

New and confirmed records of fruit flies (Diptera, Tephritidae) from Italy

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Abstract

Background

Prior to this study, 141 species of Tephritidae were known to occur in Italy.

New information

Italian records of nine species of the family Tephritidae (Diptera) are provided. Five species, *Eurasimona stigma* (Loew, 1840), *Noeeta bisetosa* Merz, 1992, *Campiglossa doronici* (Loew, 1856), *Xyphosia laticauda* (Meigen, 1826) and *Rhagoletis berberidis* Jermy, 1961 are recorded from Italy for the first time, whereas four species, *Inuromaesa maura* (Frauenfeld, 1857), *Urophora cuspidata* (Meigen, 1826), *Tephritis conyzifoliae* Merz, 1992 and *T. mutabilis* Merz, 1992, previously recorded in the Fauna Europaea database without reference to collection material, are confirmed and supplemented with host plant data and other collection data.

Keywords

Diptera, Tephritidae, Italy, checklist, additions

Introduction

Tephritidae is one of the largest families of cyclorrhaphous Diptera, with almost 5,000 named species predominantly found in the tropics (A. Norrbom, pers. comm.). The family is also referred to as “fruit flies”, as it contains many species that are specialised feeders

on fleshy fruit. The tropical regions are true hotspots of tephritid diversity, including hundreds of fruit-eating species, but also species with saprophagous larvae feeding under the bark of fallen trees or in bamboo culms (Korneyev 1999, Dohm et al. 2014). On the other hand, most Palaearctic species are flower and seed feeders, with larvae that are borers in the flower heads, stems and rhizomes of Asteraceae, Lamiaceae and Acanthaceae. The European fauna is represented by at least 265 species belonging to three subfamilies: Dacinae, Tephritinae and Trypetinae (Merz and Korneyev 2011, V. Korneyev, unpublished data). Some of the fruit-eating species are widespread economic pests which cause serious damage to fruit crops and stored fruit. The olive fly, *Bactrocera oleae* (Rossi, 1794) and the medfly, *Ceratitis capitata* (Wiedemann, 1817), as well as many members of the genera *Rhagoletis* Loew, 1862 and *Carpomya* Costa, 1854, are well-known examples.

Starting from Rondani (Rondani 1856, Rondani 1870), who listed 109 nominal species known from Italy and following numerous nomenclatural changes, the number of Italian fruit fly species reached 133 species according to Belcari et al. (1995). Later, Merz and Korneyev (2011) increased this number to 141 species, but did not provide occurrence data for species added to the Italian list. These were: *Inuromaesa maura* (Frauenfeld, 1857), *Urophora congrua* Loew, 1862, *U. cuspidata* (Meigen, 1826), *Tephritis conyzifoliae* Merz, 1992, *T. maccus* Hering, 1937, *T. mutabilis* Merz, 1992, *Chaetorellia acrolophi* White & Marquardt, 1989, *Terellia (Cerajocera) rhapsodici* Merz, 1990, *Rhagoletis batava* Hering, 1958 and *R. cingulata* (Loew, 1862), all based on collection material identified by Bernhard Merz, but not formally published.

Other relatively recent contributions to the Italian tephritid fauna, including first Italian records, were made by Merz (2002) for *Campiglossa misella* (Loew, 1869) and Rivosecchi (2008) for *Euphranta toxoneura* (Loew, 1846). Gentilini et al. (2006) described two fossil species from the Upper Miocene (Messinian) of Monte Castellaro. Seljak (2013) recorded *Euaresta aequalis* (Loew), a non-native, North American species considered beneficial as a biological control agent of the invasive plant *Xanthium strumarium* L. (Asteraceae), from Italy and Slovenia for the first time. Recently, Nugnes et al. (2018) provided the first Italian records of the invasive fruit pest species *Bactrocera dorsalis* (Hendel, 1912) from the Region of Campania.

