

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

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Received: 11. February 2014 / Accepted: 30. March 2014 / Available online: 6. July 2014 / Printed: December 2014

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 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). The genus *Sicus* Ratzeille, 1795 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, Dalmaniinae, 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 Myopinae. 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 *Pseudoconops* 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 *Carbonosicus* 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: *Parazodion* Kröber, 1927, *Robertsonomyia* Malloch, 1919, *Zodiomyia* Camras, 1957 and *Zodion* Latreille, 1797, differing from other subfamilies in having: short, broad labella, 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 Dalmaniinae. Chvála & Smith (1988) prepared the Palaearctic 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 (2008) revised the European species of *Zodion* Latreille, 1796. Stuke & Clements (2008) revised the *Myopa testacea* species-group in the Palaearctic 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 *Zodion 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 (2006), 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* Ratzeille, 1795 in Iran. The species are listed alphabetically within genera.

Subfamily: Myopinae Macquart, 1834

Type genus: *Myopa* Fabricius, 1775: 798.

Tribe: Myopini Macquart, 1834

Type genus *Myopa* Fabricius, 1775

Melanosoma bicolor (Meigen, 1824)

Material examined: Iran, East Azerbaijan, Chichekli (located in west part of Qaradagh Forests), 38° 30.34' N, 46° 37.25' E, 1689m, 07.vi.2012, 1♀; leg. S. Khaghaninia.

Distribution: Europe, North 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°50.57' 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, Mekidi valley (located in almost the center of Qaradagh Forests), 38° 50.86' N, 46° 54.90' E, 1426m, 14.vii.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, Chichekli (located in west part of Qaradagh Forests), 38° 30.342' N, 46° 37.234' E, 1689m, 17.vii.2009, 2♂; leg. S. Khaghaninia.

Distribution: Europe, Russia, Turkey, Iran.

Diagnostic characters: Face under eyes hairy, mouth edge white, without black stripes (Fig. 12); scutellum black (Fig. 11); all femora black, tibia 3 yellowish at both ends (Fig. 13); wing hyaline, without black markings, anal cell short (Fig. 14); abdomen blackish with brown edges, and with yellowish dust (Fig. 11).

Myopa pellucida (Robineau-Desvoidy, 1830)

Material examined: Iran, East Azerbaijan, Oskulu region (located near center of Qaradagh Forests), 38° 51.488' N, 46° 50.456' E, 1667m, 02.viii.2009, 3♂; leg. S. Khaghaninia.

Distribution: Europe, North Africa, Afghanistan; New to the Iranian insect fauna.

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, Chichekli (located in west part of Qaradagh Forests), 38° 40.588' N, 46° 31.537' E, 2243m, 4.vi.2011, 3♂♂; leg. S. Khaghaninia.

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

Diagnostic characters: Proboscis very long (Fig. 21); wing with black markings, cross vein at the base of cell R darkened, with additional black patterning on other veins, cell R with isolated blackish spot in the center, and wing generally with black and white patterning (Fig. 22); legs and abdomen with black hairs (Fig. 20); abdomen with silverish dusting (Fig. 19).

