

Research Article

## Robber flies (Diptera: Asiloidea: Asilidae) of northern Iran, with four new records for Iranian fauna

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**Abstract:** The specimens were collected from northern Iran using the sweeping net and Malaise traps during 2010-2019. A total of 25 species were identified, of which four species are recorded for the first time from Iran: *Choerades femorata* (Meigen, 1804), *Dysmachus dentiger* Richter, 1962, *Heteropogon ornatipes* Loew, 1851, and *Neomochtherus schineri* (Egger, 1855). Also, some species are new provincial records for the northern provinces of Iran. Local and global geographical distributions of all 25 species, diagnostic characters of the newly recorded species, and their photos are provided.

**Keywords:** Asilidae, northern Iran, Robber flies, new records

### Introduction

The family Asilidae (robber flies or assassin flies) (Diptera: Asiloidea) is a large family of predatory flies and is one of the most taxonomically diverse families of Diptera (Barnes *et al.*, 2007). Currently, robber flies include over 7500 described species distributed worldwide (Hull, 1962; Pape *et al.*, 2011; Geller-Grimm *et al.*, 2016; Dikow, 2020). Recently, based on morphological and molecular studies, a more comprehensive and complete classification was made by Dikow (2009a, 2009b), who divided the family Asilidae into 14 subfamilies.

According to Hull (1962), most robber fly species are founded in dry and sandy areas, a condition by the greater numbers of species found in arid and semiarid regions. However, in

desert or semidesert regions, the small dry stream beds attract the greatest number, and sometimes all of their populations are restricted to such places, which have the maximum vegetation and the greatest population of insects. They prefer open, dry, and sunny habitats that provide optimal conditions to hunt and develop the larvae (Joern and Rudd, 1982; Shurovnekov, 1962). Robber flies are predators in both the larval and adult stages. The larvae mainly feed on the immature stages of other arthropods, and adults prey on the flying insects of other orders such as Coleoptera, Hemiptera (suborder Heteroptera), Hymenoptera, Orthoptera, and even Odonata. They help maintain the natural balance among insect populations (Hull, 1962; Lavigne, 2001).

Portschinsky (1873) published the first species of Asilidae for Iran, describing two new species. Afterward, several new species and new records were described and reported from Iran by other specialists (Bigot, 1880; Hermann, 1905; Becker and Stein, 1913; Engel,

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1930; Timon-David, 1955; Oldroyd, 1958). The first comprehensive study in Iran was conducted by Abbassian-Lintzen (1964a, 1964b), who described eight new species for science. As a result of later studies, the number of species known from Iran increased to 304 (Lehr, 1988; Lehr *et al.*, 2007; Ghahari *et al.*, 2007; Hayat *et al.*, 2008; Tomasovic and Saghaei, 2009; Shoeibi and Karimpour, 2010; Samin *et al.*, 2010; Ghahari *et al.*, 2014; Mohammadi and Khaghaninia, 2015, 2016; Mohammadi *et al.*, 2017, 2018, 2019, 2020).

Iran is a large country (1,623,779 km<sup>2</sup>) and is located between three ecological zones (Palearctic, Afrotropical, and Indomalayan), and because of that, more species are expected to be found. North Central of Iran, includes Alborz, Guilan, Mazandaran, Tehran, and Qazvin provinces, provides diverse climatic conditions for unique vegetations, natural biomes, and agricultural areas. These regions are located on the Alborz Mountains' southern and northern slopes and include suitable habitats for Asilidae species. Our current knowledge about the diversity of Iranian Asilidae fauna is far from being complete. The main goal of this study was to increase our knowledge about the Asilidae fauna of northern Iran.

## Materials and Methods

The materials were collected in different regions of five northern provinces, including Alborz, Guilan, Mazandaran, Tehran, and Qazvin. The specimens were collected with sweeping net and Malaise traps during 2010-2019. The morphological terminology follows Engel (1930), Dikow (2009a, 2009b), Geller-Grimm *et al.* (2016); geographical distribution of this study are mainly followed Engel (1930), Lehr (1988, 2002), Richter (1962, 1988), Geller-Grimm *et al.* (2016), and Sakhvon and Lelej (2018). The illustrations were obtained using an Olympus TM SZX9 stereomicroscope equipped with a Sony™ digital camera. Then, A series of 8-10 images were merged into a single in-focus image using the image-stacking software Combine ZP 1.0. Information about species, general geographical

distributions, and distribution in Iran are provided. Diagnostic characters are given for the new Iranian records. All materials are deposited in the Insect Collection of Department of Entomology, Tarbiat Modares University, Tehran, Iran (TMUC).