In this paper, we record five tephritid species for Italy for the first time and confirm the occurrence in the country of four additional species, based on detailed collection data and host plant information obtained during research on symbiotic bacteria of over 30 fruit fly species. The analysis revealed the presence of hereditary symbiotic bacteria in *Bactrocera oleae* (Rossi, 1790) (Capuzzo et al. 2005) and in all studied species of the tribe Tephritini and the genus *Noeeta* Robineau-Desvoidy, 1830. In other tribes (e.g., Myopitini, Xyphosiini and Terelliini), despite the common trait of larvae developing in Asteraceae flower heads, evolution does not seem to have occurred for the establishment of a hereditary bacterial interaction (Mazzon et al. 2008, Mazzon et al. 2010, Mazzon et al. 2011).

Materials and methods

The flies were collected in Italy by the first author, reared from mature larvae and pupae collected together with infested flower heads. Flower heads were detached from their stems and placed in net bags at room temperature to allow the insects to complete their development. An in-field pre-screening of positive samples involved sectioning of the inflorescences and inspection for the presence of larvae or pupae. Adults of *Eurasimona stigma* (Loew, 1840) were collected with a mouth aspirator while resting on their host plant.

The species were identified using the keys of White (1988) and Merz (1994). The nomenclature follows Norrbom et al. (1999). Host plants were determined using the Italian botanical keys in Pignatti (1982); when necessary, identifications were confirmed by a specialist.

All voucher specimens (Figs 1, 2) are deposited in the fruit fly collection of the Laboratory of Entomology of the Department of Agronomy, Food, Natural Resources, Animals and Environment, University of Padua, Italy (UPI).

Taxon treatments

Eurasimona stigma (Loew, 1840)

Material

- a. scientificName: *Eurasimona stigma* (Loew, 1840); higherClassification: Subfamily Tephritinae, Tribe Myopitini; genus: *Eurasimona*; specificEpithet: *stigma*; scientificNameAuthorship: (Loew, 1840); continent: Europe; country: Italy; countryCode: I; stateProvince: Veneto Region; county: Padova Province; locality: Euganean Hills; verbatimElevation: 250 m; verbatimCoordinates: 45°19'16.08"N 11°42'20.06"E; decimalLatitude: 45.3211; decimalLongitude: 11.7055; georeferenceSources: Google Maps; samplingProtocol: mouth aspirator; eventDate: 14/06/2006; habitat: edge of forest, on *Achillea* flowers; individualCount: 3; sex: male; lifeStage: adult; preparations: dry; recordedBy: L. Mazzon; identifiedBy: L. Mazzon; dateIdentified: 2006; basisOfRecord: PreservedSpecimen; occurrenceID: 849BED38-2D8E-56FB-B8E8-D29D72E199BE

Distribution

Austria, Czechia, Estonia, Germany, Finland, France, Hungary, Latvia, Lithuania, North Macedonia, Moldova, Slovakia, Sweden, Ukraine (Korneyev and White 1991, Merz and Korneyev 2011); Russia, east to southern Siberia (Krasnoyarsk); Kazakhstan; Turkmenistan; Uzbekistan; Kyrgyzstan (Korneyev and White 1991); Iran (Zarghani et al. 2016). The species (Fig. 1a) is here recorded as **new to Italy**.

Biology

The biology of *E. stigma* is poorly known. The flies are said to have been reared from *Leucanthemum vulgare* Lam. (Roser 1840, as “*Chrysanthemum leucanthemum*”), *Achillea millefolium* L. (Loew 1862: 68), *Anthemis arvensis* L. (Korneyev et al. 2005; forming small non-lignified galls in a single flower head), *A. cotula* L. (Hendel 1927) and *Tanacetum vulgare* L. (Merz 1994), but there are no comprehensive rearing data or descriptions of its biology.

