

# Contribution to the knowledge of South Italian Gelechiidae (Lepidoptera: Gelechioidea)

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## Abstract

We provide data concerning 39 species of Gelechiidae collected in Calabria and Basilicata regions, Italy. Twenty-three species are new for the studied area and six new for southern Italy. Most interesting are the records of *Cosmardia moritzella* (Treitschke, 1835), recorded only in the Alps so far, *Aroga pascuicola* (Staudinger, 1871), *Oxypteryx immaculatella* (Douglas, 1850), and *Helcystogramma lamprostoma* (Zeller, 1847), new for the Italian mainland, and *Aproaerema cinctelloides* (Nel & Varenne, 2012), new for the Italian fauna.

**Keywords:** Lepidoptera, Gelechioidea, Gelechiidae, biodiversity, fauna, DNA barcoding, Italy.

## Contributo alla conoscenza dei Gelechiidae dell'Italia meridionale (Lepidoptera: Gelechioidea)

## Riassunto

Vengono forniti dati relativi a 39 specie di Gelechiidae raccolte in due regioni italiane, Calabria e Basilicata. Ventitré specie sono nuove per l'area studiata e sei per l'Italia meridionale. Di particolare interesse sono i rinvenimenti di *Cosmardia moritzella* (Treitschke, 1835), finora trovata solo sulle Alpi, *Aroga pascuicola* (Staudinger, 1871), *Oxypteryx immaculatella* (Douglas, 1850) e *Helcystogramma lamprostoma* (Zeller, 1847), nuove per l'Italia continentale, e *Aproaerema cinctelloides* (Nel & Varenne, 2012), nuova per la fauna italiana.

**Parole chiave:** Lepidoptera, Gelechioidea, Gelechiidae, biodiversità, fauna, DNA barcoding, Italia.

## Contribución al conocimiento de los Gelechiidae de la Italia meridional (Lepidoptera: Gelechioidea)

## Resumen

Proporcionamos datos relativos a 39 especies de Gelechiidae recolectadas en las regiones de Calabria y Basilicata, Italia. Veintitrés especies son nuevas para la zona estudiada y seis nuevas para el sur de Italia. Los registros más interesantes son los de *Cosmardia moritzella* (Treitschke, 1835), nueva para el sur de Italia, *Aroga pascuicola* (Staudinger, 1871), *Oxypteryx immaculatella* (Douglas, 1850) y *Helcystogramma lamprostoma* (Zeller, 1847), nuevas para la Italia continental y *Aproaerema cinctelloides* (Nel & Varenne, 2012), nueva para la fauna italiana.

**Palabras clave:** Lepidoptera, Gelechioidea, Gelechiidae, biodiversidad, fauna, ADN código de barras, Italia.

## Introduction

The family of Gelechiidae consists of about 500 genera and more than 4600 species worldwide (Hodges, 1998), but this number is constantly increasing with the progress of taxonomic research. In Europe, 865 species are recorded (Huemer & Karsholt, 2020), 359 of which were found in Italy (Huemer & Karsholt, 1995). However, the Italian fauna needs to be updated in the light of several new species which recently were described (e. g. Huemer & Karsholt, 2018; Timossi & Huemer, 2021, 2022; Huemer, 2022). Furthermore, it was demonstrated that the European diversity for this family is largely underestimated (Huemer et al. 2020).

The fauna of Gelechiidae of southern Italy is scarcely known as very few records are available (Costa, 1863; Parenti, 2000; Scalercio et al. 2015; Baldizzone & Scalercio, 2018; Bonelli et al. 2021). For the Calabria and Basilicata regions only 36 species of Gelechiidae are known so far, most of them only having been recorded in very recent years. Before 2015, only four species were recorded, namely *Teleiodes italica* Huemer, 1992 (Huemer & Karsholt, 1999), *Caryocolum blandelloides* Karsholt, 1981 (Huemer & Karsholt, 2010), *Aproaerema cinctella* (Clerck, 1759) (Costa, 1863) and *Aroga velocella* (Zeller, 1839) (Parenti, 2000). In more recent years, Scalercio et al. (2015) listed two species from the Sila Mountains, Huemer & Karsholt (2018) listed *Megacraspedus lanceolellus* (Zeller, 1850), and Baldizzone & Scalercio (2018) raised the total number of species to 35 thanks to one week of investigations in the Aspromonte Massif. Bonelli et al. (2021) reported one more species for the Gioia Tauro Plain reaching a total of 36 species.

In this paper we provide new records for 39 species collected in the southernmost regions of peninsular Italy, some of which significantly enlarging their known distribution range.

## Material and Methods

The study is based on 79 specimens belonging to 39 species of Gelechiidae recorded in Calabria and Basilicata. In Calabria, surveys were carried out using UV LED light traps (Infusino et al. 2017), whilst in Basilicata several light sources and collecting methods were applied. Identification was performed using available iconography (Parenti, 2000; Huemer & Karsholt, 1999, 2010), including World Wide Web sites (mothdissection.co.uk; lepi-forum.org), and DNA barcoding according to the Canadian Centre for DNA Barcoding protocol ([https://ccdb.ca/site/wp-content/uploads/2019/07/Instructions\\_Microplate-web.pdf](https://ccdb.ca/site/wp-content/uploads/2019/07/Instructions_Microplate-web.pdf)). The BOLD Identification Engine was used to confirm morphological identifications on a molecular basis, to generate a Neighbor-joining tree for successfully barcoded specimens, and to evaluate similarity of sequences with those publicly available in BOLD. Intraspecific pairwise distance was evaluated for Calabrian specimens using the distance summary tool available among sequence analysis options available in BOLD Systems (<http://www.boldsystems.org/>). Barcode Index Numbers (BINs) were also reported for the most interesting taxa. The BIN is the result of an online framework that clusters barcode sequences algorithmically. Since clusters show high concordance with species, this system can be used to verify species identifications as well as document diversity when taxonomic information is lacking (<http://www.boldsystems.org/>). Genitalia dissection was performed using the “unrolling technique” as described by Pitkin (1986).

For each species we provided region, province, municipality, and collecting site, altitude above the sea level, geographical coordinates of collecting sites, date of collection, number of collected specimens, name/s of collector/s, microscope slide number (CREA-xxxx) and BOLD sample ID number (when applicable), hostplants known from literature, species distribution, and importance of the record. Nomenclature and order of species followed Huemer & Karsholt (2020).

Specimens from the following collections were examined: CREA-FL collection of the Research Centre for Forestry and Wood (Rende, Italy); ZSM (SNSB) Bavarian State Collection of Zoology (Munich, Germany); TLMF Tiroler Landesmuseen Ferdinandeum (Innsbruck, Austria).

## Tribe Chelariini

*Nothris congressariella* (Bruand, 1858)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 280 m, 39.99141N-15.79391E, 22-XI-2015 (1 ex., BOLD ID: BC ZSM Lep 91156), A. Hausmann leg. (ZSM collection).

Host plants: larvae on *Scrophularia scorodonia* L. (Baldizzone et al. 2013).

Distribution: Great Britain, Iberian Peninsula, France, Switzerland, Italy, Balkans, Greece. In Italy it is widespread across the whole territory including Sicily and Sardinia (Baldizzone et al. 1995).

*Nothris verbascella* ([Denis & Schiffermüller], 1775)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 280 m, 39.9911N, 15.7941E, 11-IX-2020 (1 ex., BOLD ID: BC ZSM Lep 112099), A. Hausmann leg.; Calabria, Cosenza, Praia a Mare, 10 m, 39.89331N-15.78271E, 22-VIII-2021 (1 ex., BOLD ID: BC ZSM Lep 114906), A. Hausmann leg. (ZSM collection).

Host plants: various species of the genus *Verbascum* (Baldizzone et al. 2013).

Distribution: widespread across most parts of Europe. In Italy it has been recorded in the whole continental part, Sicily and Sardinia (Baldizzone et al. 1995).

## Subfamily Dichomeridinae

*Dichomeris acuminatus* (Staudinger, 1876) (Figure 3)

Records: Calabria, Cosenza, Rende, Contrada Li Rocchi, 205 m, 39.36881N-16.22861E, 13-V-2014 (1 ex., microscope slide: CREA-0249), S. Scalercio leg., G. Timossi det. (CREA-FL collection).

