Contribution to the knowledge of thick-headed flies (Diptera; Conopidae) of Iran II: Myopinae, Sicinae & Zodioninae

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Abstract. Faunistic data for 12 species in the subfamilies Myopinae, Sicinae and Zodioninae of the family Conopidae in Iran are provided. The specimens were collected from Qaradagh Forests (located in East Azerbaijan province, northwest of Iran) during 2009-2013. The following species are recorded for the first time in Iran include Myopa gregata (Linnaeus, 1758), Myopa pellucida (Robineau-Desvoidy, 1830), Myopa picta Panzer, 1798, Thecophora atra (Fabricius, 1775), Thecophora cinerascens Meigen, 1804 and Thecophora fulvipes (Robineau-Desvoidy, 1830). The genus Sicus Rambur, 1834 is also recorded for the first time but cannot currently be identified to species. A list of the genera and species is provided along with notes on diagnostic characters, geographical distribution, and supplementary figures of the studied species.

Key words: Conopidae, Northwest of Iran, Qaradagh forests, new records.

Introduction

The thick-headed flies (Diptera, Conopidae) are distributed worldwide and include more than 800 valid species currently organized in six subfamilies and about 56 genera (Gibson & Skevington 2013). Phylogenetic analyses suggest there are at least five monophyletic subfamilies of Conopidae, comprising Conopinae, Dalmanniinae, Myopinae, Stylogastrinae and Zodioninae (Gibson & Skevington 2013). Gibson et al. (2012) recently erected the subfamily Sicinae, based on the tribe Sicini of the Myopinae, and Schneider (2010) also erected the subfamily Notoconopinae to contain a single anomalous Australian species. Stylogastrinae are sometimes regarded as a separate family (Gibson et al. 2012, Gibson & Skevington 2013). Adult conopids typically feed on pollen and nectar, and often strikingly resemble wasps or bees (Hymenoptera, Apoidea), or flies of the family Syrphidae (Diptera). Larvae of the known species are all obligate endoparasitoids of aculeate Hymenoptera except in the Stylogastrinae, which parasitize crickets (Orthoptera) and cockroaches (Dictyoptera). The members of the family Conopidae may have an important deleterious effect on populations of hymenopteran pollinators, and can be considered as one of the most important economic and ecological impacts on them (Freeman 1966, Mei 1999).

Gibson et al. (2012) proposed the new tribe Thecophorini within the family. Based on their study the Myopinae now includes two tribes: Myopini (include Melanosoma Robineau-Desvoidy, 1853, Myopa Fabricius, 1775, Myopotta Zimina, 1969, Paramyopa Kröber, 1916 and Pseudomyopa Pearson, 1974) and Thecophorini (include Pseudomyopa Camras, 1962, Scatocemyia Camras, 1957, Thecophora Rondani, 1845). The Myopinae are distinguished from other subfamilies by the following characters given by Gibson et al. (2012): basisternum short, narrow, single sclerite; veins Sc and R1 fused before reaching costa; double row of black spines present on the ventral surface of all femora. The subfamily Sicinae include the genera Carbonosicosa Zimina, 1958 and Sicus Scopoli, 1763, and are distinguished from other subfamilies by the following combination of characters: male sternite 8 with dense, long, black setae, and secondary reversal to the reduced posterolateral extensions of the basisternum. The subfamily Zodioninae currently contains four genera: Para-zodion Kröber, 1927, Robertsonomyia Malloch, 1919, Zodionina Camras, 1957 and Zodon Latreille, 1797, differing from other subfamilies in having: short, broad labela, elongate prementum; shape of the basisternum; presence of shiny patches near the apex of the tibia; extended vein R1, unfused veins Sc and R1; presence of crossvein sc-r; ending of vein R2+3 near the end of vein R1; curved vein CuA2; male cerci attached by a narrow, sclerotized stalk. Chvála (1965) revised the central European species of the subfamilies Myopinae and Dalmanniinae. Chvála & Smith (1988) prepared the Palaeaeartic catalogue of this family. Smith (1975, 1980) also prepared catalogues for the adjacent Oriental and Afrotropical regions, as well as a treatment of the British fauna (Smith 1969). Camras (2000) has described numerous genera, subgenera and species worldwide in over 40 publications. Stuke (2003, 2004, 2005, 2008, 2009) has made many contributions to the knowledge of the family in the region through many new descriptions and revisions of the species, and has also provided many regional faunal lists. Stuke (2006) provided a key to the females of European species of the Thecophora atra species-group. Mei & Stuke (2006) revised the European species of Zodon Latreille, 1796. Stuke & Clements (2008) revised the Myopa testacea species-group in the Palaeaeartic region. Clements (2000 a, b), Clements & Tofts (2000) and Clements & Vincent (2001) treated various synonyms. Gibson & Skevington (2013) studied the phylogeny and taxonomy of all the known genera of Conopidae based on morphological data. Stuke et al. (2008) has previously reported Zodon cinereum (Fabricius) from Iran and recently Khaghaninia and Kazerani (2014) reported Conops longiventris Kröber, 1916 and Physocephala laticincta (Brulle, 1833) from Iran but otherwise the conopid fauna of the country is only poorly known to date. For comparison, about 39 species are known from Turkey (Stuke et al. 2008). The main aims of the present work are therefore a contribution and discussion on the zoogeography of the Iranian conopid fauna.