Inuromaesa maura (Frauenfeld, 1857)

Material

- a. scientificName: *Inuromaesa maura* (Frauenfeld, 1857); higherClassification: Subfamily Tephritinae, Tribe Myopitini; genus: *Inuromaesa*; specificEpithet: *maura*; scientificNameAuthorship: (Frauenfeld, 1857); continent: Europe; country: Italy; countryCode: I; stateProvince: Friuli-Venezia Giulia Region; county: Pordenone Province; locality: Montereale Val Cellina; verbatimElevation: 1100 m; verbatimCoordinates: 46°10'00.0"N 12°36'00.0"E; decimalLatitude: 46.1668; decimalLongitude: 12.6000; georeferenceSources: Google Maps; samplingProtocol: from flower heads of *Inula hirta*; eventDate: 25/06/2005; habitat: edge of forest; individualCount: 5; sex: 4 males and 1 female; lifeStage: adult, reared from immature stages; preparations: dry whole insect; recordedBy: L. Mazzon; identifiedBy: L. Mazzon; dateIdentified: 2005; basisOfRecord: PreservedSpecimen; occurrenceID: FA7442B1-0EA2-50EA-B0D5-39CBB3375578

Distribution

Austria, Czechia, central and southern France, Hungary, Italy, Slovakia, northern Spain, Switzerland and Ukraine (Merz and Korneyev 2011); Russia: West Siberia; Kazakhstan (Korneyev and White 1999); Iran (Zarghani et al. 2016). Note: the present records from Italy (Fig. 1b) confirm the country-level record by Merz and Korneyev (2011).

Biology

The larvae develop in the achenes of *Pentanema hirtum* (L.) D.Gut.Larr. et al. (= *Inula hirta*), *Pentanema oculus-christi* (L.) D.Gut.Larr. et al. (= *Inula oculus-christi*) (Frauenfeld 1857), *Pentanema montanum* (L.) D.Gut.Larr. et al. (= *Inula montana*) (Anonymous 1934), *Pentanema ensifolium* (L.) D.Gut.Larr. et al. (= *Inula ensifolia*) (Mihalyi 1960, Korneyev and White 1991) and *Pentanema salicinum* (L.) D.Gut.Larr. et al. (= *Inula salicina*) (Richter 1988), forming no obvious galls.

Urophora cuspidata (Meigen, 1826)

Materials

- a. scientificName: *Urophora cuspidata* (Meigen, 1826); higherClassification: Subfamily Tephritinae, Tribe Myopitini; genus: *Urophora*; specificEpithet: *cuspidata*; scientificNameAuthorship: (Meigen, 1826); continent: Europe; country: Italy; countryCode: I; stateProvince: Friuli-Venezia Giulia Region; county: Pordenone Province; municipality: Fanna; locality: Via Vals; verbatimElevation: 320 m; verbatimCoordinates: 46°11'6.43"N 12°43'55.33"E; decimalLatitude: 46.1851; decimalLongitude: 12.7320; georeferenceSources: Google Maps; samplingProtocol: reared from flower heads of *Centaurea scabiosa*; eventDate: 15/07/2006; habitat: grassland; individualCount: 2; sex: 1 male and 1 female; lifeStage: adult; preparations: dry whole insect; recordedBy: V. Girolami; dateIdentified: 2007; basisOfRecord: PreservedSpecimen; occurrenceID: 6DF3F227-CD2E-518E-A9BF-D7160E4C3A1A
- b. scientificName: *Urophora cuspidata* (Meigen, 1826); higherClassification: Subfamily Tephritinae, Tribe Myopitini; genus: *Urophora*; specificEpithet: *cuspidata*; scientificNameAuthorship: (Meigen, 1826); continent: Europe; country: Italy; countryCode: I; stateProvince: Friuli-Venezia Giulia Region; county: Pordenone Province; municipality: Fanna; locality: Via Vals; verbatimElevation: 320 m; verbatimCoordinates: 46°11'6.43"N 12°43'55.33"E; decimalLatitude: 46.1851; decimalLongitude: 12.7320; georeferenceSources: Google Maps; samplingProtocol: reared from flower heads of *Centaurea scabiosa*; eventDate: 26/06/2007; habitat: grassland; individualCount: 2; sex: 2 females; preparations: dry whole insect; recordedBy: V. Girolami; dateIdentified: 2007; basisOfRecord: PreservedSpecimen; occurrenceID: 40C0627A-BB57-520C-9704-8AC44A3E5BA0

Distribution

Northern, central and eastern Europe from northern Spain, southern France and Italy (Merz 1994, Merz and Korneyev 2011) to Ukraine, European and Asian Russia and Kazakhstan (Korneyev and White 1996); Iran (Mohamadzade Namin and Nozari 2011). Notes: the present records from Italy (Fig. 1c) confirm the country-level record by Merz and Korneyev (2011). The record from Turkey by Kütük et al. (2013) needs confirmation.