Host plants: it is a leaf-roller parasite of *Medicago sativa* L. but lives also on *Cajanus cajan* L., *Cyamopsis*, *Desmodium gyroides* (Roxb.) DC., *Indigofera arrecta* Hochst. ex A. Rich., *Sesbania sericea* (Willd.) and *Tephrosia* (Baldizzone et al. 2013).

Distribution: Iberian Peninsula, France, Corsica, Italy, Sicily, Sardinia, Malta, Albania, Greece and Cyprus (Karsholt & Nieuwerkerken, 2013). It is reported from Africa, Asia and Australia (boldsystems.org). In Italy, its presence has been recorded across the whole territory (Baldizzone et al. 2013).

*Dichomeris alacella* (Zeller, 1839) (Figure 4)

Records: Calabria, Reggio Calabria, San Ferdinando, Porta Sole, 5 m, 38.49291N-15.91701E, 15-VII-2017 (1 ex., microscope slide: CREA-0251), D. Bonelli leg., G. Timossi det. (CREA-FL collection).

Host plants: *Cercis siliquastrum* L. (Bidzilya et al. 2019).

Distribution: it is known from most of Europe (Karsholt & Nieuwerkerken, 2013). In Italy it is widespread from the North to the South and in Sardinia (Baldizzone et al. 1995).

*Helcystogramma lamprostoma* (Zeller, 1847)

Records: Calabria, Cosenza, Praia a Mare, 10 m, 39.89331N-15.78271E, 20-VIII-2019 (1 ex., BOLD ID: BC ZSM Lep 109542), A. Hausmann leg. (ZSM collection).

Host plants: *Convolvulus althaeoides* L., *Convolvulus arvensis* L. (Klimesch, 1984).

Distribution: Afro-tropical species found in most Mediterranean countries of Europe (Ponomarenko, 2009). In Italy it is present in Sicily and Sardinia (Baldizzone et al. 1995). This is the first report for Italian mainland.

*Brachmia blandella* (Fabricius, 1798) (Figure 5)

Records: Calabria, Cosenza, Orsomarso, Fiume Argentino, 160 m, 39.79491N - 15.93291E, 27-VIII-2014 (3 ex., one dissected (microscope slide: CREA-0244 in CREA-FL collection, G. Timossi det.) and one barcoded (BOLD ID: BC ZSM Lep 85078 in ZSM collection), S. Scalercio and A.

## Results

### SPECIES LIST

Family Gelechiidae  
Subfamily Anacampsinæ  
Tribe Anacampsiini

#### *Aproaerema cinctella* (Clerck, 1759)

Records: Calabria, Cosenza, San Giovanni in Fiore, Mangiatoie, 1275 m, 39.23911N-16.66251E, 05-VII-2016 (1 ex., dissected), S. Scalercio & M. Infusino leg., G. Timossi det. (CREA-FL collection).

Host plants: the larvae feed on various species of Fabaceae, in particular *Genista* and *Lotus* (Baldizzone et al. 2013).

Distribution: widely distributed in Europe across Siberia (Baldizzone et al. 2013). Its presence was reported from all over Italy, including Sicily (Baldizzone et al. 1995). It was only generically reported from Calabria (Costa, 1863).

#### *Aproaerema cinctelloides* (Nel & Varenne, 2012)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 290 m, 39.99141N-15.79391E, 11-VIII-2021 (1 ex., BOLD ID: BC ZSM Lep 115148), A. Hausmann leg. (ZSM collection).

Host plants: unknown.

Distribution: Its presence has been recorded for the first time in Corsica and then in Germany, France, Lower Austria, Balkans, Greece, and North Macedonia (Segerer & Huemer, 2020). This is the first record for Italy.

#### *Aproaerema anthyllidella* (Hübner, [1813])

Records: Calabria, Cosenza, Praia a Mare, 10 m, 39.89331N-15.78271E, 20-VII-2019 (1 ex., BOLD ID: BC ZSM Lep 109551), 17-VI-2022, A. Hausmann leg. (1 ex., BOLD ID: BC\_ZSM\_Lep\_115666); Calabria, Cosenza, Monte Pollino, 2000 m, 39.90121N-16.18111E, 09-VIII-2017 (2 ex., BOLD ID: BC ZSM Lep 101657, BC ZSM Lep 101655), A. Hausmann leg. (ZSM collection).

Host plants: various species of Fabaceae (Baldizzone et al. 2013).

Distribution: widespread over most of Europe and Russia (Karsholt & Nieuwerkerken, 2013), and recorded also in Korea and Japan. Known from all the regions of Italy including Sicily and Sardinia (Baldizzone et al. 1995; Bella & Karshol, 2015).

#### *Anacampsis timidella* (Wocke, 1887) (Figure 1)

Records: Calabria, Cosenza, Donnici, Fosso Cucolo, 550 m, 39.23731N-16.29741E, 23-VII-2013 (1 ex., microscope slide: CREA-0247), S. Scalercio leg., G. Timossi det. (CREA-FL collection).

Host plants: *Quercus cerris* L., *Q. pubescens* Willd. (Baldizzone et al. 2013).

Distribution: southern, southwestern, and eastern Europe, Near East, and Caucasus. In Italy it is known in the continental territory and in Sardinia (Baldizzone et al. 1995).

#### *Anacampsis scintillella* (Fischer von Röslerstamm, 1842) (Figure 2)

Records: Basilicata, Potenza, Trecchina, Monte Santa Maria, 1000 m, 40.00381N-15.76821E, 05-IX-2016 (1 ex., BOLD ID: BC ZSM Lep 94654), A. Hausmann leg. (ZSM collection).

Host plants: *Helianthemum nummularium* (L.) Mill. and *Teucrium chamaedrys* L. (Baldizzone et al. 2013).

Distribution: central and southern Europe. In Italy it was recorded in the continental part, in Sicily and Sardinia (Baldizzone et al. 1995).

Hausmann leg.; idem, 160 m, 39.79461N-15.92341N, 22-VIII-2018 (1 ex., BOLD ID: BC ZSM Lep 104340), A. Hausmann leg. (ZSM collection); Calabria, Cosenza, Donnici, Fosso Cucolo, 550 m, 39.23731N-16.29741E, 07-VIII-2013 (1 ex.), S. Scalercio leg. (CREA-FL collection); Basilicata, Potenza, Trecchina, Piano dei Peri, 280 m, 39.99131N - 15.79381E, 24-VIII-2014 (1 ex., BOLD ID: BC ZSM Lep 85067), A. Hausmann leg. (ZSM collection).

Host plants: its biology is incompletely known but the larvae feed on *Ulex europaeus* L. (Baldizzone et al. 2013) and other plants (Elsner et al., 1999).

Distribution: widely distributed in Europe. In Italy it is known in the continental part and in Sicily (Baldizzone et al. 2013).

#### Subfamily Thiotrichinae

*Palumbina guerinii* (Stainton, 1858) (Figure 6)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 280 m, 39.99141N-15.79391E, 22-XI-2015 (1 ex., BOLD ID: BC ZSM Lep 91164), 11-III-2019 (1 ex., BOLD ID: BC ZSM Lep 105168), A. Hausmann leg.; Calabria, Cosenza, Praia a Mare, 10 m, 39.89331N-17.78271E, 8-XI-2021 (1 ex., BOLD ID: BC ZSM Lep 115103), A. Hausmann leg. (ZSM collection); Calabria, Cosenza, Mendicino, 620 m, 39.25381N-16.18661E, 19-VIII-2013, S. Scalercio leg.; Calabria, Catanzaro, Soveria Simeri, Contrada Santa Cenere, 215 m, 38.92591N-16.67291E, 26-XI-2019 (1 ex.), S. Scalercio leg.; Calabria, Catanzaro, Marcellinara, Contrada Licari, 210 m, 38.91891N-16.49711E, 10-X-2018 (1 ex.), 12-XI-2018 (1 ex.), 4-XII-2018 (1 ex.), 05-III-2019 (1 ex.), S. Scalercio leg. (CREA-FL collection).

Host plants: various species of *Pistacia* (Baldizzone et al. 2013).

Distribution: it is found in southern Europe, from the Iberian Peninsula, in the north to France, east to Italy and Greece (Karsholt & Nieukerken, 2013). Generally reported throughout Italy (Baldizzone et al. 1995).

#### Subfamily Anomologinae

*Bryotropha italica* Karsholt & Rutten, 2005 (Figure 7)

Records: Basilicata, Potenza, Trecchina, Monte Santa Maria, 1000 m, 40.00381N - 15.76821E, 05-IX-2016 (1 ex., BOLD ID: BC ZSM Lep 59328), A. Hausmann leg. (ZSM collection).