## Results

In the present study, 25 species of Asilidae within 8 subfamilies and 21 genera were collected and identified from northern Iran, of which four species are newly reported for the Iranian fauna.

### List of Asilidae species known in this study from northern Iran

#### Subfamily Asilinae Latreille, 1802

##### *Aneomochtherus mundus* (Loew, 1849)

**Material examined.** Alborz province, Karadj (35°46'20" N, 50°56'44" E), 1278 m, 25.7.2010, 1♂, 3♀♀, Leg.: A. Nadimi and M. Kheyrandish; Chalous Road (35°55'07" N, 51°05'09" E), 1891 m, 25.7.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Guilan province: Roodsar, Rahimabad, Orkom, (36°45'44" N, 50°18'11" E), 1201 m, 9.6.2010, 5♂♂, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ghazichak (36°45'57" N, 50°19'35" E), 1803 m, 3.8.2010, 2♂♂, 2♀♀, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ghazichak (36°45'52" N, 50°20'01" E), 1787 m, 5.7.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E), 490 m, 25.7.2010, 3♂♂, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ziaz (36°52'34" N, 50°13'17" E), 537 m, 25.7.2010, 2♂♂, Leg.: A. Nadimi and M. Kheyrandish; Mazandaran province: Jorband (36°26'17" N, 52°07'13" E), 272 m, 4.6.2012, 1♂, 1♀; Gaznasara (36°16'58" N, 52°10'55" E), 2013 m, 9.6.2012, 1♀, Leg.: R. Mohammadi; Tangevaz (36°21'55" N, 52°06'10" E), 702 m, 25.8.2017, 1♀, Leg.: R. Mohammadi; Babol, Sareh (36°13'45" N, 52° 37'18" E), 690 m, 20.6.2015, 1♂, Leg.: R. Mohammadi; Tehran province: Shahriar (35°40'08" N, 50°56'56" E), 1168 m, 6.8.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Qazvin province: Qazvin-Zereshk road (36°26'24" N, 50°06'24" E), 2100 m,

10.5.2018, 1♂, 1♀, Leg.: R. Mohammadi; Qazvin-Zereshk road (36°25'42" N, 50° 06'24" E), 2035m, 10.5.2018, 1♂, Leg.: R. Mohammadi; Qazvin-Zereshk road (36°21'42" N, 50°03'54" E), 1540 m, 10.5.2018, 1♂, Leg.: R. Mohammadi.

**Distribution in Iran:** East Azarbaijan (Hayat *et al.*, 2008), Golestan (Ghahari *et al.*, 2007b), Mazandaran (Ghahari *et al.*, 2007b, current study), Alborz, Guilan, Tehran, and Qazvin provinces (current study).

**General distribution:** Greece, Turkey (Geller-Grimm *et al.*, 2016).

#### *Antifrisson adpressus* (Loew, 1849)

**Material examined.** Guilan province: Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E), 490 m, 4.6.2010, 2♀♀, Leg.: A. Nadimi and M. Kheyrandish; Mazandaran province: Babol, Sareh (36°14'1" N, 52° 36'58" E), 759.4m, 15.7.2014, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Tehran province: Shahriar (35°40'08" N, 50°56'56" E), 1168 m, 6.8.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Qazvin province: Avan Lake (36°28'36" N, 49° 25'36" E), 1818 m, 17.5.2018, 1♀, Leg.: R. Mohammadi.

**Distribution in Iran:** Fars (Saghaei *et al.*, 2009; Tomasovic and Saghaei, 2009), Khuzestan (Oldroyd, 1958), Guilan, Mazandaran, Tehran, and Qazvin provinces (current study).

**General distribution:** Azerbaijan, Egypt, Israel, Kazakhstan, Russia, Turkey (Geller-Grimm *et al.*, 2016).

#### *Antifrisson trifarius* (Loew, 1849)

**Material examined.** Alborz province: Karadj (35°46'20" N, 50°56'44" E), 1278 m, 25.8.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Guilan province, Roodsar, Rahimabad, Ziaz (36°52'34" N, 50°13'17" E), 537 m, 15.6.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Qazvin province: Kohin (36°22'12" N, 49° 40'06" E), 1514 m, 17.5.2018, 1♂, Leg.: R. Mohammadi.