Biology

The larvae develop in flower heads of *Centaurea scabiosa* L. (incl. ssp. *alpestris*) and *Ce. collina* L. (White and Korneyev 1989); records of other host species, including "*Ce. tenuifolia*" (Merz 1994) need confirmation.

Noeeta bisetosa Merz, 1992

Material

- a. scientificName: *Noeeta bisetosa* Merz, 1992; higherClassification: Subfamily Tephritinae, Tribe Noetini; genus: *Noeeta*; specificEpithet: *bisetosa*; scientificNameAuthorship: Merz,

1992; continent: Europe; country: Italy; countryCode: I; stateProvince: Friuli-Venezia Giulia Region; county: Pordenone Province; municipality: Fanna; locality: Val Cellina; verbatimElevation: 290 m; verbatimCoordinates: 46°10'11.8"N 12°40'02.7"E; decimalLatitude: 46.1699; decimalLongitude: 12.6674; georeferenceSources: Google Maps; samplingProtocol: reared from flower heads of *Hieracium piloselloides*; eventDate: 10/07/2006; habitat: gravel streambed; individualCount: 16; sex: 9 males and 7 females; lifeStage: adult; preparations: dry whole insect; recordedBy: V. Girolami; identifiedBy: L. Mazzon; dateIdentified: 2006; basisOfRecord: PreservedSpecimen; occurrenceID: 730D4E5F-1F4A-5FF2-BD0F-35EBF13ED5F2

Distribution

Austria (Merz and Kofler 2008), Hungary (Merz 2000), Russia (Basov 1999), Switzerland (Merz 1992) and Ukraine (Korneyev 2003). The species (Fig. 2a) is here recorded as **new to Italy**.

Biology

The larvae feed in flower heads of *Hieracium piloselloides* Vill. (Merz 1992).

Campiglossa doronici (Loew, 1856)

Material

- a. scientificName: *Campiglossa doronici* (Loew, 1856); higherClassification: Subfamily Tephritinae, Tribe Tephritini; genus: *Campiglossa*; specificEpithet: *doronici*; scientificNameAuthorship: (Loew, 1856); continent: Europe; country: Italy; countryCode: I; stateProvince: Veneto Region; county: Vicenza Province; locality: Monte Cengio; verbatimElevation: 1320 m; verbatimCoordinates: 45°48'40.10"N 11°23'39.36"E; decimalLatitude: 45.8111; decimalLongitude: 11.3943; georeferenceSources: Google Maps; samplingProtocol: reared from flower heads of *Doronicum austriacum*; eventDate: 02/07/2005; habitat: edge of forest; individualCount: 20; sex: 11 males and 9 females; lifeStage: adult; preparations: dry whole insect; recordedBy: L. Mazzon; identifiedBy: L. Mazzon; dateIdentified: 2005; basisOfRecord: PreservedSpecimen; occurrenceID: 41045D5F-F462-56E9-B2A3-E77993206ED2

Distribution

Austria, Czechia, France, Poland, Romania, Slovakia and Ukraine (Merz and Korneyev 2011). The species (Fig. 2b) is here recorded as **new to Italy**.

Biology

The larvae feed in flower heads of *Doronicum austriacum* Jacq. (Loew 1856).