Host plants: unknown.

Distribution: the species is known only from Italy and was described based on specimens collected by G. Baldizzone and G. Bassi on Mount Pollino (Calabrian and Lucanian slopes), but it is present in Sila mountains as well (Baldizzone & Scalercio, 2018) and Abruzzo (Karsholt & Rutten, 2005).

*Bryotropha affinis* (Haworth, 1828)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 290 m, 39.99141N-15.79391E, 11-VIII-2021 (2 ex., BOLD ID: BC ZSM Lep 115150, BC ZSM Lep 115143), A. Hausmann leg. (ZSM collection)

Host plants: larvae feed on mosses (Schütze, 1931).

Distribution: it is found in most parts of Europe and Israel. In Italy it is widespread across the whole territory, Sicily, and Sardinia (Karsholt & Nieukerken, 2013).

*Bryotropha terrella* ([Denis & Schiffermüller], 1765)

Records: Basilicata, Potenza, 3 km E Lagonegro, 1065 m, 40.11921N-15.80181E, 09-VIII-2019 (1 ex., BOLD ID: BC ZSM Lep 109590), A. Hausmann leg. (ZSM collection).

Host plants: larvae on mosses and grasses (Baldizzone et al. 2013).

Distribution: widespread across Europe, also present in northern Africa and Asia Minor. In Italy it is recorded in the entire territory, Sicily and Sardinia included (Baldizzone et al. 1995).

*Ptocheuusa paupella* (Zeller, 1847)

Records: Calabria, Cosenza, Orsomarso, Fiume Argentino, 140 m, 39.79461N-15.92341E, 22-VIII-2018 (1 ex., BOLD ID: BC ZSM Lep 104343), A. Hausmann leg. (ZSM collection).

Host plants: *Inula conyzae* (Griess.) Meikle, *I. montana* L., *Pulicaria dysenterica* (L.) Bernh. (Baldizzone et al. 2013; Bella & Karsholt, 2015).

Distribution: Great Britain, Belgium, Netherlands, Austria, Italy, France, Iberian Peninsula, Croatia, Macedonia, Greece. In Italy apparently widespread across all regions, including Sicily and Sardinia (Baldizzone et al. 2013).

*Monochroa cytisella* (Curtis, 1837)

Records: Basilicata, Potenza, Lagonegro 3 km E, 1065 m, 40.1191N-15.8021E, 27-VII-2020 (1 ex., BOLD ID: BC ZSM LEP 111823), A. Hausmann leg. (ZSM collection).

Host plants : larvae on *Pteridium aquilinum* (L.) Kuhn (Baldizzone et al. 2013).

Distribution: it is found in most parts of Europe and throughout the Palearctic region. In Italy it is present in the mainland, Sicily and Sardinia (Baldizzone et al. 1995).

*Oxypteryx immaculatella* (Douglas, 1850)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 280 m, 39.99141N-15.79391E, 31-III-2017 (1 ex., BOLD ID: BC ZSM Lep 97924), A. Hausmann leg. (ZSM collection).

Host plants: unknown. Heckford & Langmaid (1988) suggested *Hypericum pulchrum* L. as foodplant.

Distribution: Balearic Islands, Great Britain, Denmark, France, Germany, Ireland, Portugal, Spain, Netherlands (Karsholt & Nieuwerkerken, 2013), Greece (boldsystems.org), and Sardinia (Huemer et al. 2020). **New for the Italian mainland.**

## Subfamily Gelechiinae

## Tribe Gelechiini

*Mirificarma maculatella* (Hübner, 1796) (Figure 8)

Records: Calabria, Catanzaro, Marcellinara, Contrada Licari, 210 m, 38.91891N-16.49711E, 10-VI-2019 (1 ex., BOLD ID: LEP-SS-01195), S. Scalercio leg. (CREA-FL collection).

Host plants: *Coronilla emerus* L., *C. varia* (L.) Lassen. (Baldizzone et al. 2013).

Distribution: parts of Central and Southern Europe, from France to Ukraine and Turkey (Huemer & Karsholt, 1999), and the Near East (Baldizzone et al. 2013). In Italy it was known only in the northern regions (Baldizzone et al. 1995) but was reported also for Latium (Pinzari et al. 2010). This is the first report for southern Italy.

*Mirificarma flavella* (Duponchel, 1844) (Figure 9)

Records: Calabria, Catanzaro, Marcellinara, Contrada Licari, 210 m, 38.91891N-16.49711E, 10-VI-2019 (2 ex., BOLD ID: LEP-SS-01204, LEP-SS-01203), S. Scalercio leg. (CREA-FL collection).

Host plant: larvae on *Trifolium pratense* L. and other species of this genus (Huemer & Karsholt, 1999) and *Lotus corniculatus* L. (Huemer & Karsholt, 1999).

Distribution: southern parts of Europe including Mediterranean islands; Turkey and North Africa (Huemer & Karsholt, 1999). Generically reported throughout Italy (Baldizzone et al. 1995).

*Mirificarma cytisella* (Treitschke, 1835) (Figure 10)

Records: Calabria, Cosenza, Aprigliano, Quaresima, 1310 m, 39.21331N-16.45191E, 18-V-2015 (2 ex.), S. Scalercio & M. Infusino leg.; Calabria, Vibo Valentia, Serra San Bruno, Il Palmento, 840 m, 38.56251N-16.31401E, 26-V-2015 (1 ex.), S. Scalercio & M. Infusino leg.; Calabria, Cosenza, Saracena, Serrapaolo, 990 m, 38.82251N-16.09111E, 20-V-2015 (1 ex.), S. Scalercio & M. Infusino leg.; Calabria, Cosenza, Longobucco, Vivaio Sbanditi, 1350 m, 39.38881N-16.60221E, 26-VII-2014 (1

ex., BOLD ID: LEP-SS-01206), S. Scalercio leg.; Calabria, Cosenza, San Giovanni in Fiore, Mangiatoie, 1275 m, 39.23911N-16.66251E, 07-VI-2016 (1 ex., BOLD ID: LEP-SS-01205), S. Scalercio & M. Infusino leg.; Calabria, Cosenza, Spezzano della Sila, Serra Cannile, 1435 m, 39.3468EN-16.4093EE, 12-VI-2018 (1 ex., microscope slide: CREA-0254), S. Scalercio leg., G. Timossi det. (CREA-FL collection).

Host plants: larvae feed on various species of *Genista* and on *Ononis spinosa* L. (Baldizzone et al. 2013).

Distribution: central and southern Europe from Portugal to Ural Mountains. In Italy it was known only from the northern regions (Baldizzone et al. 1995) but it was recently reported also for Latium (Pinzari et al. 2010). Already reported in Calabria for the Sila Massif (Scalercio et al. 2015), we collected this species also in the Pollino and Serre Mountains.

*Mirificarma eburnella* ([Denis & Schiffermüller], 1775) (Figure 11)

Records: Calabria, Reggio Calabria, Palizzi Marina, 3 m, 37.91931N-16.0061E, 15-V-2015 (2 ex., BOLD ID: LEP-SS-01197, LEP-SS-01201), S. Urso leg.; Calabria, Cosenza, Montalto Uffugo, Vallone Argentino, 545 m, 39.40961N-16.12501E, 01-VI-2016 (1 ex., BOLD ID: LEP-SS-01198), S. Scalercio & M. Infusino leg.; Calabria, Catanzaro, Marcellinara, Contrada Licari, 210 m, 38.91891N-16.49711E, 10-VI-2019 (2 ex, one barcoded, BOLD ID: LEP-SS-01202), 02-V-2019 (1 ex., BOLD ID: LEP-SS-01199), S. Scalercio leg.; Calabria, Cosenza, Rende, Contrada Li Rocchi, 205 m, 39.36881N-16.22861E, 14-V-2014 (2 ex., one barcoded, BOLD ID: LEP-SS-01200), S. Scalercio leg. (CREA-FL collection).

Host plants: *Medicago sativa* L., *M. lupulina* L., *Hippocrepis comosa* L. (Huemer & Karsholt, 1999), *Medicago polymorpha* L., *Trifolium repens* L., *T. hirtum* All. (Pitkin, 1984).

Distribution: Europe except for the northern parts; Turkey, Middle East, North Africa and California (presumably introduced) (Huemer & Karsholt, 1999). In Italy it is widespread throughout the territory, including Sicily and Sardinia (Baldizzone et al. 1995; Bella & Karsholt, 2015).

