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AN ANNOTATED LIST OF THE BIG-HEADED FLIES (DIPTERA: PIPUNCULIDAE) OF IRAN WITH NOTES ON THE MATERIAL COLLECTED BY WINDOW TRAPS IN FARS PROVINCE

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Summary. Annotated list of 54 species from eleven genera and three subfamilies of family Pipunculidae is given.Ten species of big-headed flies have been collected by window traps at three localities in southern Iran. *Tomosvaryella israelensis* De Meyer, 1995 and *T. minuscula* (Collin, 1956) are firstly recorded from Iran.

Key words: Diptera, Pipuncilidae, window trap, fauna, new records, checklist, Iran.

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Резюме. Приводится список 54 вида из 11 родов и трех подсемейств семейства Pipunculidae. В Южном Иране на оконные ловушки собрано 10 видов большеглазок. *Tomosvaryella israelensis* De Meyer, 1995 и *T. minuscula* (Collin, 1956) впервые указываются для Ирана.

INTRODUCTION

Pipunculids are endoparasitoids of leafhoppers and planthoppers (Homoptera: Auchenorrhycha) and adult Tipulidae (Diptera); see Rafael & Skevington (2010) for a brief summary on the family's biology. The Iranian fauna of Pipunculidae or big-headed flies has received considerable attention by several study groups during the past few years. Whereas before only two species were known from the country (Becker, 1913), Gharali *et al*. 2008), Kehlmaier & Majnon-Jahromi (2015), Kazerani *et al*. (2017), Kazerani & Kehlmaier (2018), Majnon-Jahromi *et al*. (2017a, b) and Motamedinia *et al*. (2017a, b, c) have increased the knowledge of this family of brachycerous flies considerably.

The vast majority of Pipunculidae (in terms of both quantity and quality) studied these days get collected either by hand-netting or with Malaise traps. However, past studies have

also shown promising results with alternative collecting techniques like yellow pan traps (Kehlmaier, 2008), canopy fogging (Kehlmaier & Floren, 2010) or by means of a car net (Jentzsch *et al*., 2017). To our knowledge, records of big-headed flies collected with window traps have never been published so far and thus provide interesting insights into the methods of collections in this family group.

In this study we present the first Iranian checklist of the family. Moreover, ten species of these flies have been collected for the first time by window traps at three localities in southern Iran, two of them are new for the fauna of this country.

MATERIAL AND METHODS

In this study, the data is based on material collected by three window traps, a new method of collection for this family of Diptera. We used two glass holders with 40 cm length and 20 cm width which were placed across each other (Fig. 1). Below, there was a funnel connected to a plate filled with 75% ethyl alcohol. The container was filled with the alcohol each morning, and emptied at night. To increase the efficiency of the traps, an LED 5W lamp was occasionally connected to the middle of the traps so that they could work as a mix of light and window traps, during the night and day respectively (from 19 to 6 o'clock). Also, the colour of the collection plate below the glass holders was changed between yellow and white to test how much this can increase the efficiency of the window traps. The window traps were placed at three localities in Fars province, southern Iran. Trap 1 was placed at locality 3 of Majnon-Jahromi *et al*. (2017a) – IRAN, Fars province, Jahrom, 28°30′N 53°35′E, 1044 m a.s.l., mixed orange tree and palm date plantation, leg. B. Majnon Jahromi – and was in use between 10–28 September 2016. Traps 2 and 3 were placed at locality 4 of

Fig. 1. Window traps at collection sites in Iran. A – Jahrom, Fars Province, trap 1 (window and light trap); B – Jahrom, Fars Province, trap 2.