Materials and methods

Specimens were collected by means of hand-netting from the Qaradagh Forests located in the East Azerbaijan province, northwest
of Iran, during 2009–2013. The specimens were pinned using 0 and 1 standard pins and then card-mounted and labelled. In order to prepare the male genitalia, the end of abdomen was removed and boiled in 10 % KOH solution for 45–60 seconds and then was placed in acetic acid for 10–20 seconds, being afterwards washed in distilled water and stored in 0.5 ml microvials of glycerin. Morphological terminology follows Chalva (1996), Stuke (2008), Mei & Stuke (2008) and Stuke & Clements (2008). All specimens are deposited in the Insect Museum of Tabriz University (IMTU).

The following information is given for the studied specimens: number of males: ♂, number of females: ♀, administrative district (specific locality), geographical coordinates, altitude, date and collector. The general distribution for each species is mainly taken from Pape & Thompson (2011).

Results

In total 12 species belonging to five genera were identified, of which six species are newly recorded from Iran: Myopa buccata (Linnaeus, 1758); Myopa pellucida (Robineau-Desvoidy, 1830); Myopa picta Panzer, 1798; Thecophora atra (Fabricius, 1775); Thecophora cinerascens Meigen, 1804 and Thecophora fulvipes (Robineau-Desvoidy, 1830). We also give a first record of the genus Sicus Ratrèille, 1795 in Iran. The species are listed alphabetically within genera.

Subfamily: Myopinae Macquart, 1834
Type genus: Myopa Fabricius, 1775

Melanosoma bicolor (Meigen, 1824)
Material examined: Iran, East Azerbaijan, Chichakli (located in west part of Qaradagh Forests), 38° 50.45' N, 46° 34.30' E, 1689m, 07.vi.2012, 1 ♂; leg. S. Khaghaninia.

Distribution: Europe, Africa, Turkey, Iran.

Diagnostic characters: Antenna yellow, 3rd segment black at tip, arista fine (Fig. 3); legs black (Fig. 2); wing with anterior part darkened. Male abdomen: posterior margin of 1st tergite red, 2nd tergite entirely reddish yellow, tergites 3-6 black (Fig. 1).

Myopa buccata (Linnaeus, 1758)
Material examined: Iran, East Azerbaijan, Aynali region (located just west of Qaradagh Forests), 38°42.74' N, 46° 54.36' E, 1613 m, 3.viii.2010, 1 ♂, 2 ♀; leg. S. Khaghaninia.

Distribution: Europe, Asia: New to the Iranian insect fauna.

Diagnostic characters: Head: mouth edge with white hairs (Fig. 6); antenna yellowish brown, scape and pedicel with black hairs (Fig. 6); thorax blackish, scutellum brownish black with black hairs (Fig. 4); wing with a mixture of white and black spots, cross vein at base of cell R whitish (Fig. 5).