*Mirificarma mulinella* (Zeller, 1839) (Figure 12)

Records: Calabria, Catanzaro, Sellia, Campanelle, 506 m, 38.98591N-16.61981E, 01-X-2019 (1 ex., BOLD ID: LEP-SS-01207), S. Scalercio leg. (CREA-FL collection).

Host plants: the larva feeds on various species of *Genista* (Huemer & Karsholt, 1999).

Distribution: widespread across Europe, including southern parts of Scandinavia and Eastern parts of the Mediterranean, including Greece, Crete and Cyprus, and North Africa (Huemer & Karsholt, 1999). Generically reported throughout Italy (Baldizzone et al. 1995).

*Aroga velocella* (Zeller, 1839)

Records: Calabria, Cosenza, Longobucco, Lago Cecita, 1170 m, 39.38651N-16.5521E, 13-VIII-2014 (1 ex., BOLD ID: BC ZSM Lep 85004), A. Hausmann leg. (ZSM collection).

Host plants: *Rumex acetosella* L. (Bradford & Sokoloff, 1988).

Distribution: widely distributed throughout Europe to Turkey (Huemer & Karsholt, 2010). In Italy it was recorded only in the north. In Calabria recorded only in the Aspromonte Massif, so far (Parenti, 2000; Baldizzone & Scalercio, 2015).

*Aroga pascuicola* (Staudinger, 1871) (Figures 13, 22)

Records: Calabria, Cosenza, San Giovanni in Fiore, Mangiatoie, 1270 m, 39.23791N-16.66471E, 11-V-2016 (1 ex., microscope slide: CREA-0248), S. Scalercio & M. Infusino leg., G. Timossi det. (CREA-FL collection).

Host plants: host plant and early stages unknown (Huemer & Karsholt, 2010).

Distribution: it was found in Portugal, Spain, Corsica, Sardinia, South European Russia (Karsholt & Nieuwerkerken, 2013), and North Africa (Huemer & Karsholt, 2010). **New for Italian mainland.**

*Chionodes distinctella* (Zeller, 1839) (Figure 14)

Records: Basilicata, Potenza, Lagonegro, Monte Sirino, 1800 m, 40.13711N-15.81751E, 28-VIII-2017 (1 ex., BOLD ID: BC ZSM Lep 101666), A. Hausmann leg.; Calabria, Cosenza, Castrovillari, Monte Pollino, 2000 m, 39.90121N-16.18111E, 09-VIII-2017 (1 ex., BOLD ID: BC ZSM Lep 101645), A. Hausmann leg. (ZSM collection).

Host plants: various authors suggest that the larvae may feed on moss, but *Genista* and *Artemisia campestris* L. have also been published (Huemer & Karsholt, 1999).

Distribution: almost all parts of Europe, except Iceland, Croatia (Karsholt & Nieuwerkerken, 2013) and Arctic Fennoscandia. It is also present in North Africa and from Turkey to Mongolia (Huemer & Karsholt, 1999). Generally reported throughout Italy (Baldizzone et al. 1995).

## Tribe Gnorimoschemini

*Scrobipalpa acuminatella* (Sircom, 1850) (Figure 15)

Records: Calabria, Cosenza, Spezzano della Sila, Vallone Tasso, 1402 m, 39.3328N-16.4142E, 06-VIII-2018 (1 ex., microscope slide: CREA-0252), S. Scalercio leg., G. Timossi det. (CREA-FL collection).

Host plants: several species of *Cirsium*, *Carduus nutans* L., *Serratula tinctoria* L., *Centaurea scabiosa* L. and *C. jacea* L. (Schütze, 1931).

Distribution: widespread across Europe, Turkey, southern Siberia, Central Asia (Junnilainen et al. 2010) and China (Bidzilya & Li, 2010). It was reported also for Canada (Landry et al. 2013). In Italy its presence is reported above all for the north, Abruzzo, and Sicily (Baldizzone et al. 1995). **This is the first record for southern Italy.**

*Tuta absoluta* (Meyrick, 1917) (Figure 16)

Records: Calabria, Cosenza, Orsomarso, Fiume Argentino, 140 m, 39.79461N-15.92341E, 22-VIII-2018 (1 ex., BOLD ID: BC ZSM Lep 104338), A. Hausmann leg.; Calabria, Cosenza, Praia a Mare, 10 m, 39.89331N-15.78271E, 20-VIII-2019 (2 ex., BOLD ID: BC ZSM Lep 109549, BC ZSM Lep 109543), 8-XI-2021 (1 ex., BOLD ID: BC ZSM Lep 114902), A. Hausmann leg. (ZSM collection).

Host plants: various species in the Solanaceae family, but the larva feeds voraciously especially on tomato *Solanum lycopersicum* L., which is the main host plant.

Distribution: native to South America, the species is spreading rapidly in Europe, where it was first reported in Spain, then in France, Italy, Malta, Greece, and Turkey, and in northern Africa. Reported from various regions of tropical Africa and India (Baldizzone & Scalercio, 2018). In Italy it is widespread as a pest of tomato, also known from Calabria (Sannino & Espinosa, 2010).

*Cosmardia moritzella* (Treitschke, 1835) (Figure 17)

Records: Calabria, Cosenza, Spezzano Sila, Serra Cannile, 1426 m, 39.34691N-16.40861E, 16-VII-2018 (1 ex., microscope slide: CREA-0245), S. Scalercio leg., G. Timossi det.; Calabria, Cosenza, Spezzano Sila, Serra Cannile, 1433 m, 39.34641N-16.40901E, 15-IV-2018 (1 ex.), S. Scalercio leg.; Calabria, Cosenza, Spezzano della Sila, Fago del Soldato, 1399 m, 39.35641N-16.40841E, 15-IV-2018 (1 ex.), S. Scalercio leg.; Calabria, Cosenza, Spezzano della Sila, Montagna Grande, 1315 m, 39.28121N-16.61501E, 27-IV-2022 (1 ex.), S. Scalercio and C. Di Marco leg. (CREA-FL collection).

Host plants: several species of *Silene* (Huemer & Karsholt, 2010).

Distribution: found in most parts of Europe, very rare in Mediterranean countries. Outside Europe found in western and southern Siberia (Huemer & Karsholt, 2010). In Italy only recorded in the north (Baldizzone et al. 1995). First Italian records outside the Alps.

*Caryocolum tischeriella* (Zeller, 1839) (Figure 18)

Records: Calabria, Cosenza, Spezzano della Sila, Lago Ariamacina, 1316 m, 39.34341N-16.54351E, 25-VIII-2016 (1 ex., BOLD ID: BC ZSM Lep 94680), A. Hausmann leg. (ZSM collection).



Host plants: *Silene nutans* L. (Schmid, 1887).

Distribution: widely distributed in Europe, except for the British Isles, the far north and parts of the Mediterranean (Huemer & Karsholt, 1999). In Italy recorded in the north (Baldizzone et al. 1995), in Latium (Pinzari et al. 2010) and Sicily (Huemer & Karsholt, 2010). **This is the first record for southern Italy.**

*Caryocolum leucomelanella* (Zeller, 1839) (Figure 19)

Records: Calabria, Cosenza, Longobucco, Vivaio Sbanditi, 1350 m, 39.38891N-16.60221E, 13-VIII-2014 (1 ex., microscope slide: CREA-0255), S. Scalercio leg., G. Timossi det. (CREA-FL collection); Calabria, Cosenza, Spezzano della Sila, Croce di Magara, 1390 m, 39.32231N-16.47491E, 01-IX-2015 (1 ex., BOLD ID: BC ZSM Lep 91913), A. Hausmann leg. (ZSM collection).

Host plants: several species of *Dianthus* and *Petrorrhagia saxifraga* (L.) Link (Huemer & Karsholt, 2010).

Distribution: Central and southern parts of Europe, absent from the north-west and north. In Italy, its presence has been recorded in Sicily and Abruzzo (Huemer & Karsholt, 2010) and it is most widespread in the north (South Tyrol in particular) (Huemer & Hebert, 2016). **These are the first reports for southern Italy.**

*Caryocolum proxima* (Haworth, 1828)

Records: Calabria, Cosenza, Longobucco, Lago Cecita, 1179 m, 39.38651N-16.5521E, 13-VIII-2014 (1 ex., BOLD ID: BC ZSM Lep 85006), A. Hausmann leg. (ZSM collection); Calabria, Cosenza, San Benedetto Ullano, Purgatorio, 880 m, 39.39391N-16.10241E, 27-VII-2016 (1 ex., microscope slide: CREA-0250), S. Scalercio leg., G. Timossi det. (CREA-FL collection).