Majnon-Jahromi *et al*. (2017a) – IRAN, Fars province, Jahrom, 28°30′31″N 53°34′21″E, 1044 m a. s. l., mixed orange tree and palm date plantation, leg. B. Majnon Jahromi – and were in use between 8–18 October 2016 for trap 1, and 20–25 October 2016 for trap 3. Both traps were placed in a citrus and palm date garden at Jahrom in Fars province (Fig. 1). Due to the climatic conditions, many tropical and sub-tropical plants are grown in Jahrom, the natural habitat being composed of clay and rocky regions covered with low desert vegetation like *Astragalus* spp. and wild almond (*Amygdalus scoparia*). Altogether, the traps were in use for 36 collecting days in the dry season of the year. September and October are characterised by high mean temperatures of 33°C, a minimum of 22°C and by

average precipitation of 32.4 mm/m^2. From mid October to mid November onwards, the temperature drops considerably and seasonal rainfalls do commence. The window traps were hung under the tree canopy at an approximate hight of 1.5 m. The studied material of Pipunculidae is ethanol preserved and deposited at the Department of Entomology, Shiraz Branch, Islamic Azad University, Shiraz, Iran (SHIAU).

The compiled checklist of Iranian Pipunculidae provides the names of valid genera and species by subfamilies in an alphabetical order. We accepted the taxonomic arrangement of Pipunculidae regarding subfamilies, genera and species according to De Meyer (1996), Skevington & Yeates (2001) and Kehlmaier *et al*. (2014). The known Iranian localities are provided for each species.

AN ANNOTATED LIST OF PIPUNCULIDAE FROM IRAN WITH MATERIAL COLLECTED BY WINDOW TRAPS

Subfamily Chalarinae

Genus *Chalarus* Walker, 1839

***Chalarus brevicaudis* Jervis, 1992**

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015); East Azerbaijan, Kandovan (Kazerani *et al*., 2017). – Europe (Kehlmaier, 2011).

***Chalarus indistinctus* Jervis, 1992**

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015). – Europe.

Genus *Verallia* Mik, 1899

***Verrallia aucta* (Fallén, 1817)**

DISTRIBUTION. Iran: East Azerbaijan, Arasbaran (Kazerani *et al*., 2017). – Israel, Kazakhstan (De Meyer, 1996).

Subfamily Nephrocerinae

Genus *Nephrocerus* Zetterstedt, 1838

***Nephrocercus scutellatus* (Macquart, 1834)**

DISTRIBUTION. Iran: East Azerbaijan, Arasbaran (Kazerani *et al*., 2017). – West Palaearctic (Kehlmaier & Floren, 2010).

Subfamily Pipunculinae

Tribe Pipunculini

Genus *Pipunculus* Latreille, 1802

***Pipunculus lenis* Kuznetzov, 1991**

DISTRIBUTION. Iran: Lorestan, Khorramabad (Kazerani *et al*., 2017). – Russia (European part).

Tribe Cephalopsini

Genus *Cephalops* Fallén, 1810

***Cephalops* (*Semicephalops*) *penultimus* Ackland, 1993**

DISTRIBUTION. Iran: Kurdistan, Saghez (Kazerani *et al*., 2017). – Europe.

***Cephalops ultimus* (Becker, 1900)**

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015), Fars, Jahrom (Majnon Jahromi *et al*., 2017). – West Palaearctic.

Tribe Eudorylini

Genus *Claraeola* Aczél, 1940

***Claraeola conjuncta* (Collin, 1949)**

DISTRIBUTION. Iran: Sistan and Baluchestan, Zabol. South Khorasan, Birjand (Motamedinia *et al*., 2017c). – Algeria, Egypt and Israel (Kehlmaier, 2005b).

***Claraeola parnianae* Motamedinia et Kehlmaier, 2017**

DISTRIBUTION. Endemic to Iran: Sistan and Baluchestan, Zabol (Motamedinia *et al*., 2017a).

***Claraeola khorshidae* Motamedinia et Kehlmaier, 2017**

DISTRIBUTION. Endemic to Iran: South Khorasan, Birjand (Motamedinia *et al*., 2017a).

Genus *Clistoabdoominalis* Skevington, 2001

***Clistoabdominalis hyrcania* Kazerani et Kehlmaier, 2018**

DISTRIBUTION. Endemic to Iran: Golestan, Shast-Kola (Kazerani & Kehlmaier, 2018).

***Clistoabdominalis nitidifrons* (Becker, 1900)**

DISTRIBUTION. Iran: Kermanshah, Sar pol zahab (Motamedinia *et al*., 2017c). – Palaearctic and Oriental regions (Kehlmaier, 2005b; Földvári, 2013).