Myopa dorsalis Fabricius, 1794
Material examined: Iran, East Azerbaijan, Mekide valley (located in almost the center of Qaradagh Forests), 38°50.86' N, 46° 54.90' E, 1426m, 14.vi.2010, 2 ♂, 3 ♀; leg. S. Khaghaninia.

Distribution: Europe, North Africa to India; Iran.

Diagnostic characters: Mouth edge white, without black stripes (Fig. 9); scutellum reddish (Fig. 7); wing hyaline, without black markings (Fig. 7); abdomen reddish brown, tergites 4 and 5 largely dusted, dustless spots at the front edge semicircular and not well separated (Fig. 10); legs entirely yellowish brown (Fig 8).

Myopa morio Meigen, 1804
Material examined: Iran, East Azerbaijan, Chichakli (located in west part of Qaradagh Forests), 38° 30.34' N, 46° 37.24' E, 1699m, 17.vii.2009, 2 ♂; leg. S. Khaghaninia.

Distribution: Europe, Russia, Turkey, Iran.

Diagnostic characters: Antenna yellow, 3rd segment black at tip, arista fine (Fig. 3); legs black (Fig. 2); wing with anterior part darkened. Male abdomen: posterior margin of 1st tergite red, 2nd tergite entirely reddish yellow, tergites 3-6 black (Fig. 1).

Myopa picta Panzer, 1798
Syn: Myopa meridionalis Macquart, 1835; Myopa varia Wiedemann, 1830.
Material examined: Iran, East Azerbaijan, Osoklu region (located near center of Qaradagh Forests), 38° 51.48' N, 46° 50.456' E, 1667m, 02.viii.2009, 3 ♀; leg. S. Khaghaninia.


Diagnostic characters: Antenna yellow, scape and pedicel with black hairs (Fig. 16); black coloration on disc of mesoscutum does not extend to posterior margin, at least medially (Fig. 15); palp pale orange; cross vein at base of cell R blackish (Fig. 18); legs orange (Fig. 17); tergite 1 dark in anterior part, but with paler orange-brown towards posterior margin (Fig. 15).

Myopa pellucida (Robineau-Desvoidy, 1830)
Material examined: Iran, East Azerbaijan, Oskulu region (located near center of Qaradagh Forests), 38° 51.48' N, 46° 50.456' E, 1667m, 02.viii.2009, 3 ♀; leg. S. Khaghaninia.


Diagnostic characters: Antenna yellow, scape and pedicel with black hairs (Fig. 16); black coloration on disc of mesoscutum does not extend to posterior margin, at least medially (Fig. 15); palp pale orange; cross vein at base of cell R blackish (Fig. 18); legs orange (Fig. 17); tergite 1 dark in anterior part, but with paler orange-brown towards posterior margin (Fig. 15).

Myopa picta Panzer, 1798
Syn: Myopa meridionalis Macquart, 1835; Myopa varia Wiedemann, 1830.
Material examined: Iran, East Azerbaijan, Osoklu region (located near center of Qaradagh Forests), 38° 51.48' N, 46° 50.456' E, 1667m, 02.viii.2009, 3 ♀; leg. S. Khaghaninia.


Diagnostic characters: Antenna yellow, scape and pedicel with black hairs (Fig. 16); black coloration on disc of mesoscutum does not extend to posterior margin, at least medially (Fig. 15); palp pale orange; cross vein at base of cell R blackish (Fig. 18); legs orange (Fig. 17); tergite 1 dark in anterior part, but with paler orange-brown towards posterior margin (Fig. 15).

Myopa picta Panzer, 1798
Syn: Myopa meridionalis Macquart, 1835; Myopa varia Wiedemann, 1830.
Material examined: Iran, East Azerbaijan, Osoklu region (located near center of Qaradagh Forests), 38° 51.48' N, 46° 50.456' E, 1667m, 02.viii.2009, 3 ♀; leg. S. Khaghaninia.


