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New records of acalyptrate Diptera from Sicily (Brachycera, Muscomorpha: Asteiidae, Aulacigastridae, Carnidae, Lonchaeidae, Odiniidae, Pallopteridae, Periscelididae, Piophilidae, Sciomyzidae, Ulidiidae)

Martin J. EBEJER[1,*], Giuseppe NICOLOSI[2]

[1,*] *Honorary Research Fellow, Entomology Section, Department of Natural Sciences, National Museum of Wales, Cathays Park, Cardiff, UK* – martin.ebejer@btinternet.com
[2] *Department of Life Sciences and Systems Biology, University of Turin, Torino, Italy*
[*] Corresponding author

Abstract
Four families with five species of acalyptrate Diptera are recorded for the first time from Sicily: Aulacigastridae [*Aulacigaster falcata* Papp, *A. leucopeza* (Meigen)], Odiniidae [*Odinia trinotata* Robineau-Desvoidy], Periscelididae [*Periscelis annulata* (Fallén)] and Carnidae [*Meoneura freta* Collin]. In six families that were previously known from Sicily, an additional nine new species records are given. The lists of species of *Meoneura* Rondani of Italy and of *Herina* Robineau-Desvoidy (Ulidiidae) of Sicily are updated.

Key words: Sicily, Italy, Diptera, *Herina*, *Meoneura*, acalyptratae, beer trap, faunistics, new records.

Introduction

The Diptera of Sicily are not well-studied. Even when the first list of 850 species was published (Bezzi & de Stefani-Perez 1897) the authors felt that this represented only about a quarter of what could be expected. Since then, numerous papers have added species to the fauna of Sicily, which was updated in the Checklist of Italian Diptera (Minelli et al. 1995). Notwithstanding this last work, which is itself now outdated with more publications having appeared over the intervening 25 years, there remain families and species not hitherto recorded. A sample of flies collected in beer traps was forwarded to MJE for identification. This sample included numerous species pertaining to many families, some of which are new to Sicily. This paper gives an account of the new records in acalyptrate families and includes others that MJE collected in Sicily in June 1999.

There are several families of Diptera where species are not regularly encountered unless specifically searched for either by intensive and focused sampling in their usually very selective habitats and microhabitats or by setting appropriately baited traps in suitable locations at different times of the year (Manko et al. 2018). Alcohol is attractive to a wide variety of Diptera and beer is a commonly used bait. However, many species that are attracted to alcohol are also attracted to other baits, for example, decomposing liver, carrion or fish. In many instances, success is subject to fortuitous trapping in the right season as well as in the right location. Open oak woodland in the proximity of both animal husbandry and cereal fruit agriculture can be expected to yield a high diversity of species.

Materials and Methods

Location and habitats. The regional nature reserve of "Vallone di Piano della Corte"is a valley crossed by a stream located in the middle of the Erei mountains in the municipality of Agira, province of Enna. The reserve is managed by CUTGANA (Centro Universitario per la Tutela e la Gestione degli Ambienti Naturali e degli Agro-ecosistemi) of the University of Catania, and was established in 2000 from Regione Sicilia (Assessorato Regionale del Territorio e dell'Ambiente). Since 2005, 450 hectares of the valley are included in the network of Natura 2000 as Special Area of Conservation (SAC ITA060007). The Brace stream in the valley is bordered by reliefs of 500–800 meters above sea level, including mount "Teja", where the town of Agira is located. The upper section of the stream flows through sandy soil and is characterized by a gallery forest of *Salix alba, Salix pedicellata* and *Populus alba* with some old trees of *Populus nigra*. That further downstream is instead characterized by clay soils and trees of *Tamarix* sp. alternating with open meadows and rare plants of *Lavatera agrigentina* and *Lygeum spartum*.

Bottle traps baited with beer and sugar were hung on a tree, *Populus nigra,* adjacent to the river bed in a forest dominated by oak (*Quercus virgiliana*). Two traps were hung about 5 meters above the ground and were emptied after 7 days.

In 1999, after discussions with Prof. G. Sabella at the University of Catania, MJE visited a number of sites on Mt. Etna for fieldwork. The objective was to search for Diptera in a variety of habitats and open ground at various altitude around the mountain to obtain a broad perspective of Diptera diversity.

The specimens in the beer traps were transported and stored in alcohol. Specimens selected for identification and to be retained as voucher material were removed from alcohol, passed through ethyl acetate and dry mounted on card points if the specimens were larger than about 3mm. If smaller, these were passed in stages through alcohol/formalin (1:1 solution for 24 hours), alcohol/ethyl acetate (as preceding for other 24 hours) and finally through ethyl acetate (additional 24 hours) as described by Barták (1997) before being dry mounted on card points. The Diptera collected in 1999 were all taken by hand held sweep-net and micro-pinned on the day or card pointed dry later. All voucher material listed in the article is preserved in the personal collection of the first author. The taxa are given in alphabetical order.