**Distribution in Iran:** Fars (Saghaei *et al.* 2009), Mazandaran (Hayat *et al.*, 2008), Alborz, Guilan, and Qazvin provinces (current study).

**General distribution:** Albania, Azerbaijan, Belgium, Bosnia Herzegovina, Croatia, Egypt, France, Germany, Greece, Hungary, Israel,

Italy, Kazakhstan, Malta, Morocco, Romania, Russia, Slovenia, Spain, Switzerland, Syria, Tunisia, Turkey (Geller-Grimm *et al.*, 2016).

#### *Apoclea algira* (Linnaeus, 1767)

**Material examined.** Guilan province: Roodsar, Rahimabad, Ghazichak (36°45'57" N, 50°19'35" E), 1803 m, 3.8.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Qazvin province: Qazvin-Zereshk road (36°28'30" N, 50°08'36" E), 1997m, 10.5.2018, 1♀, Leg.: R. Mohammadi.

**Distribution in Iran:** Sistan and Baluchestan (Oldroyd, 1958), Guilan and Qazvin provinces (current study).

**General distribution:** Algeria, Egypt, Israel, Libya, Morocco, Niger, Tunisia, Turkey (Geller-Grimm *et al.*, 2016).

#### *Dysmachus dasyproctus* Loew, 1871

**Material examined.** Guilan province: Roodsar, Rahimabad, Ghazichak (36°45'57" N, 50°19'35" E), 1803 m, 3.8.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Isfahan (Lehr *et al.*, 2007), Guilan province (current study).

**General distribution:** Armenia, Azerbaijan, Georgia, Greece, Romania, Turkey (Geller-Grimm *et al.*, 2016).

#### *Dysmachus dentiger* Richter, 1962

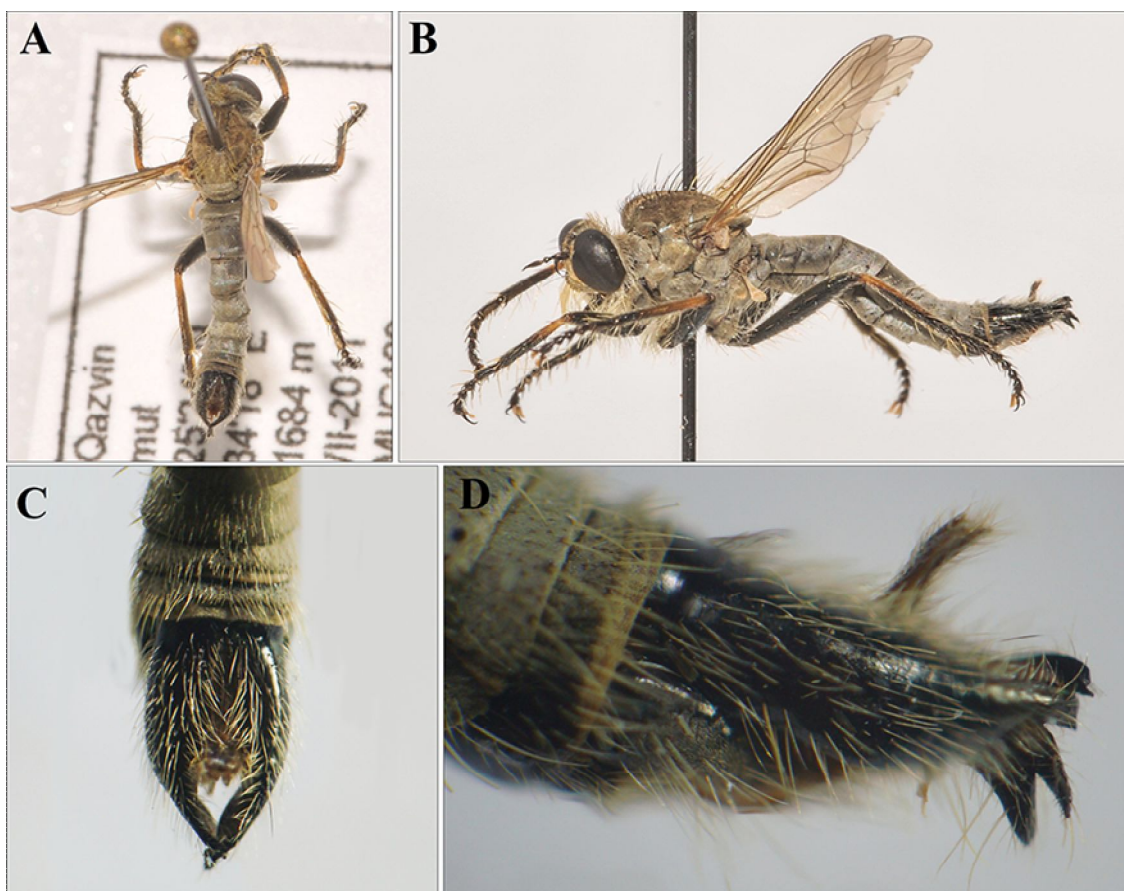
**Material examined.** Qazvin province: Alamut (36°25'24" N, 50°34'18" E), 1684 m, 12.7.2011, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Garmarod (36°24'06" N, 50°32'30" E), 1354 m, 8.5.2018, 1♀, Leg.: R. Mohammadi; Avan Lake (36°28'36" N, 49° 25'36" E), 1818 m, 17.5.2018, 1♀, Leg.: R. Mohammadi.