Diagnostic characters: Antenna yellow, scape and pedicel with black hairs (Fig. 16); black coloration on disc of mesoscutum does not extend to posterior margin, at least medially (Fig. 15); palp pale orange; cross vein at base of cell R blackish (Fig. 18); legs orange (Fig. 17); tergite 1 dark in anterior part, but with paler orange-brown towards posterior margin (Fig. 15).

Tribe: Thecophorini Gibson, 2012
Type genus: Thecophora Rondani, 1845
Only females of this genus can currently be identified with any certainty, based on the shape and form of the theca. Males can only be provisionally identified through association with females.

Thecophora atra (Fabricius, 1775)
Material examined: Iran, East Azerbaijan, Mekide valley (located in west part of Qaradagh Forests), 38° 50.86' N, 46° 54.90' E, 1426m, 14.vi.2010, 2 ♀; leg. S. Khaghaninia.

Distribution: Europe, Russia, India; New to the Iranian insect fauna.

Diagnostic characters: 2nd antennal segment longer than the 3rd segment (Fig. 26); thoracic dorsum with two grey lines of dust leaving a single undusted black line in between, on the remainder of the thoracic dorsum hardly any dusting
New records of the subfamilies Myopinae, Sicinae & Zodioninae from Iran


(Fig. 23); femur 3 at most yellowish on its basal half, femur 1 and 2 black to brown, hardly paler on inside (Fig. 24); wing hyaline (Fig. 27); female theca long, narrowed to tip and somewhat pointed, narrow at base in lateral view, bristle field of posterior surface confined to upper fifth, extending narrowly down the theca at the sides, Upper surface brownish (Fig. 25).

Thecophora cinerascens Meigen, 1804
Material examined: Iran, East Azerbaijan, Mekidi valley (located almost in center of Qaradagh Forests), 38°50.86' N, 46°54.90' E, 1426m, 25.vi.2013, 5♀♀, 6♂♂; Chichekli (located in west part of Qaradagh forests): 38°30.342' N, 46°37.243' E, 1689m, 07.vii.2010, 3♀♀, 5♂♂; leg. S. Khaghaninia.

Distribution: Europe, Asia; New to the Iranian insect


New records of the subfamilies Myopinae, Sicinae & Zodioninae from Iran
Diagnostic characters: Lower part of frons pale, upper part and ocellar triangle uniformly black (Fig. 28); antenna black, inner part of pedicel yellow (Fig. 31); wing base: radius only yellowed until just before the branching of veins R1 and R2+3, then black beyond (Fig. 30); legs black, only basal part of femur 3 yellow (Fig. 29); abdomen: tergite 6 usually not or only negligibly dusted medially (Fig. 29), female theca projecting, perpendicular to the sternites, in dorsal view as long as wide and rounded at apex, broad at base in lateral view, bristle field on posterior surface confined to upper quarter, extending about halfway down the theca at the sides (Fig. 29).

Thecophora fulvipes (Robineau-Desvoidy, 1830)

Material examined: Iran, East Azerbaijan, Chichekli (located in west part of Qaradagh Forests), 38°37.102' N, 46° 26.322' E, 1534m, 21 Jul 2012, 1 ♀, 4 ♂; leg. S. Khaghaninia.

Distribution: Europe, Asia. New to the Iranian insect fauna.
Diagnostic characters: Face yellow; antenna long, dark brown, inner side of scape and base of pedicel yellowish (Fig. 35); thorax and abdomen with golden dust (Figs. 32 & 33); wing hyaline, slightly yellowish at the base (Fig. 34); femur 3 yellowish on its basal two thirds, femur 1 and 2 brownish, turning yellowish on their inner side (Fig. 33); thoracic dorsum with two well-marked lines of grey dust and a clear undusted black line between them (Fig. 32), female theca rather similar to T. atra, narrow and pointed, on the upper side brownish (Fig. 33).