Results

ASTEIIDAE

Until now, *Asteia amoena* Meigen, 1830 was the only species recorded from Sicily. It is very common and widespread in the West Palaearctic. Several other *Asteia* Meigen, 1830 are also frequently encountered around the Mediterranean coast and the islands. The biology is very poorly known. Some species develop in fungi, flower heads and other plant tissues.

Asteia inanis Lyneborg, 1969
Material examined: 2♂, 2♀, Sicily, Noto, Vendicari, coastal marsh and dunes, 10.vi.1999, M.J. Ebejer
New record for Sicily.

Asteia (*Subanarista*) *mahunkai* Papp, 1979
Material examined: 2♀, Sicily, Noto, Vendicari, coastal marsh and dunes, 10.vi.1999, M.J. Ebejer
New record for Sicily.

AULACIGASTRIDAE

This family, known from the north of Italy, has a few species in all zoogeographic regions. Only three are found in Europe and all are associated with woodland, particularly forests of *Quercus* where the larvae develop in exuding sap from the tree trunks. These flies are also occasionally attracted to carrion. Carles-Tolrá & Garcia Rojo (2015) collected three species in Spain using beef liver.

Aulacigaster falcata Papp, 1997
Material examined: 2♂, 3♀, Sicily, Enna, Agira, 37° 38′44.32″N 14°29′44.58″E, beer trap, 07–14.viii.2019, G. Nicolosi. **The family and species are new records for Sicily**.

Aulacigaster leucopeza (Meigen, 1830)
Material examined: 5♂, 2♀, Sicily, Enna, Agira, 37° 38′44.32″N 14°29′44.58″E, beer trap, 07–14. viii.2019, G. Nicolosi.
Known from north Italy. **The family and species are new records for Sicily**.

CARNIDAE

This family was very poorly known from the whole of Italy until quite recently. The checklist (Canzoneri et al. 1995) lists only one species of *Meoneura* Rondani, 1856. The paper by Stuke & Barták (2019) adds more species and the new record from Sicily brings the total number of the known Italian species of *Meoneura* to 13. A few more species can be expected from Sicily. The biology of this family includes larvae developing as ectoparasites of birds, development in dung and in compost.

Meoneura freta Collin, 1937
Material examined: 1♂, Sicily, Enna, Agira, 37°38′44.32″N 14°29′44.58″E, beer trap, 07–14.viii.2019, G. Nicolosi. **The family and species are new records for Sicily**.

The checklist of the thus far known Italian *Meoneura* is updated here:

Meoneura Rondani, 1856
alpina Hennig, 1948
atoma Papp, 1981
baechli Stuke & Barták, 2019
*exigu*a Collin, 1930
flavifacies Collin, 1930
flavifrons Papp, 1981
freta Collin, 1937
glaberrima Becker, 1907
helvetica Papp, 1997
joedaltoni Stuke & Barták, 2019
obscurella (Fallén, 1823)
occulta Stuke, 2015
pseudoflavifacies Papp, 1997

LONCHAEIDAE

Some species have saproxylic larvae, others develop in decomposing vegetable matter and manure. Only three of the 23 species known from Italy have been recorded from Sicily. The species listed below is widespread in Europe and common around the Mediterranean.

Silba fumosa (Egger, 1862)
Material examined: 2♀, Sicily, Etna, Rifugio Citelli, *Betula*

wood, 1700m, 12.vi.1999, M.J. Ebejer. **New record for Sicily.**

ODINIIDAE

This is a small family of species in the Palaearctic. The larvae of some species develop in burrows in trees (*Alnus*, *Betula, Malus, Populus, Quercus* and *Salix*) attacked usually by the larvae of beetles of the families Cerambycidae and Curculionidae (Scolytinae). Other species are associated with fungi. Only three species of this family are known from Italy.

Odinia trinotata Robineau-Desvoidy, 1830
Material examined: 2♂, 1♀, Sicily, Enna, Agira, 37°38′44.32″N 14°29′44.58″E, beer trap, 07–14.viii.2019, G. Nicolosi.
This species is associated with oak trees. **The family and species are new records for Sicily**.

PALLOPTERIDAE

What is known of the biology of this family suggests that some species are phytophagous while others may be carnivorous or mycophagous. According to the checklist (Belcari et al. 1995), the species previously known from Sicily were *Palloptera umbellatarum* (Fabricius, 1775) and *P. usta* (Meigen, 1826).

