

Horisme exoletata (Herrich-Schäffer, 1838) in southern Italy and description of its larva (Geometridae, Larentiinae)

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Abstract. We report *Horisme exoletata* (Herrich-Schäffer, 1838) for the first time in Continental Europe: Italy, Calabria. This is a species previously considered endemic to Sicily and Malta, and an addition to the shared fauna of the Calabria and Sicily regions. We provide data concerning the biology of this species in Malta, illustrating the caterpillar for the first time.

Introduction

During recent studies carried out in southern Italy devoted to the description of macro-moth communities inhabiting fragmented woodlots composed of thermophilic *Quercus* species such as *Q. suber* L., *Q. virgiliana* (Ten.) Ten. and *Q. ilex* L., some specimens belonging to the genus *Horisme* Hübner, 1825 (Geometridae) were collected. In the study area three *Horisme* species were previously known, *H. radicularia* (la Harpe, 1855), *H. tersata* (Denis & Schiffermüller, 1775), and *H. vitalbata* (Denis & Schiffermüller, 1775), but dissection of genitalia revealed that some of the collected specimens belong to a species new to the fauna of Continental Europe, *H. exoletata* (Herrich-Schäffer, 1838), previously considered endemic to Sicilia and Malta (Hausmann and Viidalepp 2012). The first three specimens have been collected at the beginning and at the end of October, and the fourth in mid-February.

Horisme exoletata has been described as *Larentia exoletata* by Herrich-Schäffer (1838) from Sicily. Its status at species level had been contradicted by Curò and Püngeler (Ragusa 1893), who erroneously considered this species to be a synonym of *Cidaria tersata* var. *tersulata* Staudinger, 1871. One century later, Bytinski-Salz (1937) described *Horisme predotai* from Sardinia, explicitly separating it from the Sicilian *H. exoletata*, but the lack of clear diagnostic characters led Prout (1938) to consider the former a junior synonym of the latter. Their correct identities have been ascertained on the basis of clear differences in the basal papilla of the juxta of male genitalia, which are larger and touch each other distally in *H. exoletata*, and in the spines on the bursa copulatrix of females, which have petaloid branches in *H. exoletata* (Raineri 1989; Hausmann and Viidalepp 2012). Genetic data based on COI barcodes supported the presence of two distinct species at a distance of 3.3% (Hausmann and Viidalepp 2012). Therefore, the records of *H. exoletata* for Sardinia in Turati (1911, 1913) must be referred to *H. predotai*, as already suggested by Bytinski-Salz (1937) and Prout (1938).

Very few data concerning the biology of *H. exoletata* are available (Raineri 1989; Hausmann and Viidalepp 2012) and immature stages are still undescribed. In this paper we describe for the first time the larva, providing original data for its breeding carried out in Malta in winter 2005.

Material and methods

Horisme exoletata was detected in Continental Europe in Contrada Santa Cenere, at 86 meters above the sea level, in the municipality of Soveria Simeri, Catanzaro province, Calabria region, Italy (38.9259°N, 16.6729°E) (Fig. 1). We used a UV LED light trap (Infusino et al. 2017) activated one night every 4 weeks from July 2019 to February 2020. The trap was emptied early in the morning and collected specimens were identified in laboratory. Dissection of genitalia followed the protocol described in Parenti (2000). Identification was carried out comparing specimens and male genitalia to the iconography in Hausmann and Viidalepp (2012). Voucher specimens and a mounted slide of the genitalia (CREA-0225) are in the research collection of Lepidoptera of the Research Centre for Forestry and Wood, Rende, Italy (CREA-FL Collection).

Detailed information on the breeding of larvae is provided in the Results and Discussion section.

Results and discussion

Distribution

In this paragraph, we report all bibliographic information on the distribution of *Horisme exoletata*, excluding those generic or repetitive. Furthermore, we also include in this review data from the following scientific collections: collection Herbulot and Zoologische Staatssammlung München (ZSM), Germany; Peder Skou private collection, Denmark, and Norbert Poell private collection, Austria.

ITALY: Original authors' data – Calabria: Contrada Santa Cenere, Soveria-Simeri (CZ), 86m, 1.x.2019 (1 ♂), 24.x.2019 (2 ♂♂) (slide CREA-0225), 27.ii.2020 (1 ♂), leg. Scalercio S. & Di Marco C. (Coll. CREA-FL). First record for continental Europe.