**Distribution in Iran:** Qazvin province (current study). **New record for Iran.**

**General distribution:** Armenia (Geller-Grimm *et al.*, 2016).

#### **Diagnostic characters (female and male)**

(Fig. 1, A-D): 9-12 mm. Dorsocentral and acrostichal setae well developed, usually reaching the level of humeral Call (Fig. 1B); acrostichal setae of scutum short, tibiae partly yellow. In the male, both halves of epandrium have a shorter apically truncated apical process; subapical dorsal tooth on aedeagus (Fig. 1C, 1D) (Richter, 1962).



**Figure 1** *Dismachus dentiger* Richter, 1962, A-D: Male. A: general habitus, dorsal view; B: general habitus, lateral view; C: genitalia, dorsal view; D: genitalia, lateral view.

***Dismachus transcaucasicus* Richter, 1962**

**Material examined.** Mazandaran province: Tangevaz (36°21'55" N, 52°06'10" E), 692 m, 16.8.2012, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Gaznasara (36°16'58" N, 52°10'55" E), 2013 m, 9.6.2012, 3♂♂, 2♀♀, Leg.: A. Nadimi and M. Kheyrandish; Jorband (36°26'17" N, 52°07'13" E), 272 m, 5.7.2012, 2♂♂, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** East Azerbaijan (Mohammadi *et al.*, 2017), Mazandaran province (current study).

**General distribution:** Armenia, Turkey (Geller-Grimm *et al.*, 2016).

***Eremisca heleni* (Eflatoun, 1934)**

**Material examined.** Guilan province: Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E), 490 m, 18.6.2010, 1♂, Leg.: A. Nadimi and M.

Kheyrandish; Qazvin province, Qazvin-Zereshk road (36°21'42" N, 50°03'54" E), 1540 m, 10.9.2011, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Alamut (36°25'24" N, 50°34'18" E), 1684 m, 15.9.2011, 1♀, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Hormozgan, Sistan and Baluchestan (Abbassian-lintzen, 1964b), Iran (no locality cited) (Theodor, 1980), Guilan, and Qazvin provinces (current study).

**General distribution:** Egypt, Israel, Morocco, Oman (Geller-Grimm *et al.*, 2016).

***Machimus annulipes* (Brullé, 1832)**

**Material examined.** Guilan province: Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E), 490 m, 4.6.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Orkom (36°45'44" N, 50°18'11"



E), 1201 m, 4.6.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Guilan (Ghahari *et al.*, 2007b, current study), Kermanshah, Semnan (Hayat *et al.*, 2008), Mazandaran (Ghahari *et al.*, 2007b).

**General distribution:** Albania, Azerbaijan, Bosnia-Herzegovina, Bulgaria, Croatia, Great Britain, Greece, Hungary, Israel, Poland, Romania, Slovenia, Switzerland, Turkey (Geller-Grimm *et al.*, 2016).