***Clistoabdoominalis ruralis* (Meigen, 1824)**

DISTRIBUTION. Iran: East Azerbaijan, Khodafarin (Kazerani *et al*., 2017), Fars, Jahrom, Darab, Kazeroon, Lar (Majnon Jahromi *et al*., 2017), Kermanshah, Sar pol zahab; Khorasan Razavi, Mashhad; North Khorasan, Bojnord; Sistan and Baluchestan, Zabol; South Khorasan, Birjand (Motamedinia *et al*., 2017c). – Egypt and Israel (Kehlmaier, 2005a).

***Clistoabdoominalis sinaiensis* (De Meyer, 1995)**

DISTRIBUTION. Iran: Fars, Lar, Darab (Majnon Jahromi *et al*., 2017). – Sinai Peninsula (Kehlmaier, 2005b).

***Clistoabdoominalis trochanteratus* (Becker, 1900)**

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015), Fars, Jahrom (Majnon Jahromi *et al*., 2017), Kermanshah, Sar pol zahab; Sistan and Baluchestan, Zabol; South Khorasan, Birjand (Motamedinia *et al*., 2017c). – Egypt (Skevington *et al*., 2007; Kehlmaier, 2005).

Genus *Dasydorylas* Skevington, 2001

***Dasydorylas derafshani* Motamedinia et Kehlmaier, 2017**

DISTRIBUTION. Endemic to Iran: Sistan and Baluchestan, Zabol (Motamedinia *et al.,* 2017b).

***Dasydorylas discoidalis* (Becker, 1897)**

DISTRIBUTION. Iran: Sistan and Baluchestan, Zabol (Motamedinia *et al.,* 2017c). – Russia (Kehlmaier, 2005a).

***Dasydorylas horridus* (Becker, 1897)**

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015). – West Palaearctic (Kehlmaier, 2005a).

***Dasydorylas zardouei* Motamedinia & Kehlmaier, 2017**

DISTRIBUTION. Endemic to Iran: Kermanshah, Dodan (Motamedinia *et al.,* 2017b).

Genus *Eudorylas* Aczél, 1940

***Eudorylas auctus* Kehlmaier, 2005**

DISTRIBUTION. Iran: Kurdistan, Saghez (Kazerani *et al*., 2017). – Kyrgyzstan, Tajikistan, Uzbekistan (Kehlmaier, 2005a).

***Eudorylas blascoi* De Meyer, 1997**

DISTRIBUTION. Iran: Alborz, Kordan, Arangeh (Kehlmaier & Majnon Jahromi, 2015), East Azerbaijan, Sufian (Kazerani *et al*., 2017), Fars, Jahrom, Darab (Majnon Jahromi *et al*., 2017), Kermanshah, Sar pol zahab; Khorasan Razavi, Mashhad, Torqabeh; North Khorasan, Bojnord; South Khorasan, Birjand; (Motamedinia *et al.,* 2017c). – Palaearctic (Kehlmaier, 2005a).

***Eudorylas chvalai* Kozánek, 1988**

DISTRIBUTION. Iran: Fars, Kazeroon (Majnon Jahromi *et al*., 2017), South Khorasan, Birjand (Motamedinia *et al.,* 2017c). – Palaearctic (Kehlmaier, 2005a).

***Eudorylas fascipes* (Zetterstedt, 1844)**

DISTRIBUTION. Iran: West Azerbaijan, Khoy (Kazerani *et al*., 2017). – Europe (Kehlmaier, 2005a).

***Eudorylas fluviatilis* (Becker, 1900)**

DISTRIBUTION. Iran: Fars, Jahrom (Majnon Jahromi *et al*., 2017), Kermanshah, Sar pol zahab; North Khorasan, Bojnord; South Khorasan, Birjand (Motamedinia *et al.,* 2017c). – Near East, North Africa (Kehlmaier, 2005a).

***Eudorylas jenkinsoni* Coe, 1966**

DISTRIBUTION. Iran: Kermanshah, Sar pol zahab (Motamedinia *et al.,* 2017c). – East Palaearctic (Kehlmaier, 2005a).