Host plants: *Stellaria media* (L.) Vill (Karsholt, 1981) and *Cerastium fontanum* Baumg. (Bradford, 1979).

Distribution: widely distributed in Europe except for the northernmost parts. In Italy its presence has been recorded in the north (Baldizzone et al. 1995) and in Sicily (Huemer & Karsholt, 2010).

*Caryocolum herwigvanstai* Huemer, 2022 (Figure 20)

Records: Calabria, Cosenza, Castrovillari, Monte Pollino, 2000 m, 39.90121N-16.18111E, 09-VIII-2017 (1 ex., BOLD ID: BC ZSM Lep 101656), A. Hausmann leg. (ZSM collection).

Host plants: unknown.

Distribution: species recently described as endemic from Italy (Huemer, 2022), previously reported as *C. fibigerium* Huemer, 1988 from southern Italy and doubtfully from Sicily (Baldizzone et al. 1995). Confirmed records only from Latium and Abruzzo (Huemer et al. 2014). **New to southern Italy.**

#### Tribe Litini

*Teleiodes italica* Huemer, 1992 (Figure 21)

Records: Calabria, Cosenza, Saracena, Serrapaolo, 1010 m, 39.82251N-16.08831E, 19-VI-2015 (1 ex., microscope slide: CREA-0243), S. Scalercio & M. Infusino leg., G. Timossi det. (CREA-FL collection); Basilicata, Monte Pollino, Timpa del Demonio, 12-VII-1991, Baldizzone leg. (ZMUC) (Huemer & Karsholt, 1999).

Host plants : *Crataegus laevigata* (Poir.) DC., *Cydonia oblonga* Mill. (Huemer, 1992), *Sorbus aucuparia* L. (Huemer & Karsholt, 1999).

Distribution: widespread across the Mediterranean area, in particular Italy, southernmost Switzerland (Ticino), Spain (Huemer & Karsholt, 1999), France (Karsholt & Nieuwerkerken, 2013) and

Portugal (Corley et al. 2015). In Italy its presence has been recorded only for the north, in particular southern Alps (Huemer, 1992), and Latium (Pinzari et al. 2010).

*Neotelphusa cisti* (Stainton 1869)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 290 m, 39.9911N-15.7941E, 11-VIII-2021 (1 ex., BOLD ID: BC ZSM Lep 115146), A. Hausmann leg. (ZSM collection).

Host plants: *Cistus salvifolius* L., *C. albidus* L., *C. monspeliensis* L., and *Halimium alyssoides* (Lam.) C. Koch (Huemer & Karsholt, 1999).

Distribution: Mediterranean parts of Europe, from Portugal to Greece but also Turkey and Canary Islands (Huemer & Karsholt, 1999). In Italy it has been recorded on the mainland and in Sicily.

*Neotelphusa sequax* (Haworth, 1828)

Records: Basilicata, Potenza, 1.7 km N Madonna del Sirino, 1800 m, 40.13711N-15.81751E, 28-VIII-2017 (1 ex., BOLD ID: BC ZSM Lep 101671), A. Hausmann leg. (ZSM collection).

Host plants: *Helianthemum nummularium* (L.) Mill. and other species of the genus, *Dorycnium pentaphyllum* Scop. and *Thymus* (Huemer & Karsholt, 1999).

Distribution: it is found in most parts of Europe, and it is widely distributed in the western Palearctic region, being mentioned also from North America (Huemer & Karsholt, 1999). In Italy its presence has been recorded throughout the mainland.

*Carpatolechia decorella* (Haworth, 1812)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 280 m, 39.99141N-15.79391E, 22-XI-2015 (1 ex., BOLD ID: BC ZSM Lep 91160), A. Hausmann leg. (ZSM collection).

Host plants: *Abies alba* Mill., various species of *Quercus* and *Pistacia*, *Cornus mas* L. and *Swida sanguinea* (L.) Opiz (Huemer & Karsholt, 1999).

Distribution: widely distributed throughout Europe. Also recorded from North Africa, the Canary Islands, Turkey, Middle East to Kazakhstan (Huemer & Karsholt, 1999). In Italy reported from the whole territory (Baldizzone et al. 1995).

*Xenolechia aethiops* (Humphreys & Westwood, 1845)

Records: Basilicata, Potenza, Trecchina, Piano dei Peri, 280 m, 39.99141N-15.79391E, 11-III-2019 (1 ex., BOLD ID: BC ZSM Lep 105174), A. Hausmann leg. (ZSM collection).

Host plants: leaf-miner of *Erica cinerea* L. and other species of the genus (Huemer & Karsholt, 1999).

Distribution: many European countries from Spain to Russia, in north-western Europe to the Orkney Islands, absent from Scandinavia and north-eastern Europe. Also recorded from North Africa, Turkey, Palearctic Asia, and North America (Huemer & Karsholt, 1999). In Italy it has been recorded from the north, south and Sardinia.

*Recurvaria leucatella* (Clerck, 1759)

Records: Basilicata, Potenza, Lagonegro 3 km E, 1065 m, 40.11921N-15.80181E, 09-VIII-2019 (1 ex., BOLD ID: BC ZSM Lep 109588), A. Hausmann leg. (ZSM collection).

Host plants: *Amalanchier ovalis* Med., various species of the genera *Crataegus*, *Malus*, *Prunus* and *Sorbus*, but also *Betula*, *Acer* and *Fraxinus* (Huemer & Karsholt, 1999).

Distribution: Present in most European countries, and across Turkey to Central Asia (Huemer & Karsholt, 1999). In Italy its presence has been reported in the mainland, Sicily and Sardinia.

## DNA Barcoding analysis

Barcoded specimens allowed us to investigate the diversification of mitochondrial lineages of South Italian populations. Whilst most specimens show a perfect match or a pairwise distance lower

than 1% from other European samples, *Mirificarma cytisella* and *M. eburnella* are more strongly divergent (Table 1). The barcode sequence of the Calabrian *M. cytisella* belongs to a supposedly endemic Barcode Index Number (BIN), which is even different from an additional BIN including Piedmont region samples (Figure 23). It is a genetically variable species, separated into five BINs, many of them without clear geographic separation. In fact, two BINs appear to be sympatric in Bavaria, two in Austria and two in Italy (Figure 23). *M. eburnella* shows two BINs in Calabria, one shared with Austrian, Greek and Montenegrin specimens, the other one appears to be endemic (Figure 24). Therefore, for *Mirificarma* species, this mitochondrial variation seems to be linked to an intraspecific genetic diversity.

**Table 1.** Best match of barcode sequences obtained for Calabrian species with those published and deposited in BOLD. The most different Calabrian sequence for each species was selected.

Species	N	Pairwise distance		Selected ID	bp	Best match ID	%	Country
		mean	max					
<i>Approaerema cinctelloides</i>	1	NA	NA	BC ZSM Lep115148	658	BC ZSM Lep 61913	99.83	Germany
<i>Approerema anthyllidella</i>	4	2.22	3.98	BC_ZSM_Lep_115666	658	TLMF Lep 17217	99.24	Austria
<i>Anacampsis scintillella</i>	1	NA	NA	BC ZSM Lep 94654	658	BC ZSM Lep 28265	99.39	Germany
<i>Nothris congressariella</i>	1	NA	NA	BC ZSM Lep 91156	658	TLMF Lep 29984	100	Greece
<i>Nothris verbascella</i>	2	0	0	BC ZSM Lep 114906	658	TLMF Lep 06564	100	Austria
<i>Helcystogramma lamprostoma</i>	1	NA	NA	BC ZSM Lep 109542	658	TLMF Lep 03268	99.85	Spain
<i>Brachmia blandella</i>	2	0.46	0.46	BC ZSM Lep 85078	658	TLMF Lep 17664	100	Austria
<i>Palumbina guerinii</i>	3	0.31	0.46	BC ZSM Lep 115103	658	TLMF Lep 29884	99.69	Greece
<i>Bryotropha italica</i>	1	NA	NA	BC ZSM Lep 59328	658	TLMF Lep 25611	99.28	Italy
<i>Bryotropha affinis</i>	2	0.31	0.31	BC ZSM Lep 115150	658	BC ZSM Lep 952096	99.85	Germany
<i>Bryotropha terrella</i>	1	NA	NA	BC ZSM Lep 109590	658	TLMF Lep 03824	99.69	Italy
<i>Ptocheuusa paupella</i>	1	NA	NA	BC ZSM Lep 104343	658	TLMF Lep 30186	100	Greece
<i>Monochroa cytisella</i>	1	NA	NA	BC ZSM Lep 111823	658	MM03604	99.69	Finland
<i>Oxypteryx immaculatella</i>	1	NA	NA	BC ZSM Lep 97924	658	MM19711	100	France
<i>Mirificarma maculatella</i>	1	NA	NA	LEP-SS-01195	614	TLMF Lep 05285	99.84	Macedonia
<i>Mirificarma flavella</i>	2	0	0	LEP-SS-01203	658	TLMF Lep 24985	100	Cyprus
<i>Mirificarma cytisella</i>	1	NA	NA	LEP-SS-01205	658	TLMF Lep 03769	98.62	Italy
<i>Mirificarma eburnella</i>	5	1.21	2.03	LEP-SS-01199	658	TLMF Lep 27254	98.01	Greece