Tephritis conyzifoliae Merz, 1992

Material

- a. scientificName: *Tephritis conyzifoliae* Merz, 1992; higherClassification: Subfamily Tephritinae, Tribe Tephritini; genus: *Tephritis*; specificEpithet: *conyzifoliae*; scientificNameAuthorship: Merz, 1992; continent: Europe; country: Italy; countryCode: I; stateProvince: Trentino-Alto Adige Region; county: Trento Province; municipality: Moena; locality: San Pellegrino Pass; verbatimElevation: 1925 m; verbatimCoordinates: 46°22'48.0"N 11°47'37.0"E; decimalLatitude: 46.3800; decimalLongitude: 11.7936; georeferenceSources: Google Maps; samplingProtocol: reared from flower heads of *Crepis conyzifolia*; eventDate: 28/07/2008; habitat: pasture; individualCount: 17; sex: 8 males and 9 females; lifeStage: adult; preparations: dry whole insect; recordedBy: L. Mazzon; identifiedBy: L. Mazzon; dateIdentified: 2008; basisOfRecord: PreservedSpecimen; occurrenceID: DE05CB66-0E5E-5962-8056-ABABDA7316AD

Distribution

Armenia (Evstigneev and Glukhova 2020), Czechia, France, Italy, Switzerland (Merz and Korneyev 2011), Russia (Evstigneev 2016), Kazakhstan, Kyrgyzstan (Korneyev 2016a), Poland (Klasa and Palaczyk 2005), Tajikistan (Korneyev and Korneyev 2019) and Ukraine (Korneyev and Klasa 2016). Note: the present records from Italy (Fig. 2c) confirm the country-level record by Merz and Korneyev (2011).

Biology

The larvae develop in flower heads of *Crepis conyzifolia* (Gouan) A. Kern. (Merz 1992), *Cr. sibirica* L. (Shcherbakov 2001, Korneyev 2016a), *Cr. pannonica* (Jacq.) K. Koch (Evstigneev 2016) and *Cr. ciliata* K. Koch (Evstigneev and Glukhova 2020).

Notes

This species was recorded from continental Italy by Merz and Korneyev (2011), without further collection data. Korneyev (2016a) treated *T. conyzifoliae* as a senior synonym of *Tephritis academica* Bassov and Tolstoguzova, 1994, *T. nartshukovi* Bassov and Tolstoguzova, 1994 and *T. epicrepis* Scherbakov, 2001, all described from Russia.

Tephritis mutabilis Merz, 1992

Material

- a. scientificName: *Tephritis mutabilis* Merz, 1992; higherClassification: Subfamily Tephritinae, Tribe Tephritini; genus: *Tephritis*; specificEpithet: *mutabilis*; scientificNameAuthorship: Merz, 1992; continent: Europe; country: Italy; countryCode: I; stateProvince: Friuli-Venezia Giulia Region; county: Pordenone Province; municipality: Fanna; verbatimElevation: 280 m; verbatimCoordinates: 46°11'12.3"N 12°44'39.7"E;

decimalLatitude: 46.1867; decimalLongitude: 12.7444; georeferenceSources: Google Maps; samplingProtocol: reared from flower heads of *Leontodon hispidus*; eventDate: 28/05/2007; habitat: grassland; individualCount: 3; sex: 1 males and 2 females; lifeStage: adult; preparations: dry whole insect; recordedBy: V. Girolami; identifiedBy: L. Mazzon; dateIdentified: 2007; basisOfRecord: PreservedSpecimen; occurrenceID: 03004E35-5BF0-55F9-8D5A-AA46FEFCB977

Distribution

Central Europe (Austria, Czechia, France, Germany, Italy, Poland, Slovakia, Switzerland) (Merz and Korneyev 2011), Finland (Kahanpää and Winqvist 2014), Russia (Korneyev 2016b) and Ukraine (Korneyev and Klasa 2016). Note: the present records from Italy (Fig. 2d) confirm the country-level record by Merz and Korneyev 2011.

Biology

The larvae feed in flower heads of *Leontodon hispidus* L. (Merz 1992, Merz 1994).