***Eudorylas longifrons* Coe, 1966**

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015), East Azerbaijan, Arasbaran (Kazerani *et al*., 2017), Fars, Jahrom (Majnon Jahromi *et al*., 2017), North Khorasan, Bojnord (Motamedinia *et al.,* 2017c). – West Palaearctic (Kehlmaier, 2005a).

***Eudorylas pannonicus* (Becker, 1897)**

DISTRIBUTION. Iran: Ilam, Dalab forest park (Gharali *et al*., 2008), West Azerbaijan, Urmia (Kazerani *et al*., 2017). – Palaearctic.

***Eudorylas zermattensis* (Becker, 1897)**

DISTRIBUTION. Iran: Alborz, Kordan, Arangeh (Kehlmaier & Majnon Jahromi, 2015), Kurdistan, Saghez and East Azerbaijan, Arasbaran (Kazerani *et al*., 2017), Fars, Kazeroon (Majnon Jahromi *et al*., 2017), Kermanshah, Gheshlagh (Motamedinia *et al.,* 2017d). – West Palaearctic.

Tribe Tomosvaryellini

Genus *Dorylomorpha* Aczél, 1932

***Dorylomorpha* (*Dorylomya*) *tanasijtshuki* Albrecht, 1990**

DISTRIBUTION. Iran: East Azerbaijan, Sufian (Kazerani *et al*., 2017). – Kyrgyzstan and Uzbekistan.

Genus *Tomosvaryella* Aczél, 1939

***Tomosvaryella angulata* Kehlmaier et Majnon Jahromi, 2017**

DISTRIBUTION. Endemic to Iran: Fars, Jahrom, Lar (Majnon Jahromi *et al*., 2017).

***Tomosvaryella argyrata* De Meyer, 1995**

DISTRIBUTION. Iran: East Azerbaijan, Arasbaran (Kazerani *et al*., 2017). – Israel.

***Tomosvaryella* cf *brachybasis* De Meyer, 1993**

DISTRIBUTION. Iran: Alborz, Kordan, Arangeh (Kehlmaier & Majnon Jahromi, 2015).

NOTES. True *T. brachybasis* have been recorded from South Africa (Botswana, Namibia, and South Africa) and Canary Islands (Kehlmaier & Majnon Jahromi, 2015).

***Tomosvaryella coquilletti* (Kertész, 1907)**

MATERIAL EXAMINED. Iran: Fars, Jahrom, 28°30′N 53°35′E, 1044 m, window trap, 10–28.IX 2016, 2♂, leg. B. Majnon Jahromi.

DISTRIBUTION. Iran: Ilam, Dalab forest park (Gharali *et al*., 2008), Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015), Ardabil, Meshgin Shahr (Kazerani *et al*., 2017), Fars, Kherameh (Majnon Jahromi *et al*., 2017). – Nearctic, Palaearctic and Oriental regions.

***Tomosvaryella dentiterebra* (Collin, 1949)**

DISTRIBUTION. Iran: Fars, Jahrom (Majnon Jahromi *et al*., 2017b). – Egypt (Collin, 1949).

***Tomosvaryella demeyeri* Kuznetzov, 1993**

MATERIAL EXAMINED. Iran: Fars, Jahrom, 28°30′N 53°35′E, 1044 m, window trap, 10–28.IX 2016, 1♂, leg. B. Majnon Jahromi.

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015), Fars, Jahrom, Lar (Majnon Jahromi *et al*., 2017). – Egypt (Kuznetzov, 1993).

***Tomosvaryella docta* De Meyer, 1995**

DISTRIBUTION. Iran: Fars, Jahrom, Lar (Majnon Jahromi *et al*., 2017). – Egypt and Israel (De Meyer, 1995).

***Tomosvaryella freidbergi* De Meyer, 1995**

DISTRIBUTION. Iran: Alborz, Arangeh, Kordan (Kehlmaier & Majnon Jahromi, 2015), East Azerbaijan, Qurigol, (Kazerani *et al*., 2017), Fars, Jahrom (Majnon Jahromi *et al*., 2017). – Israel (Foldvary & De Meyer, 1999).