Thecophora melanopa Rondani, 1857
Material examined: Iran, East Azerbaijan, Chichakli (located in west part of Qaradagh Forests), 38° 50.340’ N, 46° 37.243’ E, 1689m, 07.vi.2012, 1 ♀♂; leg. S. Khaghaninia.

Distribution: Europe, North Africa, Turkey, Iran, Afghanistan.

Diagnostic characters: Antenna black, lower part of 2nd and 3rd segments yellow (Fig. 39); thoracic dorsum with two black undusted lines in a large field of grey dust (Fig. 36); wing hyaline, slightly yellowish at the base (Fig. 40); all femora blackish (Fig. 37); abdomen black and dusted (Fig. 36); female theca not projecting, normally laying flat on the sternites, short, wide and rounded at tip with brownish upper surface (Fig. 38).

Subfamily: Zodioninae Rondani, 1856
Type genus: Zodion Latreille, 1797

Zodion cinereum (Fabricius, 1794)
Material examined: Iran, East Azerbaijan, Chichakli (located in west part of Qaradagh Forests), 38° 50.340’ N, 46° 37.243’ E, 1689m, 07.vi.2012, 1 ♀♂; leg. S. Khaghaninia.

Distribution: Palaearctic (throughout Europe), India [Uttar Pradesh]; Iran.

Diagnostic characters: Antennae blackish at tip, yellowish at base (Fig. 43); palps dark brown; legs black, distal part of femora and tibia ventrally at the base yellowish (Fig. 42); wing: cell R closed (Fig. 45); abdomen blackish and grey dusted (Fig. 41 & 42); Female: theca broad and short, trapezoidal, with the bristle field broader and less curved (Fig. 44).

Subfamily: Sicinae Zimmer, 1960
Type genus: Sicus Scopoli, 1763

Only females of this genus can currently be identified with any certainty, based on the shape and form of the theca. Males can only be provisionally identified through association with females.

Sicus species.
Material examined: Iran, East Azerbaijan, Oskulu region (located near center of Qaradagh Forests), 38° 53.7a’ N, 46° 48.86’ E, 1859m, 20.viii.2011, 2 ♂♂; leg. S. Khaghaninia.

Distribution: Palaearctic (throughout Europe); Genus new to the Iranian insect fauna.

Diagnostic characters: Antenna yellow (Fig. 46); frons yellow (Fig. 46), face light brown; abdomen light brown, tergite 2 about as long as the combined length of tergites 3 + 4, 4th -5th tergites dusted (Fig. 47).

Note: This specimen is very similar to Sicus ferrugineus (Linnaeus, 1761) but decisive identification is only possible by reference to female characteristics of theca.

Discussion
Among the studied species, the genus Myopa has the greatest species diversity, whilst numerically Zodion cinereum and Thecophora cinerea have the greatest frequencies.

Most of the studied species were collected from forestry areas that have a rich flora which can provide appropriate conditions for the activity of pollinating insects, including aculeate Hymenoptera. Janssens (1955) noted that the cono-pids are not important in biological control and they may be considered pests because of their role on parasitizing adult Hymenoptera, e.g., vespsids, bees and sphedids, which are important pollinator or predator agents. Severin (1937) noted that Zodion fulvifrons is a parasitoid of worker honeybees in South Dakota, and can cause heavy damage to colonies. Schmid-Hempel & Schmid-Hempel (1988) studied parasitic flies as an important stress factor for the ergonomics of their bumblebee hosts, including Myopa bucaata which has larvae which are endoparasitic in bumble bees of the genus Bombus (Smith, 1969).

Stuke et al. (2008) reported 18 species of the subfamilies Myopinae, Sicinae and Zodioninae from Turkey. Stuke & Clemens (2008) stated that the distribution of Myopa bellula in the Middle East includes Afghanistan, Iran, Kirgistan, Turkey and Turkmenistan, and that Myopa testacea was found in Turkey and Afghanistan. In addition, Myopa stigma Meigen 1824 was reported from Turkey and Kazakhstan. Based on these and other results in adjacent countries, it can be concluded that other species of the studied subfamilies may be found in Iran in future, and therefore, further studies will be required in other parts of the country.

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