Palloptera muliebris (Harris, 1780)
Material examined: 1♂, 1♀, Sicily, Etna, Bronte, Monte Minardo, 345m, 11.vi.1999, M.J. Ebejer.
This species was swept from the leaves on the lower branches of oak trees. It is a common species in Europe and Italy. **New record for Sicily.**

Palloptera ustulata Fallén, 1820
Material examined: 3♂, 1♀, Sicily, Etna, Monte Spagnolo, 1200m, woodland of *Acer*, *Castanea* and *Pinus*, 6.vi.1999, M.J. Ebejer.
Swept from the leaves of lower branches of trees, this is a very common and widespread European species. **New record for Sicily.**

PERISCELIDIDAE

Two relatively recent papers give detailed taxonomic accounts of the subfamily Periscelidinae in the West Palaearctic (Papp & Withers 2011; Roháček & Andrade 2017). This subfamily is associated with forests where larvae are thought to develop in sap exuding from deciduous trees.

Periscelis annulata (Fallén, 1813)
Material examined: 5♂, 6♀, Sicily, Enna, Agira, 37°38′44.32″N 14°29′44.58″E, beer trap, 07–14.viii.2019, G. Nicolosi.
Known from north Italy. **The family and species are new records for Sicily**.

PIOPHILIDAE

The only species previously known from Sicily is the cosmopolitan *Piophila casei* (Linnaeus, 1758). Both species recorded below are widespread in Europe and both are known from mainland Italy. Piophilidae species are late stage carrion feeders as larvae.

Prochyliza nigrimana (Meigen, 1826)
Material examined: 1♀, Sicily, Etna, Monte Spagnolo, 1200m, woodland of *Acer*, *Castanea* and *Pinus*, 6.vi.1999, M.J. Ebejer. **New record for Sicily.**

Protopiophila latipes (Meigen, 1838)
Material examined: 1♀, Sicily, Enna, Agira, 37°38′44.32″N 14°29′44.58″E, beer trap, 07–14.viii.2019, G. Nicolosi. Known from south Italy. **New record for Sicily.**

SCIOMYZIDAE

The Sciomyzidae is a well-known family whose larvae are predators/parasitoids of terrestrial and freshwater molluscs. The Italian fauna was comprehensively studied and documented by Rivosecchi (1992) who recorded twenty species from Sicily.

Pherbellia annulipes (Zetterstedt, 1846)
Material examined: 2♂, Sicily, Etna, 3km NW of Milo, forest of *Castanea* and *Corylus*, 1000m, 9.vi.1999, M.J. Ebejer. Swept from leaf litter in the shade beneath the above named trees. **New record for Sicily.**
Apparently *P. annulipes* is not yet known from the southern parts of Italy, but almost certainly occurs there.

ULIDIIDAE

A family of very diverse species all of which develop in decomposing organic matter, often of plant origin. Many are attracted to dung of various animal origin. Since the publication of the checklist (Belcari et al. 1995) and a comprehensive study of this family by Rivosecchi (1995), two papers (Kameneva 2007; Morgulis et al. 2013) added new records and one new species to the previously listed single species of *Herina* Robineau-Desvoidy, 1830 from Sicily. The list is brought up to date below and a genus and species new for Sicily is added.

Herina Robineau-Desvoidy, 1830
ghilianii Rondani, 1869
rivosecchii Merz, 2001
sicula Morgulis, Freidberg & Kameneva, 2013
tristis (Meigen, 1826)

Myennis octopunctata (Coquebert, 1798)
Material examined: 3♂, 3♀, Sicily, Enna, Agira, 37°38′44.32″N 14°29′44.58″E, beer trap, 07–14.viii.2019, G. Nicolosi.

Widespread in Italy and known from Sardinia. **New record for Sicily.**

Discussion

Fieldwork using hand held sweep nets with direct visual observations in a variety of habitats for an overview of the topology, vegetation and overall insect activity is a productive way for a preliminary assessment of Diptera diversity. However, it cannot be relied upon as the sole method. Sampling with traps in well-chosen localities almost always adds more species as demonstrated in this article.

Populus trees in the Mediterranean, especially near water, are an important resource for a wide variety of insect life and many species of Diptera can be found in close proximity to even a single tree. Oak woods are prime habitats for some species of Aulacigastridae, Periscelididae and Odiniidae. The first two families have larval stages that develop in sap runs and the third family has species whose larvae develop in the burrows in trees that have been caused by species of beetles such as some species of Cerambycidae and Scolytinae (Curculionidae). The 14 new species records and the four new family records for the fauna of Sicily support the view that much remains to be learnt about the distribution of species and faunal composition of Diptera on this island and in the Mediterranean sub-region.

Biodiversity and conservation have always been important issues, but in very recent years have gained their deserved prominence in discussions when policies for land use are discussed at all levels from local to central government. At first, small insects may be considered insignificant in this context, but biologists and ecologists are very aware of the dominant vital and intricate role they play in the maintenance of healthy and balanced ecosystems upon which all life depends.

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