***Tomosvaryella gazliensis* Kuznetzov, 1994**

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015). – Uzbekistan (Kuznetzov, 1994).

***Tomosvaryella geniculata* (Meigen, 1824)**

DISTRIBUTION. Iran: Fars, Jahrom, Neyriz (Majnon Jahromi *et al*., 2017). – West Palaearctic (De Meyer 1995).

***Tomosvaryella glabrum* (Adams, 1905)**

MATERIAL EXAMINED. Iran: Fars, Jahrom, 28°30′N 53°35′E, 1044 m, window trap, 10–28.IX 2016, 1♂, leg. B. Majnon Jahromi.

DISTRIBUTION. Iran: Alborz, Arangeh, Kordan (Kehlmaier & Majnon Jahromi, 2015), Fars, Jahrom, Lar, Marvdasht (Majnon Jahromi *et al*., 2017). – Afrotropical region, North Africa, Canary Is., Near East.

***Tomosvaryella hamata* Majnon Jahromi et Kehlmaier, 2017**

DISTRIBUTION. Endemic to Iran: Fars, Jahrom, Lar, Marvdasht (Majnon Jahromi *et al*., 2017b).

***Tomosvaryella immutata* (Becker, 1913)**

DISTRIBUTION. Endemic to Iran: Sistan and Baluchestan, between Kūh-i-Mughak mountain, Kerman (Becker, 1913), Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015).

***Tomosvaryella israelensis* De Meyer, 1995**

MATERIAL EXAMINED. Iran: Fars, Jahrom, 28°30′31″N 53°34′21″E, 1044 m, window trap, 20–25.X 2016, 1♂, leg. B. Majnon Jahromi.

DISTRIBUTION. Iran: Fars (new record). – Europe (Foldvary & De Meyer, 1999).

NOTE. This species is recorded from Iran for the first time.

***Tomosvaryella kuthyi* Aczél, 1994**

DISTRIBUTION. Iran: Ilam, Dalab forest park (Gharali *et al*., 2008), Fars, Jahrom, Lar, Kherameh, Sepidan (Majnon Jahromi *et al*., 2017). – West and Central Europe (Foldvary & De Meyer, 1999).

***Tomosvaryella minima* (Becker, 1897)**

MATERIAL EXAMINED. Iran: Fars, Jahrom, 28°30′N 53°35′E, 1044 m, window trap, 10–28 IX.2016, 1♂, leg. B. Majnon Jahromi.

DISTRIBUTION. Iran: Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015), Fars, Jahrom, Lar (Majnon Jahromi *et al*., 2017). – Europe (Foldvary & De Meyer, 1999).

***Tomosvaryella minuscula* (Collin, 1956)**

MATERIAL EXAMINED. Iran: Fars, Jahrom, 28°30′31″N 53°34′21″E, 1044 m, window trap, 8–18.X 2016, 1♂, leg. B. Majnon Jahromi.

DISTRIBUTION. Iran: Fars (new record). – Egypt (Foldvary & De Meyer, 1999).

NOTE. This species is new for the fauna of Iran.

***Tomosvaryella nodosa* De Meyer, 1993**

DISTRIBUTION. Iran: Fars, Jahrom, Lar, Marvdasht (Majnon Jahromi *et al*., 2017). – Egypt and Israel (De Meyer, 1995).

***Tomosvaryella parakuthyi* De Meyer, 1995**

MATERIAL EXAMINED. Iran: Fars, Jahrom, 28°30′N 53°35′E, 1044 m, window trap, 10–28 IX.2016, 3♂, leg. B. Majnon Jahromi.

DISTRIBUTION. Iran: Alborz, Arangeh (Kehlmaier & Majnon Jahromi, 2015), East Azerbaijan, Shabestar (Kazerani *et al*., 2017), Fars, Jahrom, Lar, Marvdasht (Majnon Jahromi *et al*., 2017). – Canary Is, Near East, North Africa (De Meyer, 1995).

***Tomosvaryella pistacia* Majnon Jahromi et Kehlmaier, 2017**

DISTRIBUTION. Endemic to Iran: Fars, Kherameh (Majnon Jahromi *et al*., 2017).