<i>Mirificarma mulinella</i>	1	NA	NA	LEP-SS-01207	658	KB08022	100	Norway
<i>Aroga velocella</i>	1	NA	NA	BC ZSM Lep 85004	658	UKLB40A05	United Kingdom 99.21	
<i>Chionodes distinctella</i>	2	0.30	0.30	BC ZSM Lep 101666	658	NHMO-DAR-14981	99.52	Norway
<i>Tuta absoluta</i>	4	0	0	BC ZSM Lep 104338	658	GBGL12677-13	100	Montenegro
<i>Caryocolum tischeriella</i>	1	NA	NA	BC ZSM Lep 94680	658	TLMF Lep 26798	100	France
<i>Caryocolum leucomelanella</i>	1	NA	NA	BC ZSM Lep 91913	658	TLMF Lep 25276	100	Croatia
<i>Caryocolum proxima</i>	1	NA	NA	BC ZSM Lep 85006	658	BC_LSNOE_Lep_03082	99.85	Austria
<i>Caryocolum herwigvanstaai</i>	1	NA	NA	BC ZSM Lep 101656	622	TLMF Lep 01601	99.84	Italy
<i>Neotelphusa cisti</i>	1	NA	NA	BC ZSM Lep 115146	658	TLMF Lep 30192	99.69	Greece
<i>Neotelphusa sequax</i>	1	NA	NA	BC ZSM Lep 101671	658	TLMF Lep 26495	99.39	Austria
<i>Carpatolechia decorella</i>	1	NA	NA	BC ZSM Lep 91160	658	MM17714	100	Bulgary
<i>Xenolechia aethiops</i>	1	NA	NA	BC ZSM Lep 105174	658	TLMF Lep 24932	100	Greece
<i>Recurvaria leucatella</i>	1	NA	NA	BCZSM Lep 109588	658	BIOUG17445-F03	100	Germany

## Discussion and conclusions

Although we listed a relatively low number of species compared to those known in Italy, the number of faunistic novelties is very high, as expected due to the scarce investigation of Microlepidoptera in South Italian regions. In detail, *Aproaerema cinctelloides* is new for the Italian fauna, *Aroga pascuicola*, *Helcystogramma lamprostoma* and *Oxypteryx immaculatella* are new for continental Italy, *Cosmardia moritzella* is recorded for the first time in Italy outside the Alps, six species are new for the fauna of southern Italy (*Mirificarma maculatella*, *Scrobipalpa acuminatella*, *Caryocolum tischeriella*, *C. herwigvanstaai*, *C. leucomelanella*, *Teleiodes italica*, *Carpatolechia decorella*), and 24 species are new for the regional fauna lists of Calabria and Basilicata.

*Aproaerema cinctelloides* was described from Corsica (Nel & Varenne, 2012), where it was separated from the similar *A. cinctella* on morphological bases. It has initially been supposed to be an endemic of Corsica, but subsequently was reported in other European countries (Segeer & Huemer, 2020). Although it has not been reported from Italy so far, it is likely that its presence in Italy was underestimated. As noticed by Segeer & Huemer (2020), specimens collected at hot, dry locations should be thoroughly checked for their identity. In fact, the South Italian record is consistent with this expectation.

In Italy, only two documented reports are available for *Cosmardia moritzella* from central-eastern Alps (South Tyrol, Trentino-Alto Adige), at an altitude of 1250 m (Huemer & Hebert, 2016; Huemer et al. 2020). Although it is common in the Sila mountains, it seems to be absent from northern and central Apennines. We compared the male genitalia of a specimen from the Sila with the available iconography (Huemer & Karsholt, 2010, plate 14, figure 140) and with those of a specimen from northern Italy (unpublished data; Veneto, Belluno, Monte Vette, Rifugio Dal Piaz 1998 m, 10-VII-2017) which was the southernmost finding known in Italy. There are no morphological differences in habitus and

genitalia. The great geographic distance between Alpine and Calabrian populations suggests performing further research including DNA barcode analysis for assessing a possible genetic divergence.

*Aroga pascuicola* is poorly documented in Europe, where it is only found in Spain, Portugal, Corsica, Sardinia, and South European Russia (Karsholt & Nieuwerkerken, 2013). In Italy it is only known from one Sardinian locality, Monte Iscudu (Huemer et al. 2020). This is the first record from Italian mainland. We collected one specimen in May, supporting the bivoltinism supposed in Huemer & Karsholt (1999).

*Oxypteryx immaculatella* is documented from Central-West Europe and Greece and was recorded only recently for Italy in Sardinia, Monte Albo (Huemer et al. 2020). This is the first record from Italian mainland. The specimen was collected in a dry habitat with sparse Mediterranean shrubs, where congeneric species of the supposed host plant *Hypericum pulchrum* are present.

The European distribution of *Helcystogramma lamprostoma* is limited to Mediterranean countries. In Italy it has been reported only from Sicily and Sardinia, the Calabrian finding constituting the easternmost record of continental Europe. The Mediterranean character of the species is confirmed also by the occurrence of the species near to the coastal line.

DNA barcoding analysis showed the presence of endemic BINs for some species, deserving further taxonomic studies.

