) 5.8 times (horizontal) diameter of eye, falcate, second and third segment of similar length, yellow, third segment with brown suffusion; proboscis light yellow; antenna black, with bronze sheen, the nine last segments white above, double ciliate, ciliae twice the width of shaft; head with appressed scales, black, with bronze sheen; thorax black with bronze sheen, tegulae with silvery sheen. Forewing brownish black, with curved sub-basal, orange fascia not reaching dorsal margin, an orange longitudinal fascia runs from sub-basal band to one quarter from termen, a short transversal orange band at two thirds; three white marks, a preapical one, a pretornal one and one on costa at one third from base; sub-basal fascia edged proximally and longitudinal fascia edged on both sides with plumbeous scales; a plumbeous patch present in middle of black basal area; cilia dark grey. Hindwing brownish black with bronze sheen; cilia dark grey. Legs grey, midleg with one pair of tibial spurs, hindleg with two yellowish pairs. Abdomen black with bluish sheen.

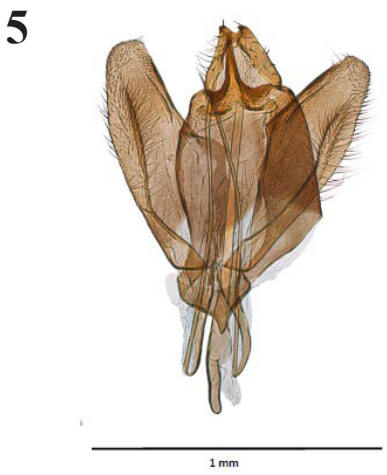
Female. On the average larger than male, wingspan 13–15 mm. Antenna lacking cilia. Otherwise as male.

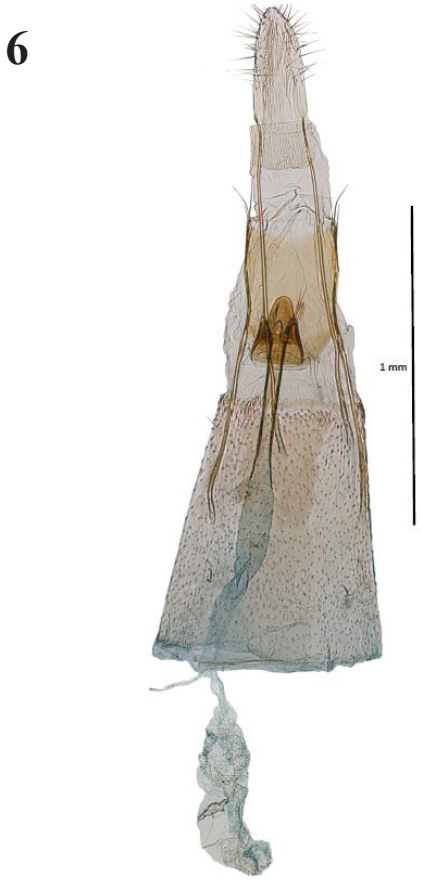
Variation. There is little variation; in some individuals there is an additional longitudinal orange fascia closer to costa.

Male genitalia (Figure 5). Tegumen large; uncus broad, sub-triangular, with broad, strongly sclerotized lateral margins, apically bilobate, with scattered bristles; gnathos with slender medial process, tapered, apically slightly widened; valva broad, gradually narrowing towards relatively broad and rounded termination, costa extended, forming setose ridge; tegumen small, saccus cone-shaped; two lateral juxta lobes with basic portion short and directed anteriorly, posteriorly directed portion long and slender, tip pointed, reaching

FIGURES 1–3. Adults of *Schiffermuelleria*. **1**. *S. sempronas* sp. n. **2**. *S. schaefferella* (Linnaeus, 1758). **3**. *S. grandis* (Desvignes, 1842). Photos: K. Sund (figures 1 and 3), K. Berggren (figure 2).

FIGURE 4. Head of *Schiffermuelleria sempronas* sp. n. in lateral view. Photo: K. Sund.





FIGURES 5–6. Genitalia of *Schiffermuelleria sempronas* sp. n. **5**. Male genitalia (slide NHMO 4170). **6**. Female genitalia (slide NHMO 4268).

beyond base of gnathos; phallus tubular, of same length as posterior part of juxta lobes, no cornuti.

Female genitalia (Figure 6). Ovipositor telescopic; apophyses posteriores nearly twice the length of apophyses anteriores; segment 8 longer than wide; opening of ostium bursae forming u-shaped depression in trapezoidal sclerite, sides of opening rounded and with posteriorly directed spines; inside «u» a conical, dentate sclerite; additional tongue-shaped sclerite present beneath «trapezoid»; posterior third of ductus bursae sclerotized, ductus bursae wider in middle; ductus seminalis inserted in anterior part; corpus bursae oval, with numerous denticles and elongate, dentate signum.