***Neomochtherus schineri* (Egger, 1855)**

**Material examined.** Mazandaran province: Gaznasara (36°16'56" N, 52°10'58" E), 2032 m, 15.6.2012, 2♂♂, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Mazandaran province (current study). **New record for Iran.**

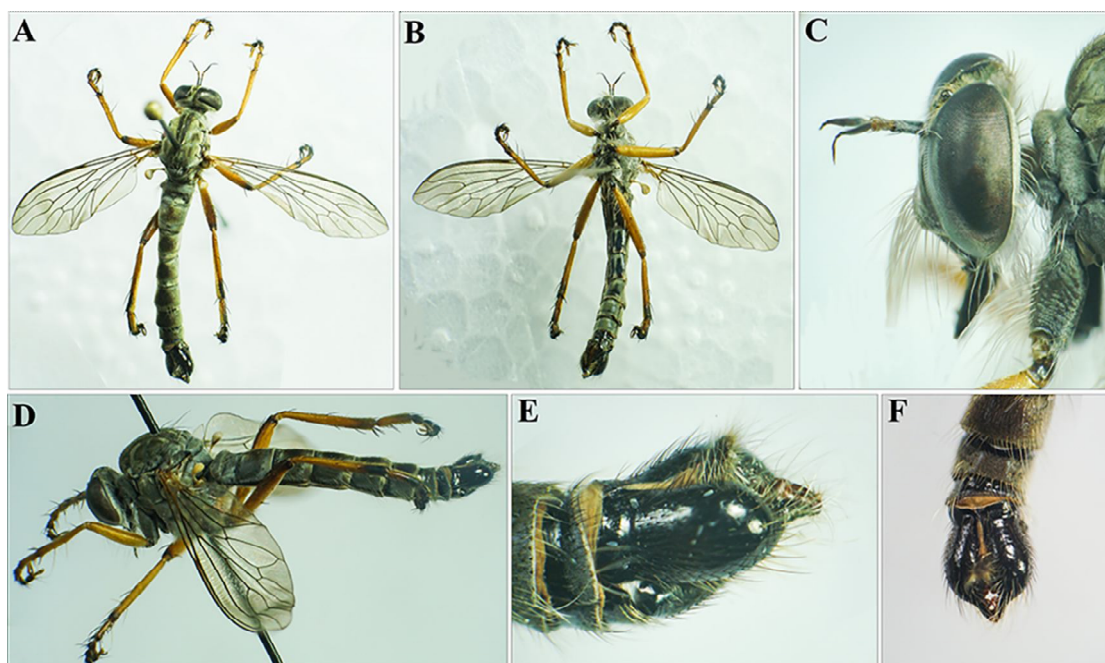
**General distribution:** Austria, former Yugoslavia, Germany, Spain (Geller-Grimm *et al.*, 2016).

**Diagnostic characters (male) (Fig. 2, A-F):** The black 3<sup>rd</sup> antenna segment (postpedicel) is shorter than the two basal segments combined (scape + pedicel); wings light with

gray opacity at the tip and rear edge (Fig. 2A, 2B, 2D); hypopygium shiny black (Fig. 2E, 2F); coxa and trochanter black (Fig. 2B); sternites mainly shiny (Fig. 2B) (Engel, 1930).

***Philodicus ponticus* (Bigot, 1880)**

**Material examined.** Alborz province: Karadj (35°46'20" N, 50°56'44" E), 1278 m, 20.7.2012, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Guilan province: Roodsar, Rahimabad, Orkom (36°45'44" N, 50°18'11" E), 1201 m, 16.8.2010, 1♂, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E), 490 m, 18.6.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Mazandaran province: Tangevaz (36°21'55" N, 52°06'10" E), 702 m, 5.7.2012, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Tehran province: Shahriar (35°40'08" N, 50°56'56" E), 1168 m, 16.7.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Qazvin province: Tarum (36°40'12" N, 50° 26'24" E), 290 m, 12.9.2011, 1♂, Leg.: A. Nadimi and M. Kheyrandish.



**Figure 2** *Neomochtherus schineri* (Egger, 1855), A-F: Male. A: general habitus, dorsal view; B: general habitus, ventral view; C: head, lateral view; D: general habitus, lateral view; E: genitalia, lateral view; F: genitalia, dorsal view.