Other data – Sicily: Madonie, 19.xi.1932 (1 ♂) (Raineri 1989); Mistretta, 25.ix.1938 (1 ♀) leg. R. Lunak (Raineri 1989); Sferracavallo, winter 1951–52 (1 ♀) (Raineri 1989); Parco d'Orleans, Palermo, 3.iii.1993 (1 ♀) (Grillo and Parenzan 1996); Piano Zucchi, Madonie, 5.ix.1931; Partinico, 30.iii.1937 (Arnone and Raineri 2004); Bosco Artale, Caccamo, 17.iii.1997 (Parenzan and Porcelli 2006); Pantani di Vendicari, 5.x, 27.xii.1997, 29.IV, 29.ix.1998, 29.x, 28.xii.2000 (Bella et al. 2009); Etna, Pedara, 610m, 20–22.v.55 (1 ♂) R. Löberbauer leg. (Coll. Herbulot/ZSM); Madonie, 1200m, 17.iii (1 ex.), 22.iv–27.v (45 exx.), 16.vii (4exx.), 26.vii (1 ex.), 10.viii–11.ix (1 ex.), 4.xii (1 ex.), 21.xii (1 ex.), leg. F. Daniel (Coll. ZSM); Castelbuono, 880m, 6.x.2001 (1 ex.), N. Poell leg. (Barcoding of Life Database); Madonie, 1200m, 2.ix.1932 (2 exx.), F. Dannehl leg. (Coll. Peder Skou); 5 km SE of Castelluzzo, 300 m, 12.v.2003 (1 ♂), M. Mølgaard leg. (Coll. Peder Skou); 5,7 km ESE of San Stefano Quisquina, near Pizzo della Rondine, 1000m, 9–10.x.2010 (4 exx.), P. Skou leg. (Coll. Peder Skou); 5,8 km ESE of San Stefano Quisquina, near Pizzo della Rondine, 1000m, 23–24.ix.2014 (1 ex.), Peder Skou leg. (Coll. Peder Skou). – Pantelleria: Lave del Khaggiar, 4.x.1986 (1 ♀), F.P. Romano leg. (Romano and Romano 1995); San Vito, 350m, 8–13.x.2007 (1 ♀) (Fischer 2009). – Ustica: Guardia dei Turchi (PA), 190m, end of October 2011 (1 ♀), mid April 2012 (Fischer and Fischbacher 2012).



Figure 1. Collecting site for the first record off *Horisme exoletata* for Continental Europe: **a** Panoramic view of locality Santa Cenere, Soveria-Simeri (Catanzaro province). Yellow arrow indicates the collecting site; **b** detail of the collecting site with used light trap. Photo: S. Scalercio.

MALTA: Original authors' data – Mosta Wied Il-Ghasel, 15.i.1988 (1♀), leg. A. Catania; Haż-Żebbuġ, 6.xi.2005 (1♀), leg. A. Catania; Haż-Żebbuġ, bred iv.2006 (4♂♂, 2♀♀), leg. A. Catania; Haż-Żebbuġ, 18.ii.2018 (1♂), leg. A. Catania; Gozo Żebbuġ, 29.xi.2010 (1♂), leg. A. Catania (Coll. Aldo Catania).

Other data – Wied Incita, summer 1945 (2 exx.) (De Lucca 1948).

Currently the Italian distribution of *H. exoletata* covers the Calabria region of southern Italy, Sicily, where it was mainly found on the Madonie Mountains and in general in the Tyrrhenian part of the region, Pantelleria and Ustica Islands (Fig. 2). It was reported for the first time in Malta by De Lucca (1948), and reported again by Sammut (2000). We confirm with our data that its presence in Malta where it is very rare.

Morphology

The wing pattern of specimens collected in Calabria region matches that illustrated in Hausmann and Viidalepp (2012), with autumn specimens (Fig. 3a) smaller and darker than those collected in February (Fig. 3b). The presence of melanistic specimens on Mt. Etna (Hausmann and Viidalepp 2012) could be only due to seasonal variations, but this can only be ascertained with the availability of further material. Morphology of the male genitalia (Fig. 4) is very similar to that of illustrated Sicilian specimens (Raineri 1989; Hausmann and Viidalepp 2012), confirming the