Genetic analysis. The Neighbour Joining dendrogram (Figure 7) shows that *S. sempronas* sp. n. is clearly separated from the other species

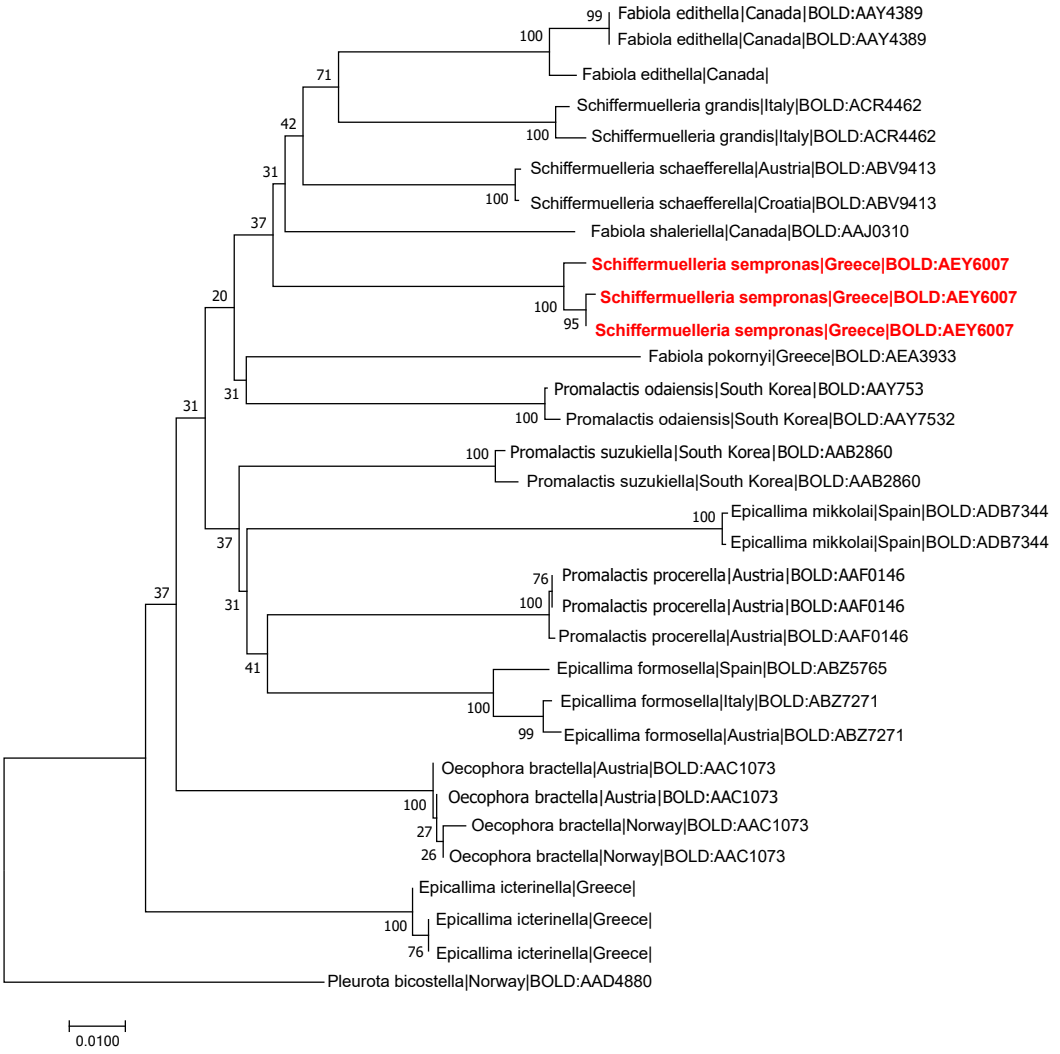


FIGURE 7. Neighbour joining dendrogram with *Schiffermuelleria sempronas* sp. n. (in red letters) and relatives. The number depicted for each sample (BOLD:XXXXXXX) gives the specimen's BIN assignment (Ratnasingham & Hebert 2013). The numbers placed at each node in the tree report bootstrap support for the group (1000 replications).