**Distribution in Iran:** Fars (Saghaei *et al.*, 2009; Tomasovic and Saghaei, 2009), Golestan (Hayat *et al.*, 2008), Guilan (Hayat *et al.*, 2008, current study), Kerman, Khorasan (Becker and Stein, 1913), Khuzestan (Ghahari *et al.*, 2007b), Mazandaran (Ghahari *et al.*, 2007b, current study), Sistan and Baluchestan (Becker and Stein, 1913; Oldroyd, 1958), Iran (no locality cited) (Engel, 1930; Theodor, 1980), Alborz, Tehran, and Qazvin provinces (current study).

**General distribution:** Afghanistan, Azerbaijan, Greece, Iraq, Israel, Soviet Middle Asia, South European territory, Turkey (Geller-Grimm *et al.*, 2016).

#### ***Satanas gigas* (Eversmann, 1855)**

**Material examined.** Alborz province: Karadj (35°46'08" N, 50°56'55" E), 1277 m, 25.8.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Guilan province: Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E), 490 m, 25.8.2016, 1♂, Leg.: R. Mohammadi; Qazvin province: Avan Lake (36°28'36" N, 49°25'36" E), 1818 m, 17.5.2018, 1♂, Leg.: R. Mohammadi.

**Distribution in Iran:** Fars (Saghaei *et al.*, 2009; Tomasovic and Saghaei, 2009), Kerman, Khorasan (Becker and Stein, 1913), Mazandaran (Ghahari *et al.*, 2007b), Semnan (Hayat *et al.*, 2008; Sakenin *et al.*, 2010), Sistan and Baluchestan (Becker and Stein, 1913; Oldroyd, 1958), Iran (no locality cited) (Engel, 1930), Alborz, Guilan and Qazvin provinces (current study).

**General distribution:** Algeria, Azerbaijan, China, Egypt, Greece, Israel, Kazakhstan, Libya, Mongolia, Romania, Russia, Turkey (Geller-Grimm *et al.*, 2016).

#### **Subfamily Brachyropalinae Hardy, 1926**

##### ***Habropogon longiventris* Loew, 1847**

**Material examined.** Guilan province: Roodsar, Rahimabad, Orkom (36°45'44" N, 50°18'11" E), 1201 m, 16.8.2010, 1♂, 1♀, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Sistan and Baluchestan (Hayat *et al.*, 2008), Tehran (Abbassian-lintzen, 1964a) and Guilan province (current study).

**General distribution:** France, Greece, Israel, Russia, Transcaucasia, Turkey, Ukraine (Geller-Grimm *et al.*, 2016).

##### ***Heteropogon ornatipes* Loew, 1851**

**Material examined.** Guilan province: Roodsar, Rahimabad, Orkom (36°45'44" N, 50°18'11" E), 1201 m, 16.8.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish.