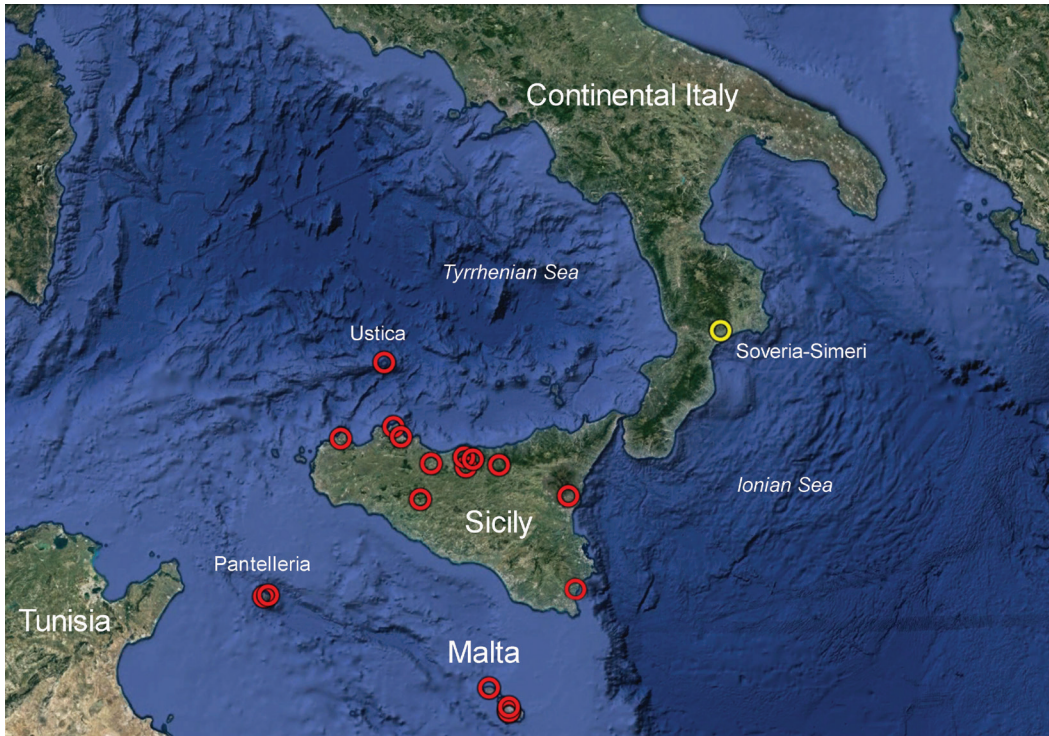


Figure 2. Collecting sites of *Horisme exoletata*. Red circles: collecting sites in the islands; yellow circle: first record for Continental Italy. Map data 2020 © Google.

differences with the Sardinian *H. predotai* and leading us to suppose a strong affinity of the Calabrian population with Sicilian ones.

Biology

According to the Caterpillar Hostplant Database of the National History Museum London the food plant for most of the *Horisme* species is of the family Ranunculaceae (<https://www.nhm.ac.uk/our-science/data/hostplants/>). In Malta the family Ranunculaceae is represented by twenty-one species (http://www.maltawildplants.com/wildplants_index_pg03.php#RANU). Most of the *Horisme* species feed on *Clematis* (Hausmann and Viidalepp 2012) of which in Malta there is only native *Clematis cirrhosa* L. On the 6th of November 2005, a female was collected with an actinic light trap from Haż-Żebbuġ, Malta. The moth was fed on sugar diluted with water. Few eggs were laid the following night in a plastic container. Eggs of *Horisme exoletata* are very small, oval-shaped, creamy white in colour, turning to light brown before hatching. The eggs started hatching on the 17th of November. Newly hatched larvae are cinnamon in colour, and 3 mm in length (Fig. 5a). They have tiny black hairs on each segment and two creamy lines along the body that remain there until the final instar. Rearing this moth was important to gain knowledge about its biology while using a locally growing common food plant. At Wied Qirda (a nearby valley), *Ranunculus bullatus* L. was easily accessible in reasonable quantity. This low growing plant keeps well in pots