Xyphosia laticauda (Meigen, 1826)

Materials

- a. scientificName: *Xyphosia laticauda* (Meigen, 1826); higherClassification: Subfamily Tephritinae, Tribe Xyphosiini; genus: *Xyphosia*; specificEpithet: *laticauda*; scientificNameAuthorship: (Meigen, 1826); continent: Europe; country: Italy; countryCode: I; stateProvince: Friuli-Venezia Giulia Region; county: Pordenone Province; municipality: Maniago; locality: Colvera; verbatimElevation: 210 m; verbatimCoordinates: 46°10'11.11"N, 12°44'16.48"E; decimalLatitude: 46.1698; decimalLongitude: 12.7379; georeferenceSources: Google Maps; samplingProtocol: reared from flower heads of *Centaurea triumfettii*; eventDate: 10/07/2006; habitat: gravel streambed; individualCount: 1; sex: male; lifeStage: adult; preparations: dry whole insect; recordedBy: V. Girolami; identifiedBy: L. Mazzon; dateIdentified: 2006; basisOfRecord: PreservedSpecimen; occurrenceID: 1ED6AF25-030E-5FDB-99EE-7703099B6EEC
- b. scientificName: *Xyphosia laticauda* (Meigen, 1826); higherClassification: Subfamily Tephritinae, Tribe Xyphosiini; genus: *Xyphosia*; specificEpithet: *laticauda*; scientificNameAuthorship: (Meigen, 1826); continent: Europe; country: Italy; countryCode: I; stateProvince: Friuli-Venezia Giulia Region; county: Pordenone Province; municipality: Cavasso Nuovo; locality: Meduna; verbatimElevation: 147 m; verbatimCoordinates: 46°12'41.0"N 12°46'38.9"E; decimalLatitude: 46.2114; decimalLongitude: 12.7775; georeferenceSources: Google Maps; samplingProtocol: reared from flower heads of *Centaurea triumfettii*; eventDate: 07/07/2006; habitat: gravel streambed ; individualCount: 1; sex: male; lifeStage: adult; preparations: dry whole insect; recordedBy: V. Girolami; identifiedBy: L. Mazzon; dateIdentified: 2006; basisOfRecord: PreservedSpecimen; occurrenceID: 5B9A226B-93D2-5661-8BFF-B169C9D97A47

Distribution

Austria, France, Hungary, Switzerland (Merz and Korneyev 2011); Armenia (Korneyev 1983); Russian North Caucasus (Korneyev and Korneyev, unpublished data). The species (Fig. 2e) is here recorded as **new to Italy**.

Biology

The larvae develop in flower heads of *Centaurea montana* L. (Frauenfeld 1857); this species is superficially similar to *Centaurea triumfettii* All.; either both species are infested by this species or misidentifications have occurred.

Rhagoletis berberidis Jermy, 1961

Material

- a. scientificName: *Rhagoletis berberidis* Jermy, 1961; higherClassification: Subfamily Trypetinae, Tribe Carpomyini; genus: *Rhagoletis*; specificEpithet: *berberidis*; scientificNameAuthorship: Jermy, 1961; continent: Europe; country: Italy; countryCode: I; stateProvince: Friuli-Venezia Giulia Region; county: Pordenone Province; municipality: Claut; verbatimElevation: 675 m; verbatimCoordinates: 46°16'6.14"N, 12°31'39.23"E; decimalLatitude: 46.2684; decimalLongitude: 12.5276; georeferenceSources: Google Maps; samplingProtocol: reared from fruits of *Berberis vulgaris*; eventDate: 15/08/2008; habitat: edge of forest; individualCount: 2; sex: males; lifeStage: adult; preparations: dry whole insect; recordedBy: V. Girolami; identifiedBy: L. Mazzon; dateIdentified: 2009; basisOfRecord: PreservedSpecimen; occurrenceID: 0E9D0BB2-3A55-51DC-AA25-511FD34142A4

Distribution

Austria, Hungary, Slovakia, Switzerland, Ukraine (Merz and Korneyev 2011); Russian North Caucasus (Kandybina 1977), Turkey (Kütük and Özaslan 2006) and Iran (Mohamadzade Namin et al. 2010). The species (Fig. 2f) is here recorded as **new to Italy**.