***Tomosvaryella propinqua* (Becker, 1913)**

DISTRIBUTION. Endemic to Iran: Sistan and Baluchestan (Becker, 1913), Alborz, Kordan (Kehlmaier & Majnon Jahromi, 2015).

***Tomosvaryella subsylvatica* Kehlmaier et Kazerani, 2017**

DISTRIBUTION. Endemic to Iran: East Azerbaijan, Qurigol, (Kazerani *et al*., 2017).

***Tomosvaryella subvirescens* (Loew, 1872)**

MATERIAL EXAMINED. Iran: Fars, Jahrom, 28°30′N 53°35′E, 1044 m, window trap, 10–28 IX.2016, 1♂, leg. B. Majnon Jahromi.

DISTRIBUTION. Iran: Alborz, Arangeh, Kordan (Kehlmaier & Majnon Jahromi, 2015) – Egypt, Israel, Yemen (De Meyer, 1993, 1995).

NOTE. This species is recorded from Fars province for the first time.

***Tomosvaryella sylvatica* (Meigen, 1824)**

DISTRIBUTION. Iran: Lorestan, Khorramabad (Kazerani *et al*., 2017), Fars, Neyriz (Majnon Jahromi *et al*., 2017). – Nearctic, Palaearctic, Oriental (Foldvary & De Meyer, 1999).

***Tomosvaryella urdaensis* Kuznetzov, 1994**

DISTRIBUTION. Iran: Fars, Neyriz (Majnon Jahromi *et al*., 2017). – Kazakhstan (Kuznetzov, 1994).

DISCUSSION

Kehlmaier (2010) collected 83 Pipunculidae in nine days by hand-net trap, as they were hovering within or above the vegetation or ground. Again Kehlmaier & Floren (2010) with the same method could collect 386 specimens during eleven days.

Among using the other methods of collecting the yellow pan trap was quite surprising with gathering 30 different taxa of the family in comparison with the Malaise trap which represents the most collecting method with yielding 64 taxa, which representing 44.1% of the overall species number (Kehlmaier, 2008). After hand netting and Malaise traps, the yellow pan trap is an efficient way of collecting Pipunculidae, resulted in a high number of specimens with 114, of which 50 specimens were belonging to rarely collected species groups.

There are different literatures showing using different methods of collection, none of which show the window trap has been used so far. Leather (2015) traced back the origins of this widely used flight interception trap to a paper by Chapman & Kinghorn (1955), who apparently invented this device and put it to use for entomological sampling.

Using the new method of window trap, in this study, represents 40% of the other methods. Nine species *C. ruralis*, *C. sinaiensis*, *T. coquilletti*, *T. demeyeri*, *T. glabrum*, *T. israelensis*, *T. minima*, *T. minuscula*, *T. parakuthyi*, *T. subvirescens* were collected by window trap. Though the number of yielded materials are far too few, but gaining two new national records for the area represents a new discovery that though the other methods are gathering more specimens but still not able to cover the whole biological system and activity of the family group. The environment and areas that the materials are getting collected also are so important, as their influence, if is not more but still not lesser than the efficiency of collecting methods.

The pipunculid flies are an unfortunate forgotten parasitoid species that have very important affective role in nature, in case of biological control, which got the least attention (Gharali *et al*., 2008).

Fifty-four species of big-headed flies are currently reported from Iran in the present list: one Nephrocerinae, three Chalarinae and 50 Pipunculinae (one Pipunculini, two Cephalopsini, 21 Eudorylini and 26 Tomosvaryellini). Eleven species (*Claraeola parnianae*, *C. khorshidae*, *Clistoabdominalis hyrcania*, *Dasydorylas derafshani*, *D. zardouei*, *Tomosvaryella angulata*, *T. hamata*, *T. immutata*, *T. pistacia*, *T. propinqua* and *T. subsylvatica*) are known only from Iran. Such a large proportion of endemic species (20.4%) from the currently known species of Iran indicates that the Iranian fauna of big-headed flies is still largely unknown and needs further investigation.

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