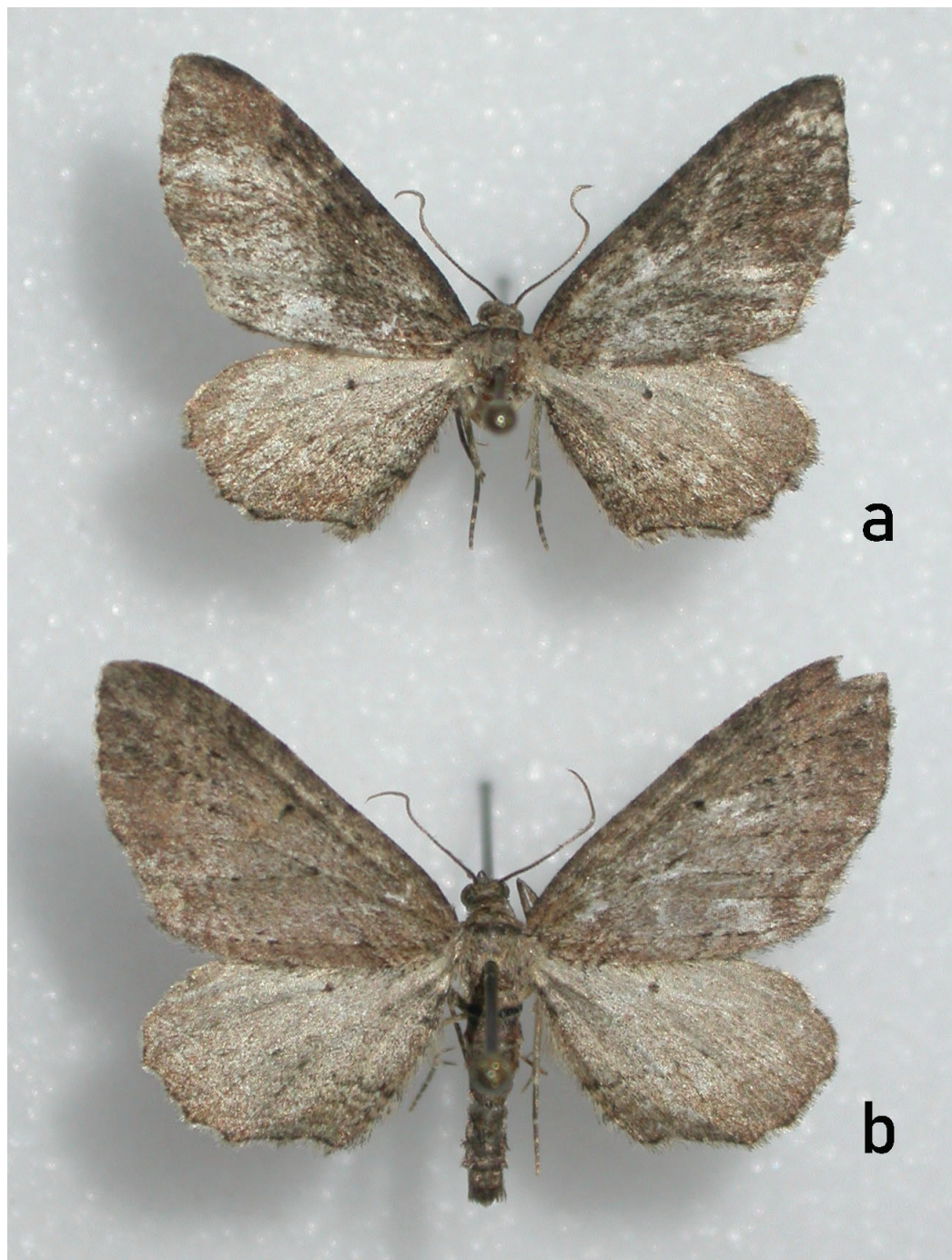


Figure 3. *Horisme exoletata*. **a** Contrada Santa Cenere, Soveria-Simeri (Catanzaro province), ♂, 24.x.2019, 23 mm; **b** idem, ♂, 27.ii.2020, 26 mm. Photo: S. Scalercio.