Tribe: Thecophorini Gibson, 2012

Type genus: *Thecophora* Rondani, 1845

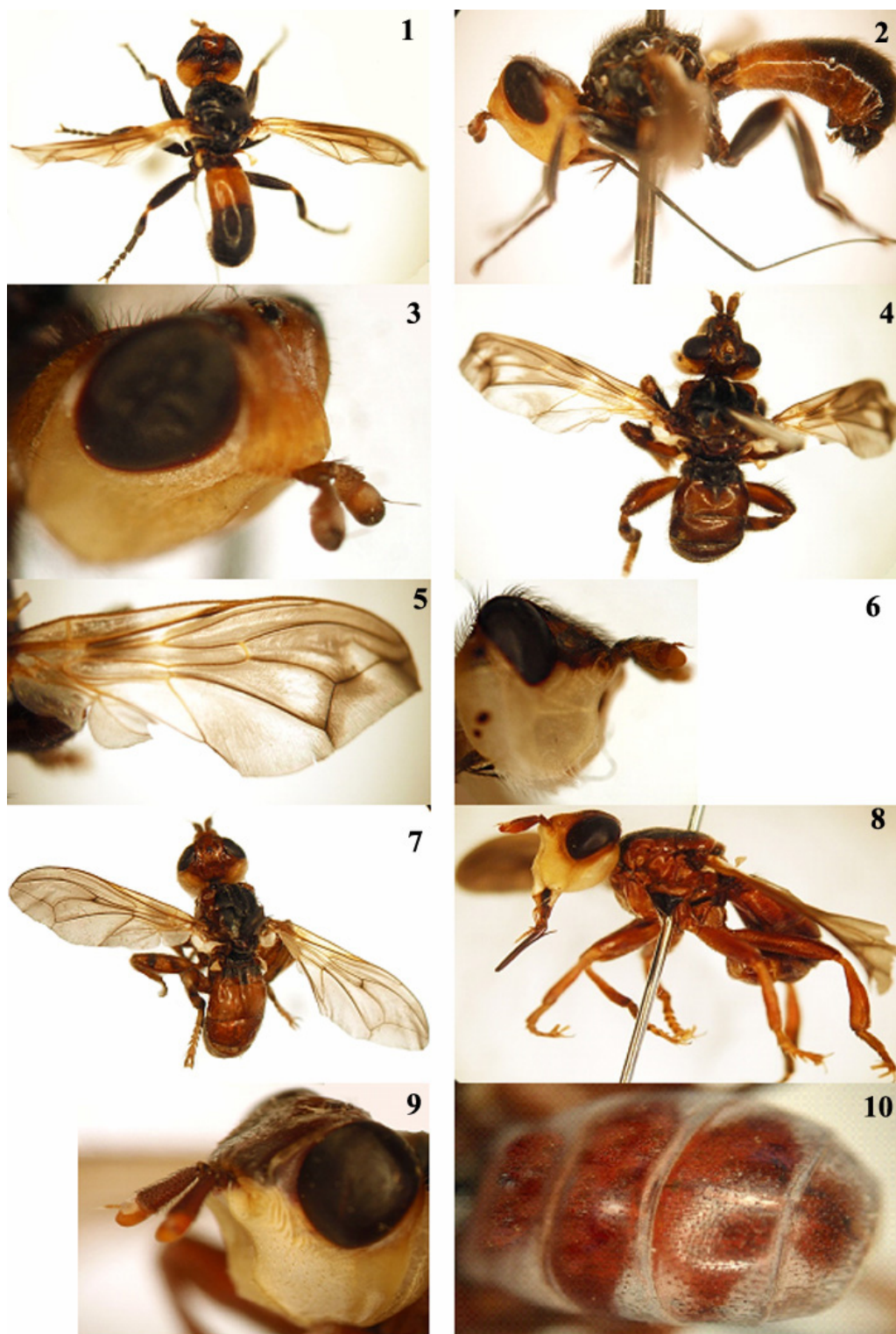
Only females of this genus can currently be identified with any certainty, based on the shape and form of the theca. Males can only be provisionally identified through association with females.

Thecophora atra (Fabricius, 1775)

Material examined: Iran, East Azerbaijan, Mekidi valley (located in almost center of Qaradagh Forests), 38° 50.86N', 