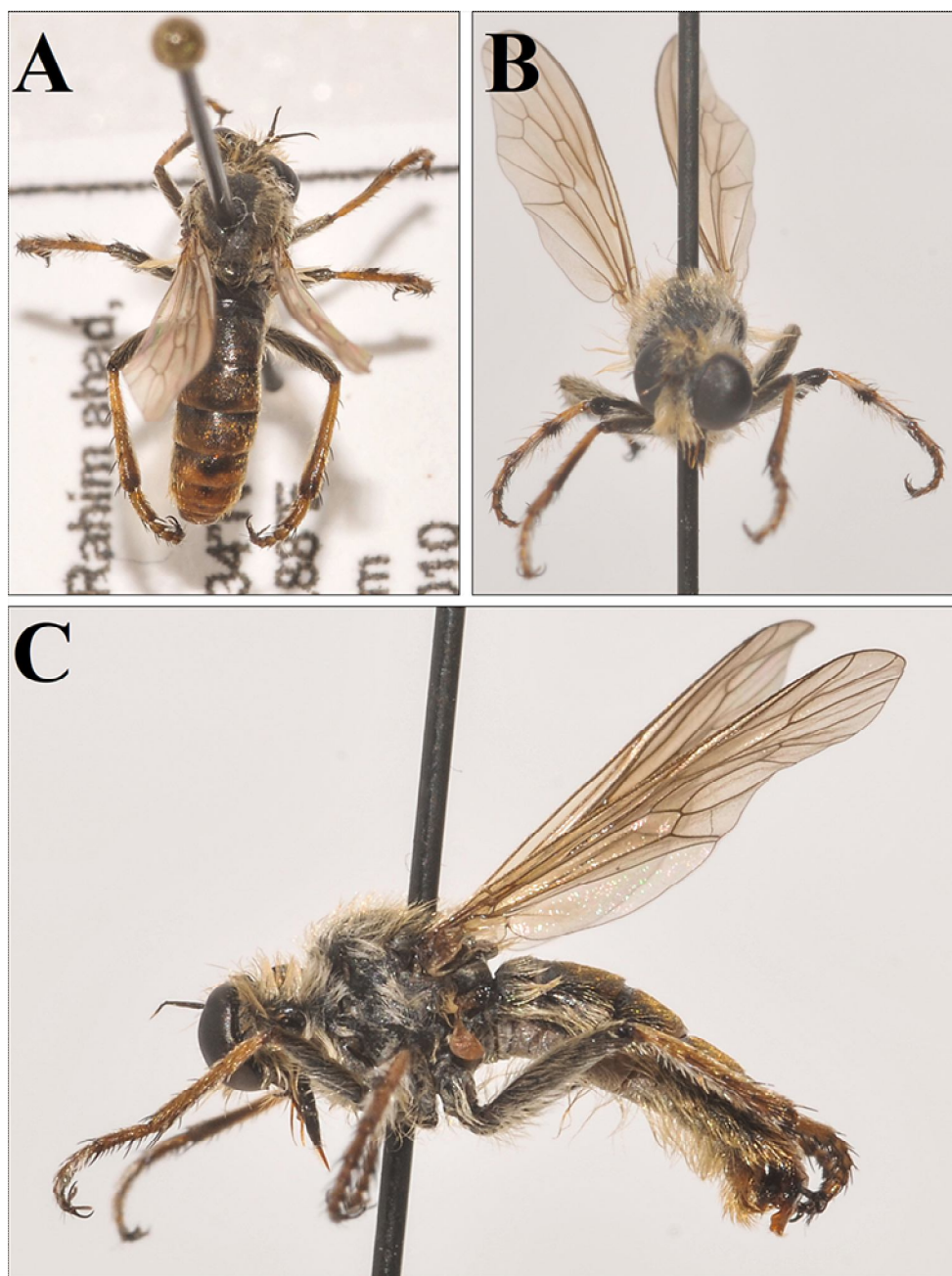
**Distribution in Iran:** Guilan province (current study). **New record for Iran.**

**General distribution:** Albania, Bulgaria, former Yugoslavia, Greece, Israel, Russia, Transcaucasia, Turkey, Ukraine (Sakhvon and Lelej, 2018).

**Diagnostic characters (Male) (Fig. 3, A-C):** Body length 13.0–16.0 mm.; small brown or dark brown species; lateral parts of occipit greatly convex; maxillary palpus large, swollen; proboscis pointed at the apex (Fig. 3C); mid tibia with dense white setae not reaching basitarsus and with a conspicuous tuft of black setae in the middle in male; scutum with short white and black setae; scutellum with 2–4 apical scutellar macrosetae; femora dark brownish, tibiae yellowish-brown, tarsi reddish yellowish-brown and slightly darker (Fig. 3, A-C) (Sakhvon and Lelej, 2018).

##### ***Pycnopogon fasciculatus* (Loew, 1847)**

**Material examined.** Guilan province: Roodsar, Rahimabad, Ziaz (36°52'34" N, 50°13'17" E), 537m, 4.6.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ziaz (36°52'27.18" N, 50°13'24" E), 490 m, 15.6.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ghazichak (36°45'52" N, 50°20'01" E), 1787m, 4.6.2010, 1♂, 2♀♀, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ghazichak (36°45'57" N, 50°19'35" E), 1803 m, 3.8.2010, 1♂, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Ghazichak (36°45'52" N, 50°20'01" E), 1787m, 5.7.2010, 2♀♀, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Orkom (36°45'44" N, 50°18'11" E), 1201 m, 9.6.2010, 2♂♂, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Qazvin province: Alamut (36°25'24" N, 50°34'18" E), 1684 m, 15.5.2018, 2♂♂, Leg.: R. Mohammadi; Qazvin-Zereshk road (36°28'30" N, 50°08'36" E), 1997 m, 10.5.2018, 1♀, Leg.: R. Mohammadi.