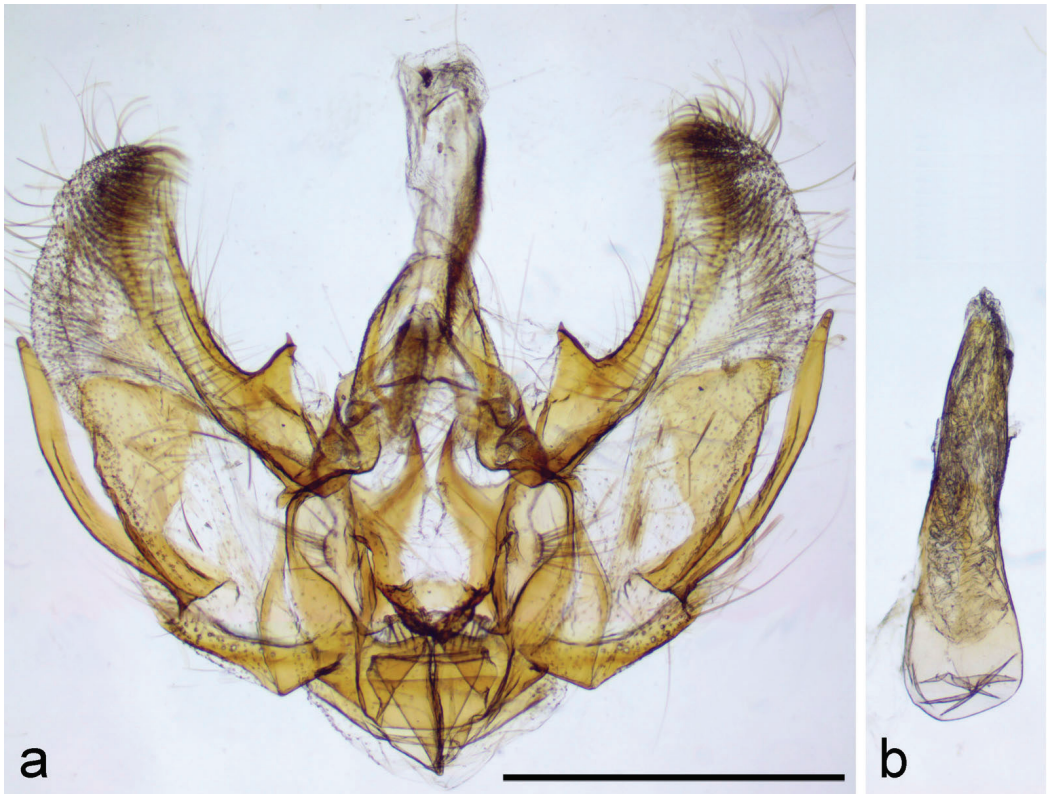


Figure 4. Male genitalia of *Horisme exoletata*: **a** genitalia; **b** phallus (prep. CREA-0225). Photo: S. Scalercio. Scale bar: 1 mm.

and was in season. It is also important to note that no nearby *Clematis* plants have been observed at Haž-Žebbuġ and this valley.

Larvae started feeding on the flowers of *Ranunculus bullatus* without problems. At first, cut food plants were provided and changed after 3 days as fungus growth soon started in plastic containers with the consequence that some larvae died. The second instar larvae were transferred to plants growing in pots to minimize losses. They fed mainly on flowers and seed heads. Larvae are nocturnal feeders and by day rest attached from the hind legs, motionless, resembling a dry stick on stems, underneath the flowers. On the 20th of December 2005, the larvae were in the last instar, still feeding mainly on flower heads, seeds and occasionally leaves (Figs 5d, e, 6). On the 27th of December, the larvae stopped feeding and formed a light silken cocoon on the ground between leaves. Unfortunately, no information is available on the pupa. Moths started emerging during the first week of April the following year.

Information on the feeding behaviour of adults could be misleading and the information available should be attributed to *H. predotai*. In fact, the feeding observations on blooming willows were carried out by Turati (1913) in Sardinia before the description of *H. predotai*, and thus cannot be attributed to *H. exoletata*, as reported in Hausmann and Viidalepp (2012).