Biology

The larvae develop in seeds of *Berberis vulgaris* L. (Jermy 1961, Merz 1994).

Discussion

Based on the present results and on a recent revision of the fauna, the revised checklist of Italian Tephritidae (Mazzon and Korneyev, in press) includes 151 extant and two fossil species.

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Author contributions

LM: collection and identification of the species, curation of specimens for permanent storage, preparation of the manuscript and photographs; DW: writing, reviewing and editing of manuscript; PC: reviewing and editing of manuscript; VAK: validation of fruit fly identifications, data curation, writing, reviewing and editing of manuscript.

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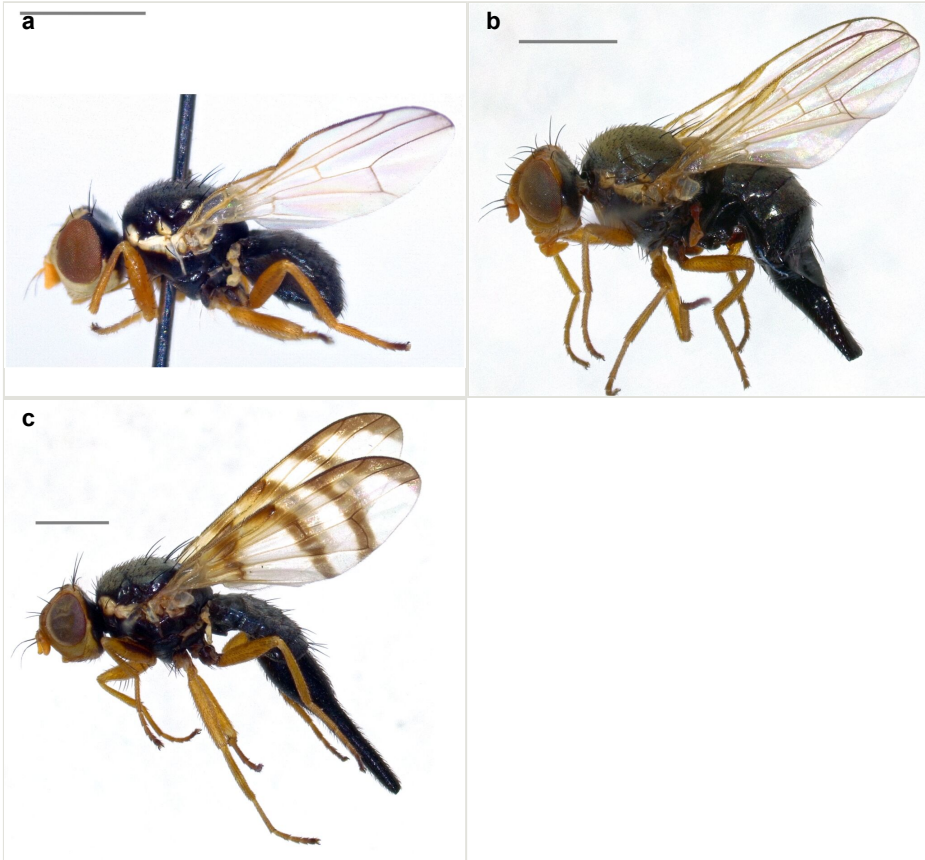


Figure 1.

Habitus images of Tephritidae (Tephritinae, Myopitini) treated in this paper. Scale bars: 1.0 mm.

a: *Eurasimona stigma* (Loew, 1840)

b: *Inuromaesa maura* (Frauenfeld, 1857)

c: *Urophora cuspidata* (Meigen, 1826)