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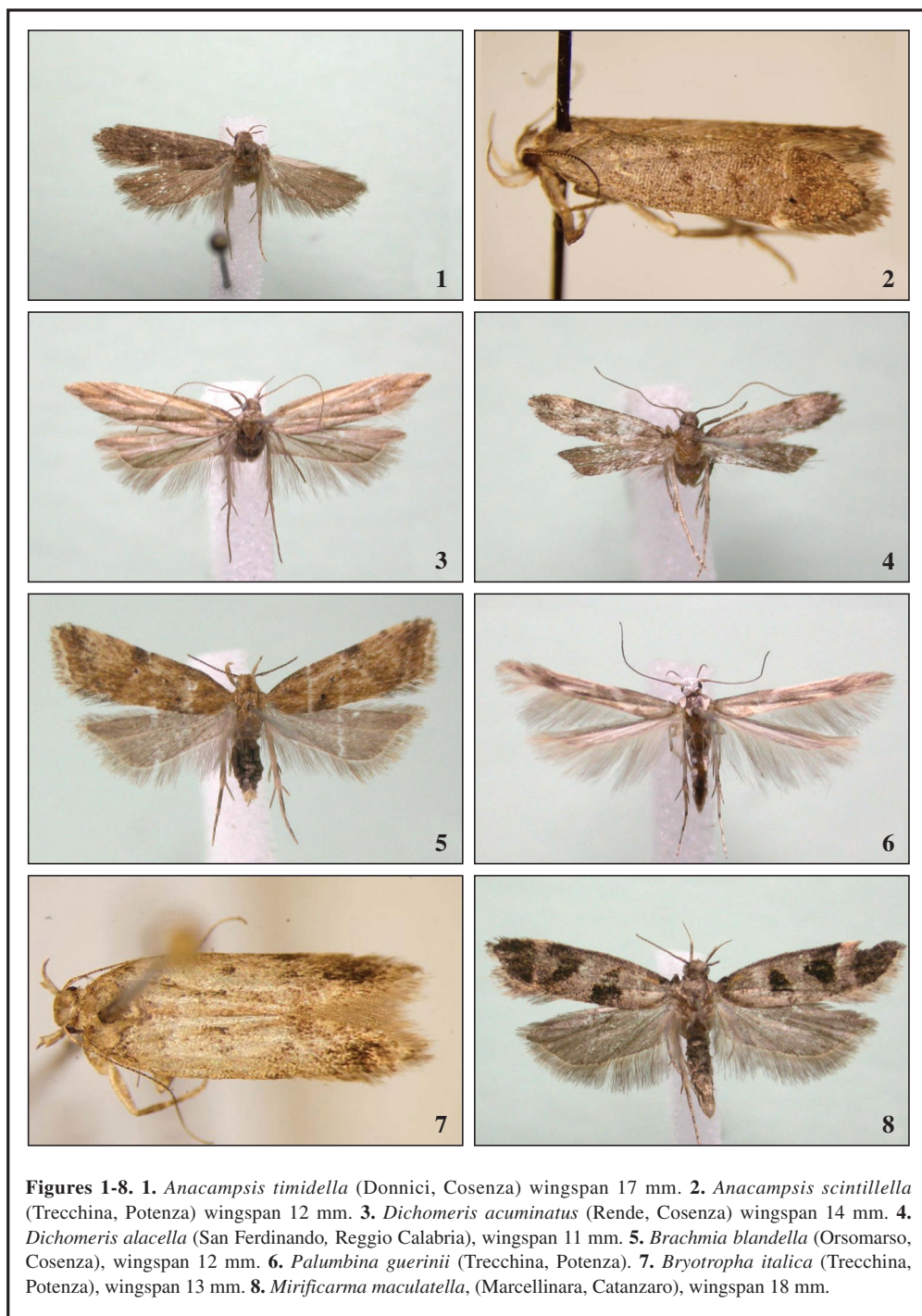
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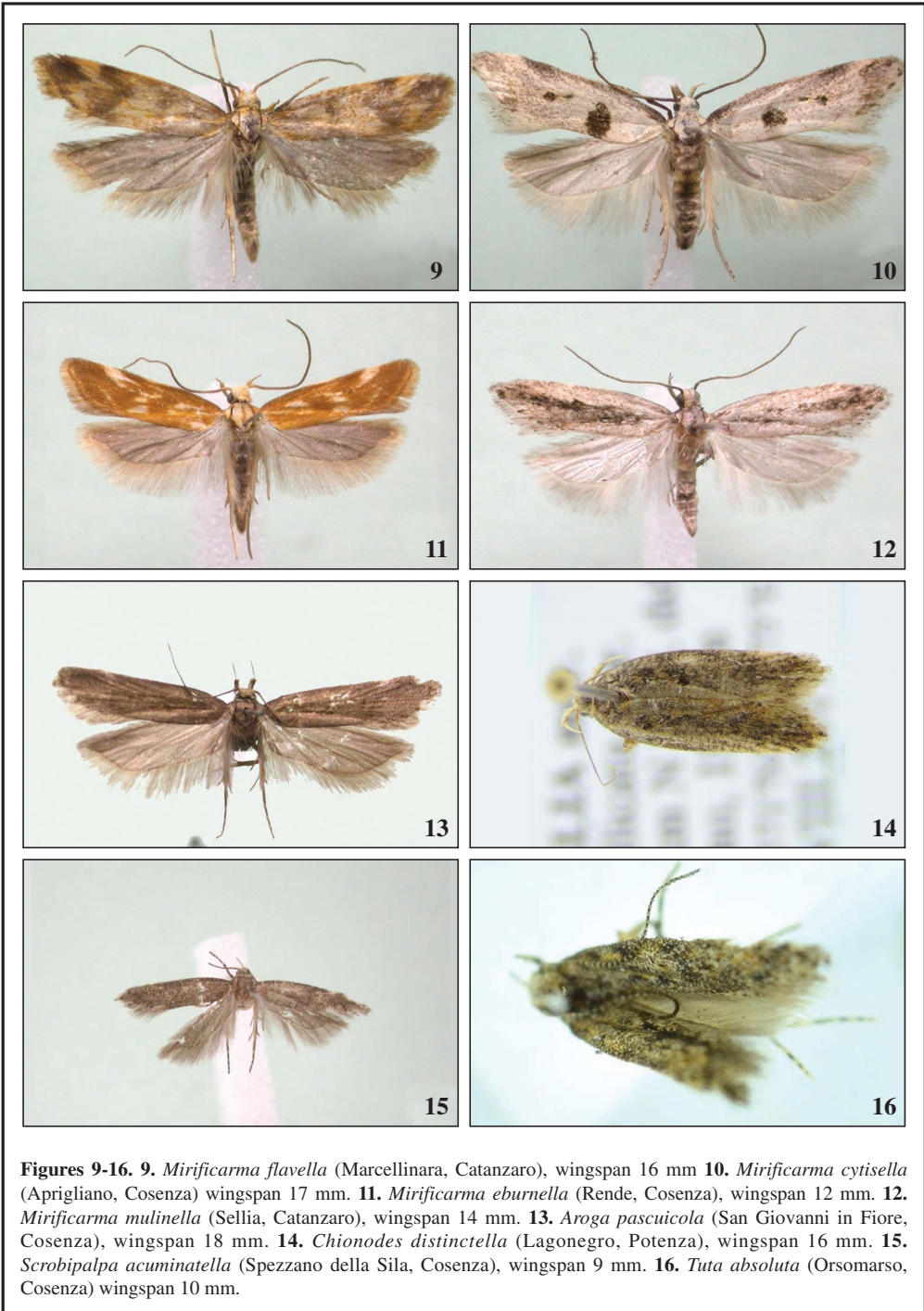
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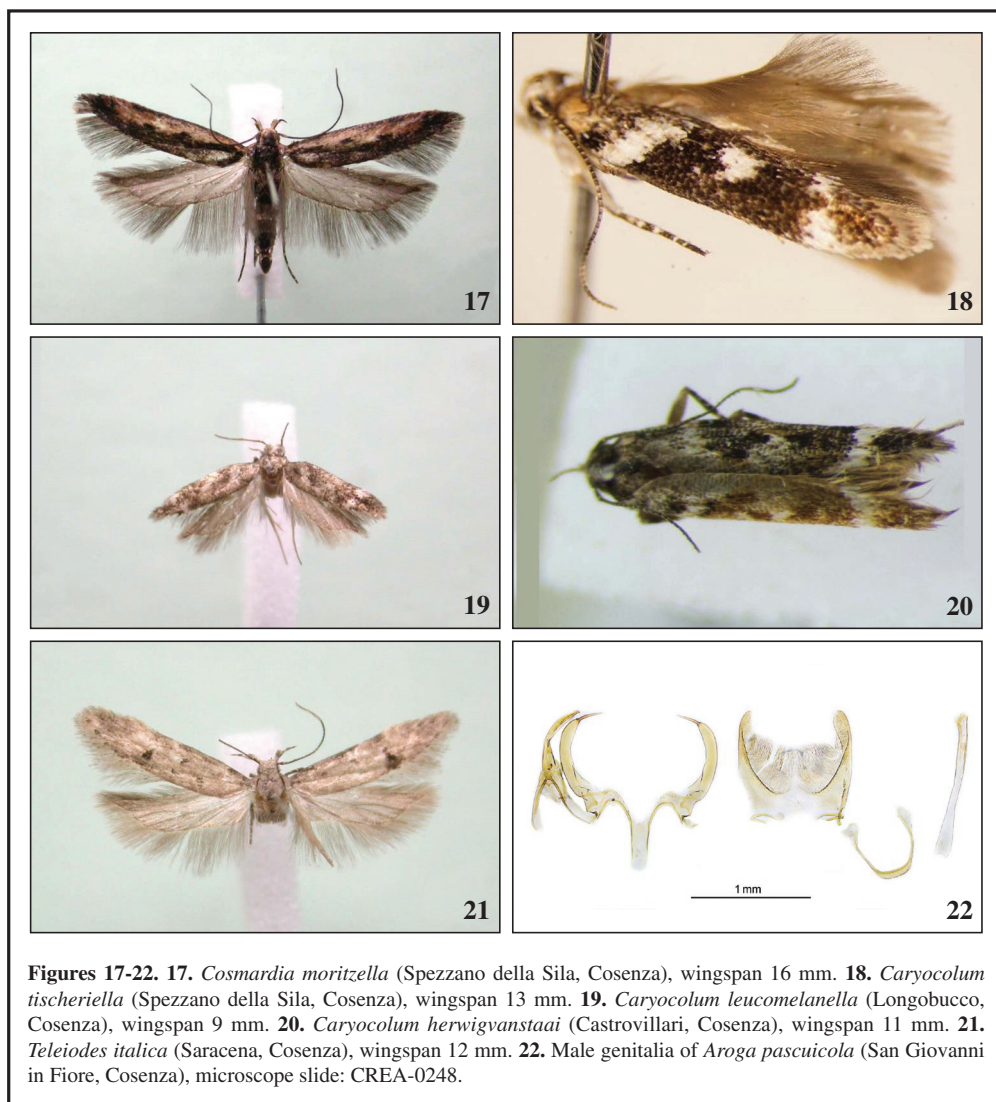
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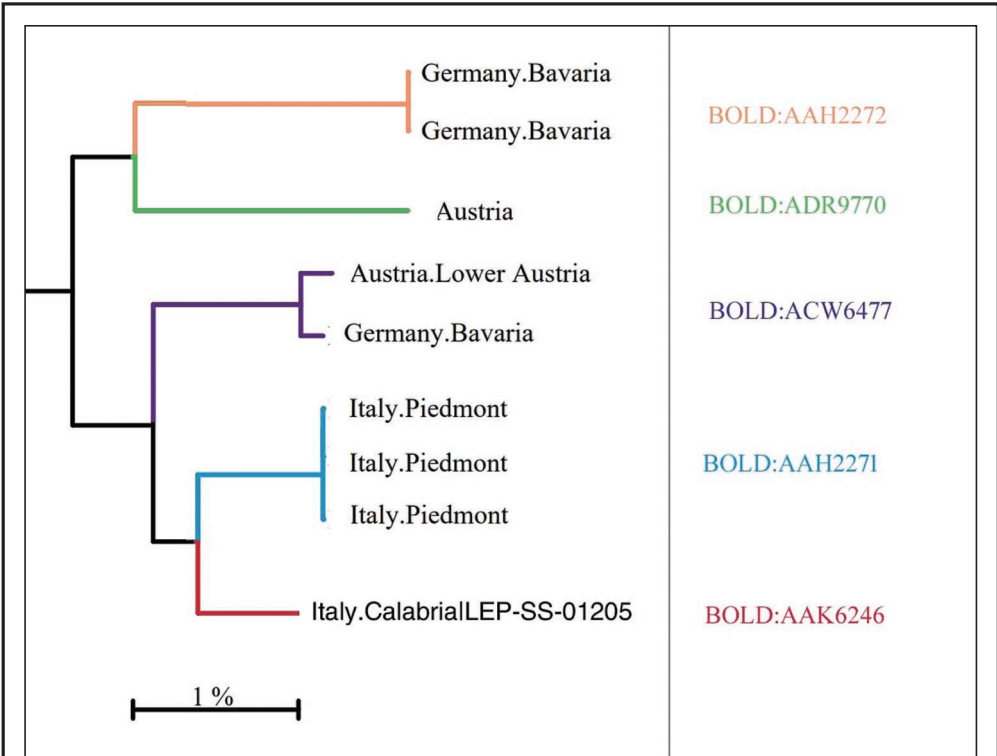