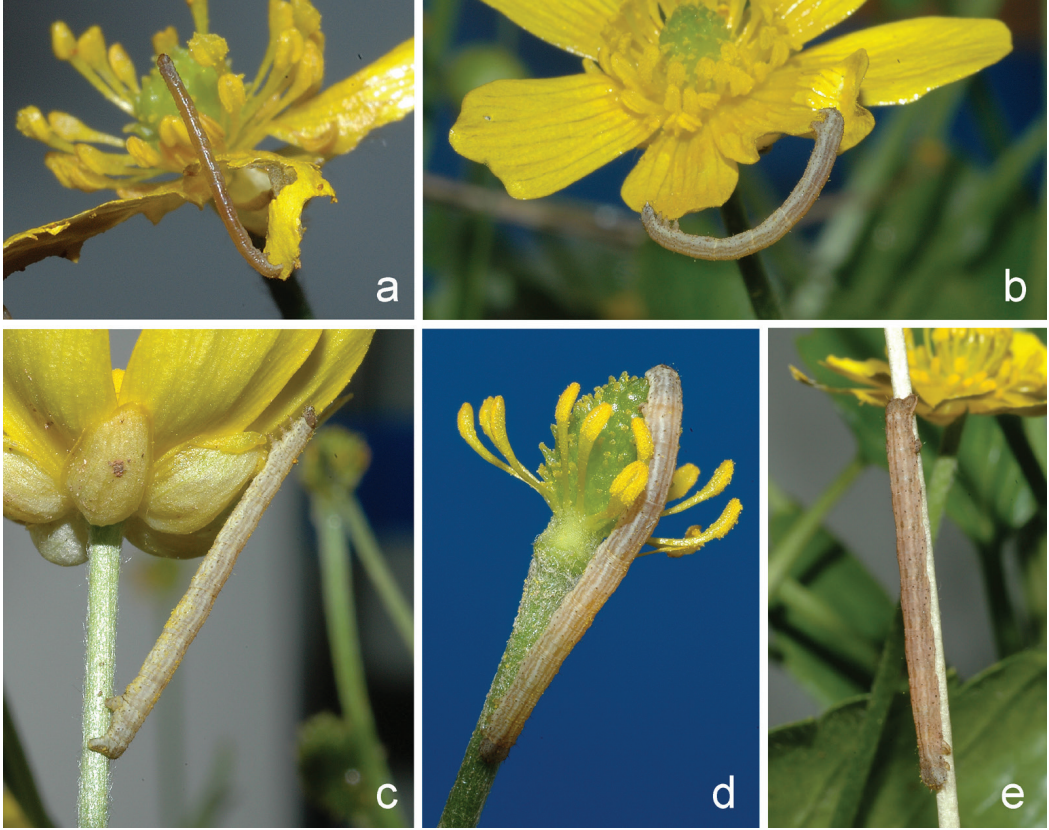


Figure 5. Larva of *Horisme exoletata* on *Ranunculus bullatus*. **a** First instar larva; **b**, **c** second and third instar larva; **d**, **e** mature larva. Photo A. Catania.



Figure 6. Mature larva of *Horisme exoletata*. Photo A. Catania.

Habitat

Horisme exoletata seems to be linked to hot and dry climate and to habitats with forest cover sometimes very scattered. It has been found at elevations from 0 to 1,200 metres above sea level (Hausmann and Viidalepp 2012), and in areas with a variable level of habitat degradation, being collected in an urban garden of Palermo (Grillo and Parenzan 1995) but also in semi-natural habitats of the Madonie Mountains. In Ustica and Pantelleria Islands it has been collected in thermophilic and xeric habitats with a highly fragmented forest cover (Fischer 2009; Fischer and Fischbacher 2012). Similarly, in Continental Italy it has been collected in a site at the border of a highly fragmented *Quercus ilex* woodlot, near the bed of the Simeri river covered by various cultivated plants. Near the collecting site, the undergrowth is densely covered by *Smilax aspera* L. (Liliaceae) but we did not find any of the larval foodplants which are likely present in the surroundings.

Phenology

Adults have been collected throughout the year, except in June. The month with the highest number of captures is October, but its presence during most of the year indicates the presence of at least three generations according to elevation, probably partially overlapping (Hausmann and Viidalepp 2012).

Conclusions

In this paper we provide the first record in Continental Europe and the first illustrations and detailed data on preimaginal stages for *Horisme exoletata*.

The presence of this species in Continental Italy is of great biogeographic interest. Furthermore, it increases the number of shared species between Sicily and the eastern coastal area of Calabrian region (Infusino and Scalercio 2011). *H. exoletata* fulfills the set of requirements of species exclusively present in Italy which share these geographic areas, the species preferring hot and xeric habitats. Species with these characteristics probably survived the last glaciations in relict areas of southernmost Italian regions, and successively were unable to spread northward or into the relatively colder and wetter western coast of Calabria region (Infusino and Scalercio 2011). The difficulty of colonisation in recent times of Continental Italy by Sicilian Lepidoptera populations has also been proved for butterflies (Scalercio et al. 2020).

In the future, DNA barcodes of Sicilian and Calabrian specimens of *Horisme exoletata* will be studied. Furthermore, we can expect that more Lepidoptera shared by Calabria and Sicily will be found as a large portion of eastern Calabria is still under-investigated.

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