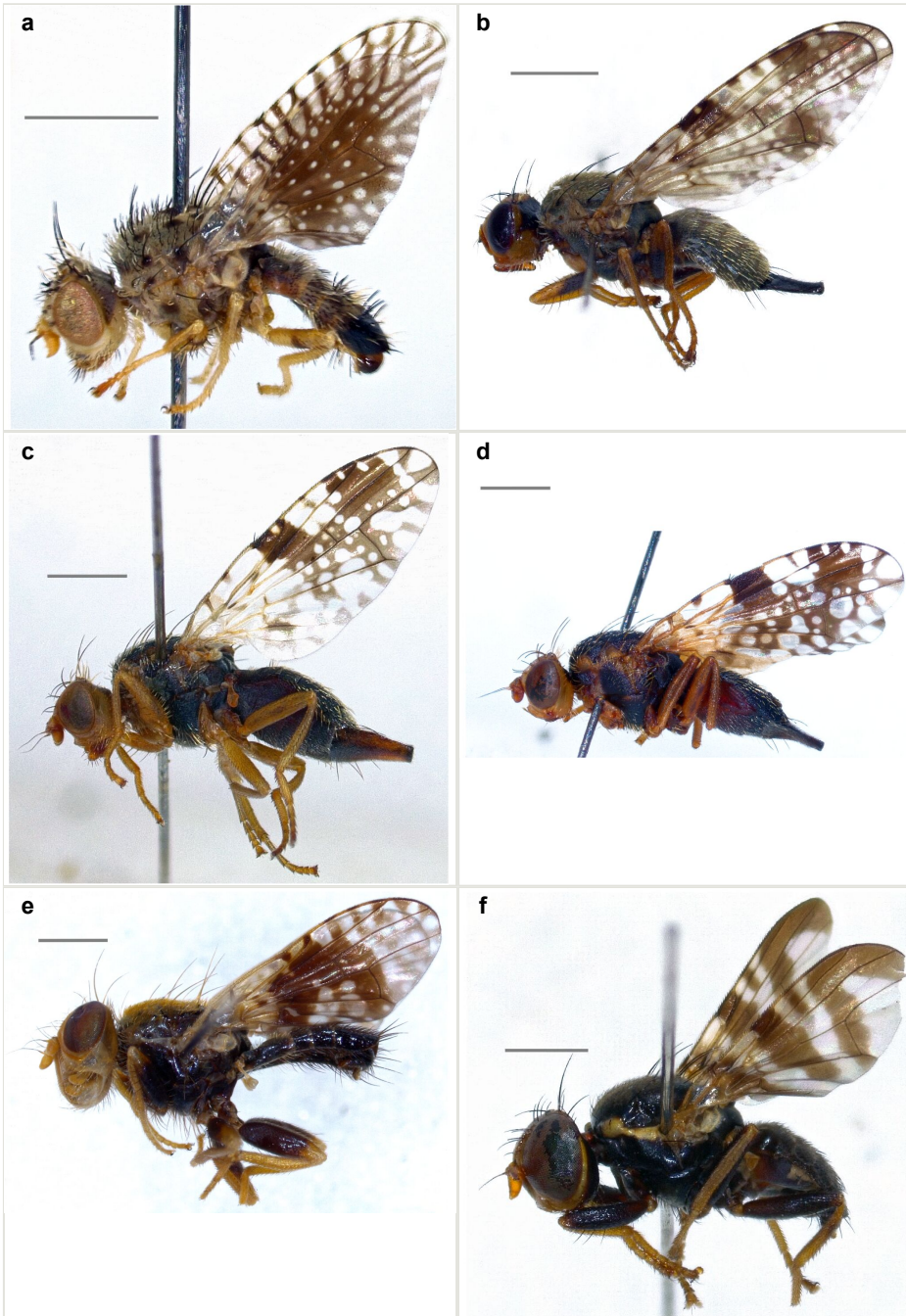


Figure 2.

Habitus images of Tephritidae treated in this paper. a. Tephritinae, Noetini; b-d Tephritinae, Tephritini; e. Tephritinae, Xyphosiini; f. Trypetinae, Carpomyini. Scale bars: 1.0 mm.

- a: *Noeeta bisetosa* Merz, 1992
- b: *Campiglossa daronici* (Loew, 1856)
- c: *Tephritis conyzifoliae* Merz, 1992
- d: *Tephritis mutabilis* Merz, 1992
- e: *Xyphosia laticauda* (Meigen, 1826)
- f: *Rhagoletis berberidis* Jermy, 1961