TABLE 1. List of samples included in the dendrogram

BOLD Process ID	Species	Country	BIN
CNFDF728-14	*Fabiola edithella*	Canada	-
CNKJE2074-14	*Fabiola edithella*	Canada	BOLD:AAY4389
GBGL20171-15	*Promalactis suzukiella*	South Korea	BOLD:AAB2860
LEASS171-16	*Epicallima mikkolai*	Spain	BOLD:ADB7344
LEASS180-16	*Epicallima mikkolai*	Spain	BOLD:ADB7344
LEASV426-19	*Fabiola pokornyi*	Greece	BOLD:AEA3933
LEASX020-21	*Epicallima icterinella*	Greece	-
LEASX077-21	*Epicallima icterinella*	Greece	-
LEASX078-21	*Epicallima icterinella*	Greece	-
LEATH022-14	*Oecophora bractella*	Austria	BOLD:AAC1073
LEATH057-14	*Oecophora bractella*	Austria	BOLD:AAC1073
LEATH060-14	*Schiffermuelleria schaefferella*	Austria	BOLD:ABV9413
LEATH360-14	*Schiffermuelleria grandis*	Italy	BOLD:ACR4462
LEATH366-14	*Schiffermuelleria grandis*	Italy	BOLD:ACR4462
LON1655-15	*Pleurota bicostella*	Norway	BOLD:AAD4880
LON1663-15	*Oecophora bractella*	Norway	BOLD:AAC1073
LON2703-16	*Oecophora bractella*	Norway	BOLD:AAC1073
LTOLB806-11	*Promalactis odaiensis*	South Korea	BOLD:AAY7532
LTOLB807-11	*Promalactis odaiensis*	South Korea	BOLD:AAY7532
LTOLB908-11	*Promalactis suzukiella*	South Korea	BOLD:AAB2860
MNAE083-07	*Fabiola edithella*	Canada	BOLD:AAY4389
NLON1115-22	*Schiffermuelleria*	Greece	BOLD:AEY6007
NLON1116-22	*Schiffermuelleria*	Greece	BOLD:AEY6007
NLON1117-22	*Schiffermuelleria*	Greece	BOLD:AEY6007
NLON533-19	*Schiffermuelleria schaefferella*	Croatia	BOLD:ABV9413
OPPQC477-17	*Fabiola shaleriella*	Canada	BOLD:AAJ0310
PHLAE120-11	*Epicallima formosella*	Italy	BOLD:ABZ7271
PHLAE256-11	*Promalactis procerella*	Austria	BOLD:AAF0146
PHLAH420-12	*Epicallima formosella*	Austria	BOLD:ABZ7271
PHLAH442-12	*Promalactis procerella*	Austria	BOLD:AAF0146
PHLAI820-13	*Promalactis procerella*	Austria	BOLD:AAF0146
PHLSA286-11	*Epicallima formosella*	Spain	BOLD:ABZ5765

included, with good bootstrap support. While COI is not very informative for higher taxonomy than the species level, the dendrogram does not contradict the suggestion that the genera included are in need of revision; species belonging to the same genera do not cluster monophyletically.

Etymology. Named after the village in Crete, Sempronas, where the type series was collected.

Biology. Like its congeners probably feeding on decaying wood under bark of old trees (Figure

FIGURE 8. The olive grove in Sempronas village where *Schiffermuelleria sempronas* sp. n. is present.

FIGURE 9. An old olive tree in Sempronas, the habitat of *Schiffermuelleria sempronas* sp. n.

9). All specimens of *S. sempronas* sp. n. were collected flying around trunks or inside hollow olive trees. However, since its relatives can utilize several tree species, it is likely that the new species also has this ability. The deciding factor probably is which species of fungus are present in the decaying wood. According to our observations, the species is only active in sunshine. Not a single specimen was attracted to the nearby moth lamps. It was present on the sunny sides of the trees from before noon until late afternoon, as long as the sun was up. The species was quite abundant in the locality (Figure 8). During the ten days period we searched for it, nearly every strike with the net would yield a specimen or two.

Distribution. Only known from Sempronas village, Chania Province, in W Crete. Sempronas is situated inland about halfway between the south and the north coast of the island.

Discussion

In spite of external similarity and similar ecology, the three European *Schiffermuelleria* species differ strongly from each other in the genitalia. This led Leraut (1989) to erect the genus *Schiffermuellerina* Leraut, 1989 for *S. grandis*. However, the whole complex of genera around e.g., *Schiffermuelleria* Hübner, 1825, *Callimodes* Leraut, 1989, *Epicallima* Dyar, 1903, *Fabiola* Busck 1908, and *Promalactis* Meyrick, 1908 needs revision (Wang *et al.* 2015). The genus *Promalactis* shows strong diversity in the morphology of the genitalia and contains more than 400 described species (Wang & Liu 2021). Several species of *Promalactis* have a broad, bilobate uncus. Other male genitalia traits in *S. sempronas* as the long and slender phallus and long and slender juxta lobes, can also be seen in species of *Promalactis*. However, these morphological elements appear and disappear among closely related species within the various groups of this huge genus. This is an indication that some of the current smaller genera in future revisions will be reduced to mere species groups. For the time being, in a European context, we place the new species in *Schiffermuelleria* together with *S. schaefferella* and *S. grandis* with which it shares similar wing pattern and similar ecology.

Future inventories may show that *S. sempronas* sp. n. is widely distributed in Crete, present in suitable localities with old olive trees. However, spraying against pesticides is probably a threat to populations of the species. In addition, the removing of old trees can eradicate populations. These trees probably harbour numerous specialized insect species of Coleoptera, Diptera and Hymenoptera. During our investigation, two additional species of Oecophoridae were discovered in the habitat, viz. *Esperia sulphurella* (Fabricius, 1775) and *Denisia luctuosella* (Duponchel, 1840). These two species were present in low numbers.

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