46° 54.90E', 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



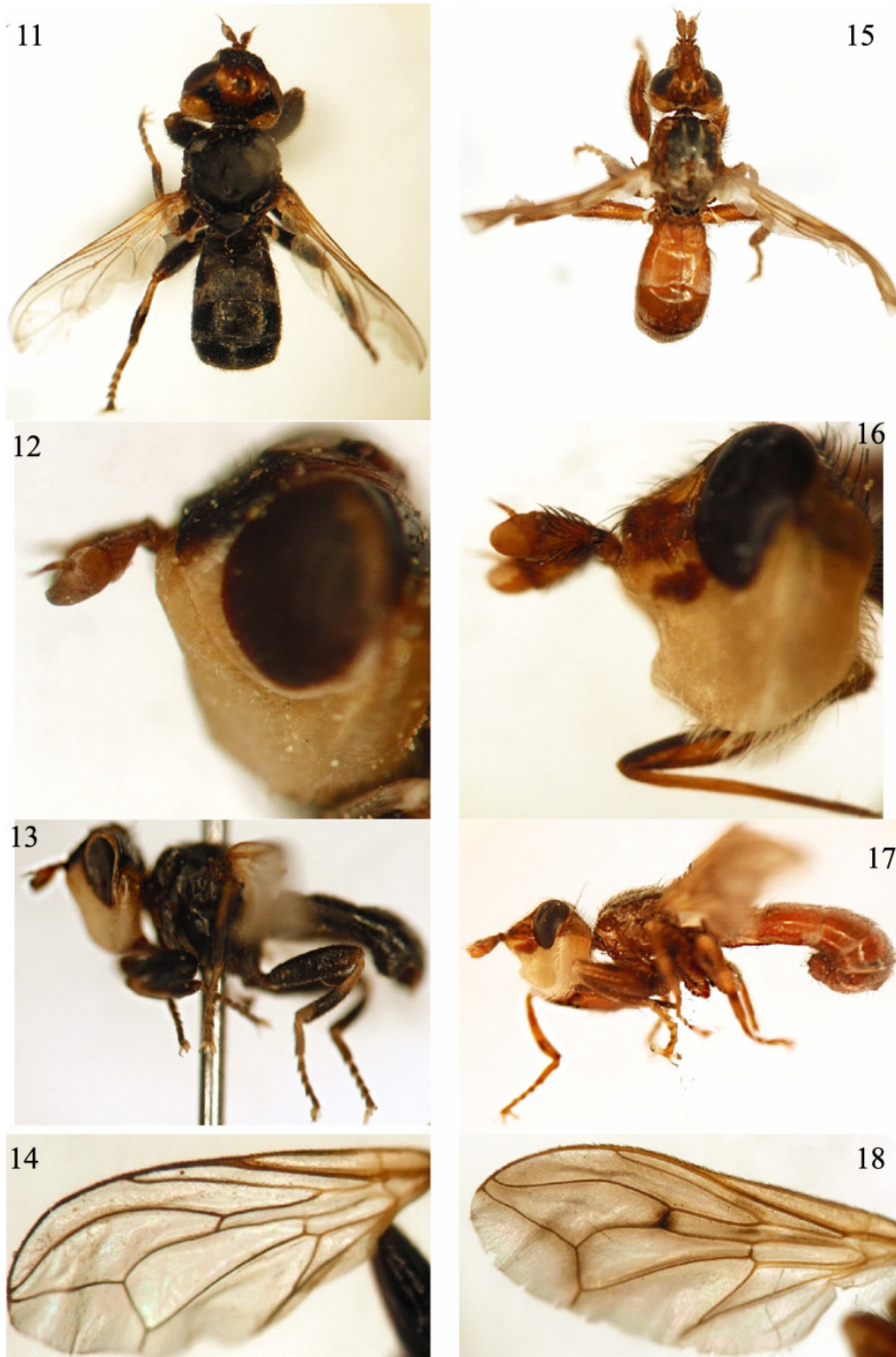
Figures 1-10. 1-3: *Melanosoma bicolor* (Meigen, 1824) (male), 1. Dorsal view, 2. Lateral view, 3. Lateral view of head; 4-6: *Myopa buccata* (Linnaeus, 1758) (male), 4. Dorsal view, 5. Wing, 6. Lateral view of head; 7-10: *Myopa dorsalis* Fabricius, 1794 (male), 7. Dorsal view, 8. lateral view, 9. Lateral view of head, 10. Dorsal view of abdomen.