**Figures 1-8.** 1. *Anacampsis timidella* (Donnici, Cosenza) wingspan 17 mm. 2. *Anacampsis scintillella* (Trecchina, Potenza) wingspan 12 mm. 3. *Dichomeris acuminatus* (Rende, Cosenza) wingspan 14 mm. 4. *Dichomeris alacella* (San Ferdinando, Reggio Calabria), wingspan 11 mm. 5. *Brachmia blandella* (Orsomarso, Cosenza), wingspan 12 mm. 6. *Palumbina guerinii* (Trecchina, Potenza). 7. *Bryotropha italica* (Trecchina, Potenza), wingspan 13 mm. 8. *Mirificarma maculatella*, (Marcellinara, Catanzaro), wingspan 18 mm.

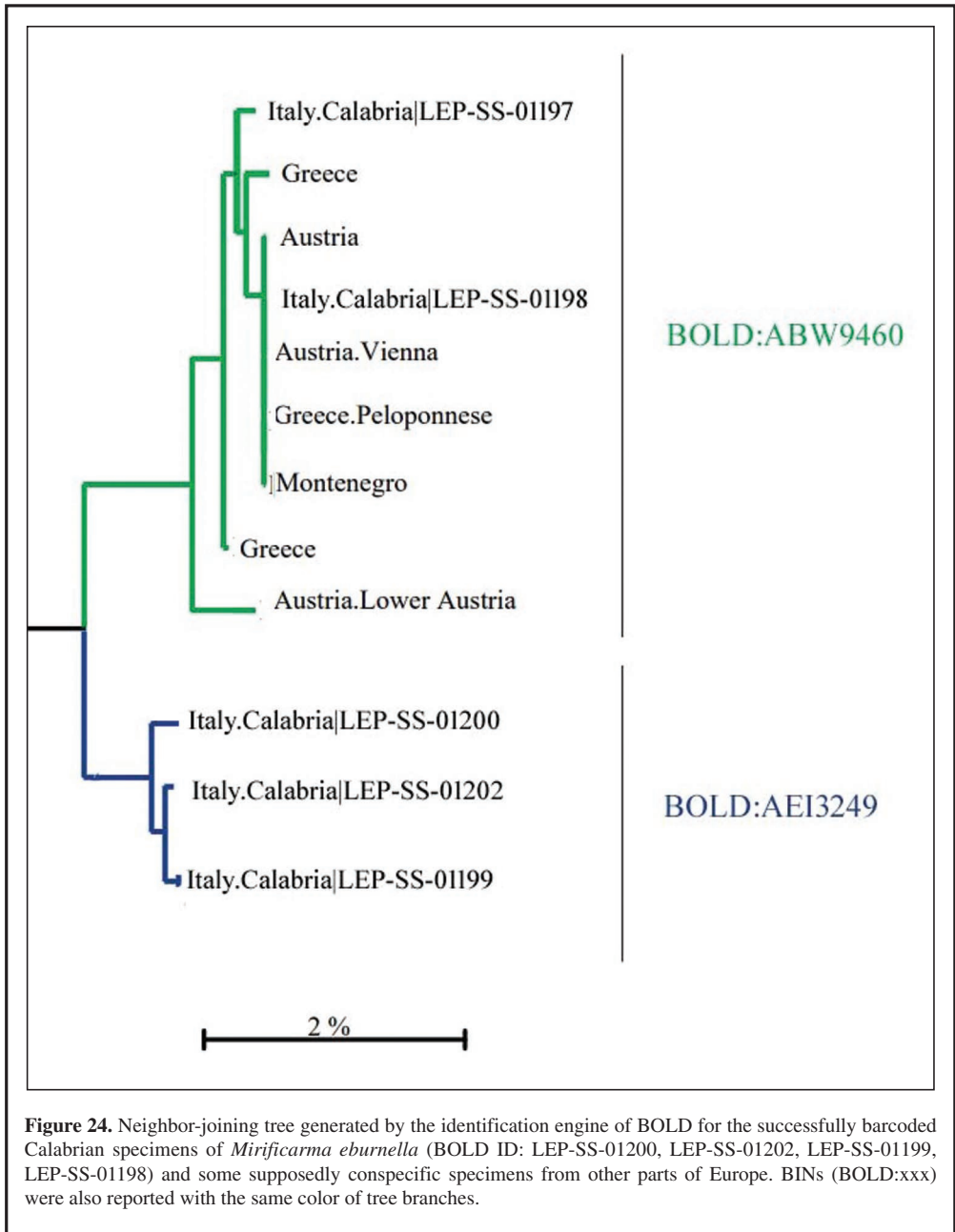








**Figure 23.** Neighbor-joining tree generated by the identification engine of BOLD for the successfully barcoded Calabrian specimen of *Mirificarma cytisella* (BOLD ID: LEP-SS-01205) and some supposedly conspecific specimens from other parts of Europe. BINs (BOLD:xxx) were also reported with the same color of tree branches.



**Figure 24.** Neighbor-joining tree generated by the identification engine of BOLD for the successfully barcoded Calabrian specimens of *Mirificarma eburnella* (BOLD ID: LEP-SS-01200, LEP-SS-01202, LEP-SS-01199, LEP-SS-01198) and some supposedly conspecific specimens from other parts of Europe. BINs (BOLD:xxx) were also reported with the same color of tree branches.