(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.

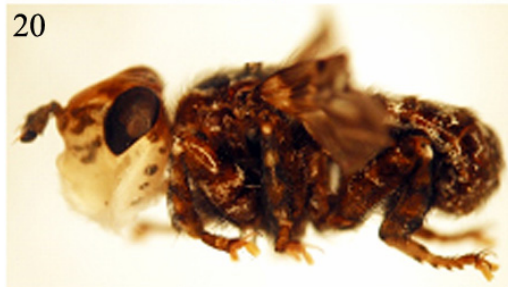
Distribution: Europe, Asia; New to the Iranian insect

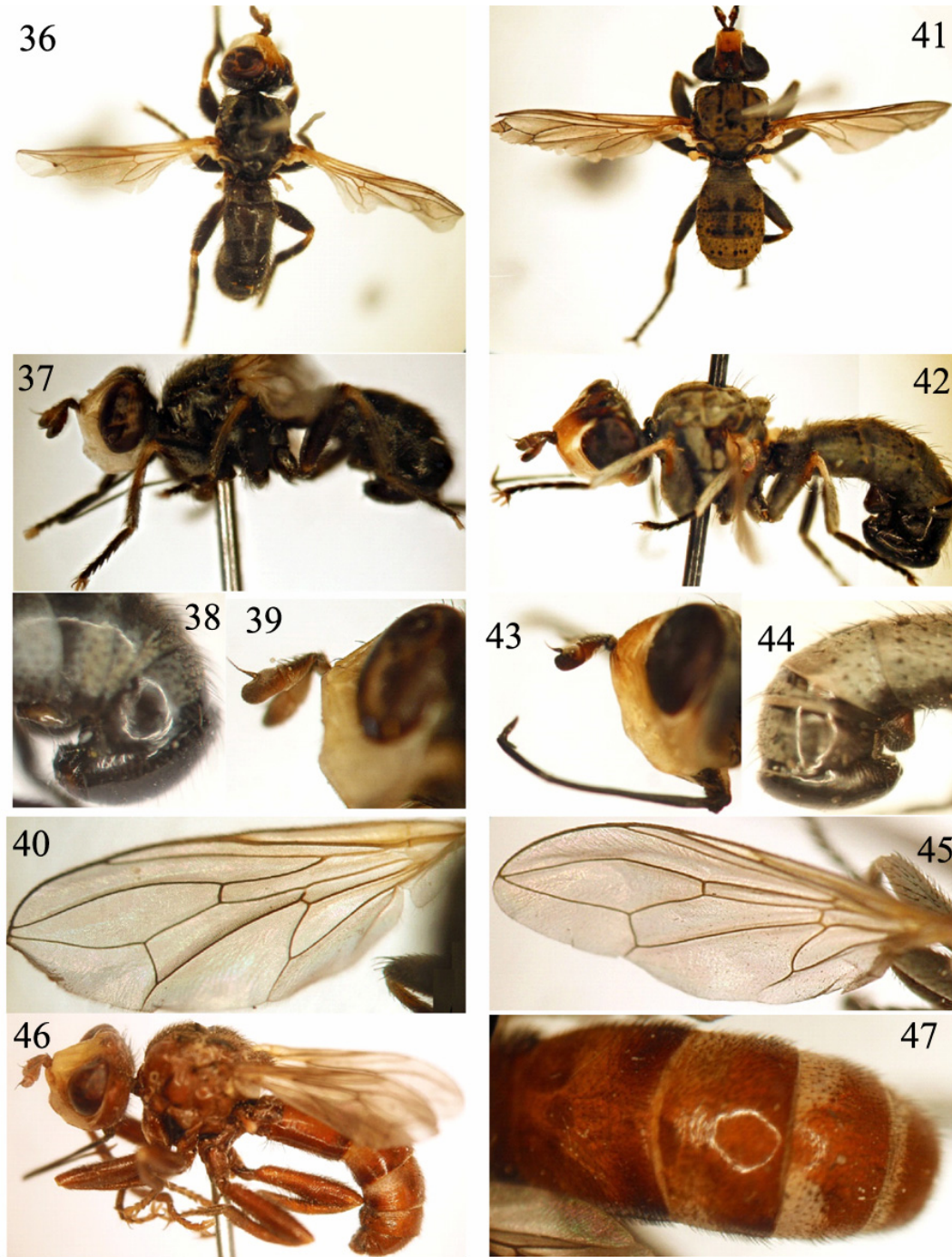


Figures 11-18. 11-14: *Myopa morio* Meigen, 1804, (male), 11. Dorsal view, 12. Lateral view of head, 13. Lateral view, 14. Wing; 15-18: *Myopa pellucida* (Robineau-Desvoidy, 1830), (male), 15. Dorsal view, 16. Lateral view of head, 17. Lateral view, 18. Wing.

Figures 19-27. 19-22: *Myopa picta* Panzer, 1798, (male), 19. Dorsal view, 20. Lateral view, 21. Lateral view of head, 22. Wing; 23-27: *Thecophora atra* (Fabricius, 1775), (female), 23. Dorsal view, 24. Lateral view of head; 25. Lateral view of theca, 26. Lateral view of head, 27. Wing.

Figures 28-35. 28-31: *Thecophora cinerascens* Meigen, 1804, (female), 28. Dorsal view, 29. Lateral view, 30. Wing, 31. Head lateral view; 32-35: *Thecophora fulvipes* (Robineau-Desvoidy, 1830), 32. Dorsal view (male), 33. Lateral view (female), 34. Wing, 35. lateral view of head (female).





Figures 36-47. 36-40: *Thecophora melanopa* Rondani, 1857, (female), 36. dorsal view, 37. lateral view, 38. Lateral view of theca, 39. head lateral view, 40. Wing. 41-45: *Zodion cinereum* (Fabricius, 1794), 41. dorsal view (male), 42. Lateral view (Female), 43. Head lateral view, 44. Lateral view of theca. 45. Wing; 46-47: *Sicus* sp. (male), 46. Dorsolateral view, 47. Dorsal view of abdomen.

fauna.

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, Chichekli (located in west part of Qaradagh Forests), 38° 30.342' 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, Chichekli (located in west part of Qaradagh Forests): 38° 30.34' N, 46° 37.24' E, 1689m, 07.vii.2013, 4♀♀; Oskulu region (located near center of Qaradagh Forests): 38° 53.736' N, 46° 48.860' E, 1859m, 20.viii.2011, 2♀♀, 3♂♂; 38° 53.467' N, 46° 48.198' E, 1355m, 05.vii.2012, 2♀♀, 5♂♂; Aynali region (located just west of Qaradagh Forests): 38° 57.194' N, 46° 43.456' E, 782m, 14.vii.2010, 3♀♀, 4♂♂; 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 Zimina, 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 cinerascens* 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 conopids are not important in biological control and they may be considered pests because of their role on parasitizing adult Hymenoptera, e.g., vespids, bees and sphecids, 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 buccata* 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 & Clements (2008) stated that the distribution of *Myopa pellucida* in the Middle East includes Afghanistan, Iraq, 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.

Acknowledgements. The authors offer their sincere thanks to David Clements (Cardiff, U.K.) who kindly gave assistance with identifications and literature, as well proof-read the manuscript, and also to Dr. Jens-Hermann Stuke (Leer, Germany) who kindly read the manuscript, made comments and added some literature.

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