**Figure 3** *Heteropogon ornatipes* Loew, 1851, A-C: Male. A: general habitus, dorsal view; B: general habitus, fronto-lateral view; C: general habitus, lateral view.

**Distribution in Iran:** Golestan, Mazandaran (Lehr *et al.*, 2007), Guilan, and Qazvin provinces (current study).

**General distribution:** Albania, Algeria, Azerbaijan, Bulgaria, Czech Republic, France, Greece, Israel, Italy, Morocco, Romania, Spain,

Syria, Tunisia, Turkey (Geller-Grimm *et al.*, 2016).

**Subfamily Dasypogoninae Macquart, 1838**

***Dasypogon magisi* Tomasovic, 1999**

**Material examined.** Guilan province: Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E),

490 m, 4.6.2010, 2♂♂, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Fars (Tomasovic, 1999; Saghaei *et al.*, 2009; Tomasovic and Saghaei, 2009), Guilan (current study).

**General distribution:** Iraq (Ghahari *et al.*, 2014).

#### ***Saropogon megrimensis* Richter, 1966**

**Material examined.** Guilan province: Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E), 490 m, 18.6.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** East Azerbaijan (Mohammadi *et al.*, 2017), Guilan (current study).

**General distribution:** Armenia (Geller-Grimm *et al.*, 2016).

#### **Subfamily Dioctriinae Enderlein, 1936**

##### ***Dioctria arnoldii* Richter, 1964**

**Material examined.** Mazandaran province: Gaznasara (36°16'58" N, 52°10'55" E), 2013 m, 3.8.2012, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Gaznasara (36°16'56" N, 52°10'58" E), 2032 m, 18.6.2012, 1♂, 2♀♀, Leg.: A. Nadimi and M. Kheyrandish; Jorband (36°26'15" N, 52°07'13" E), 275 m, 3.8.2012, 1♂, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Guilan (Mohammadi *et al.*, 2019), Mazandaran (current study).

**General distribution:** Armenia, Azerbaijan, Georgia (Lehr, 1988, 2002).

#### **Subfamily Laphriinae Macquart, 1838**

##### ***Choerades femorata* (Meigen, 1804)**

**Material examined.** Alborz province: Karadj (35°46'08" N, 50°56'55" E), 1277 m, 8.7.2010, 2♀♀, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Alborz province (current study). **New record for Iran.**

**General distribution:** Austria, Czech Republic, Germany, Slovakia (Geller-Grimm *et al.*, 2016).

**Diagnostic characters (female) (Fig. 4, A-C):** Face in the lower part bearing few long, strong setae and short pile; face of females with yellow hair (Fig. 4, A-C); first antennal segment 3.4-4.0 times as long as the second segment; mesonotal pile short, addressed; tergites scantily covered with hair, exclusive of the hind corners, which have yellow hair (tergites have the appearance of being bare), the hair is directed from the front

corners to the hind middle of each tergite (Fig. 4C) (Geller-Grimm *et al.*, 2016).

##### ***Laphria caspica* Hermann, 1906**

**Material examined.** Tehran province: Shahriar (35°40'08" N, 50°56'56" E), 1168 m, 16.7.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Guilan (Mohammadi *et al.*, 2019), Tehran province (current study).

**General distribution:** Rumania, Transcaucasia (Richter, 1988).

##### ***Laphria dizonias* Loew, 1847**

**Material examined.** Guilan province: Roodsar, Rahimabad, Ziaz (36°52'27" N, 50°13'24" E), 490 m, 4.6.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** Fars (Abbassian-Lintzen, 1964a; Saghaei *et al.*, 2009; Tomasovic and Saghaei, 2009), Southern Iran (no locality cited) (Abbassian-Lintzen, 1964a), Guilan province (current study).

**General distribution:** Armenia, Azerbaijan, Greece, Iraq, Israel, Turkey (Geller-Grimm *et al.*, 2016).

##### ***Psilocurus hypopygialis* (Paramonov, 1930)**

**Material examined.** Mazandaran province: Babol, Sareh (36°13'21" N, 52° 37'48" E), 484 m, 21.7.2015, 1♂, Leg.: R. Mohammadi.

**Distribution in Iran:** Khuzestan (Oldroyd, 1958; Abbassian-Lintzen, 1964a), Mazandaran province (current study).

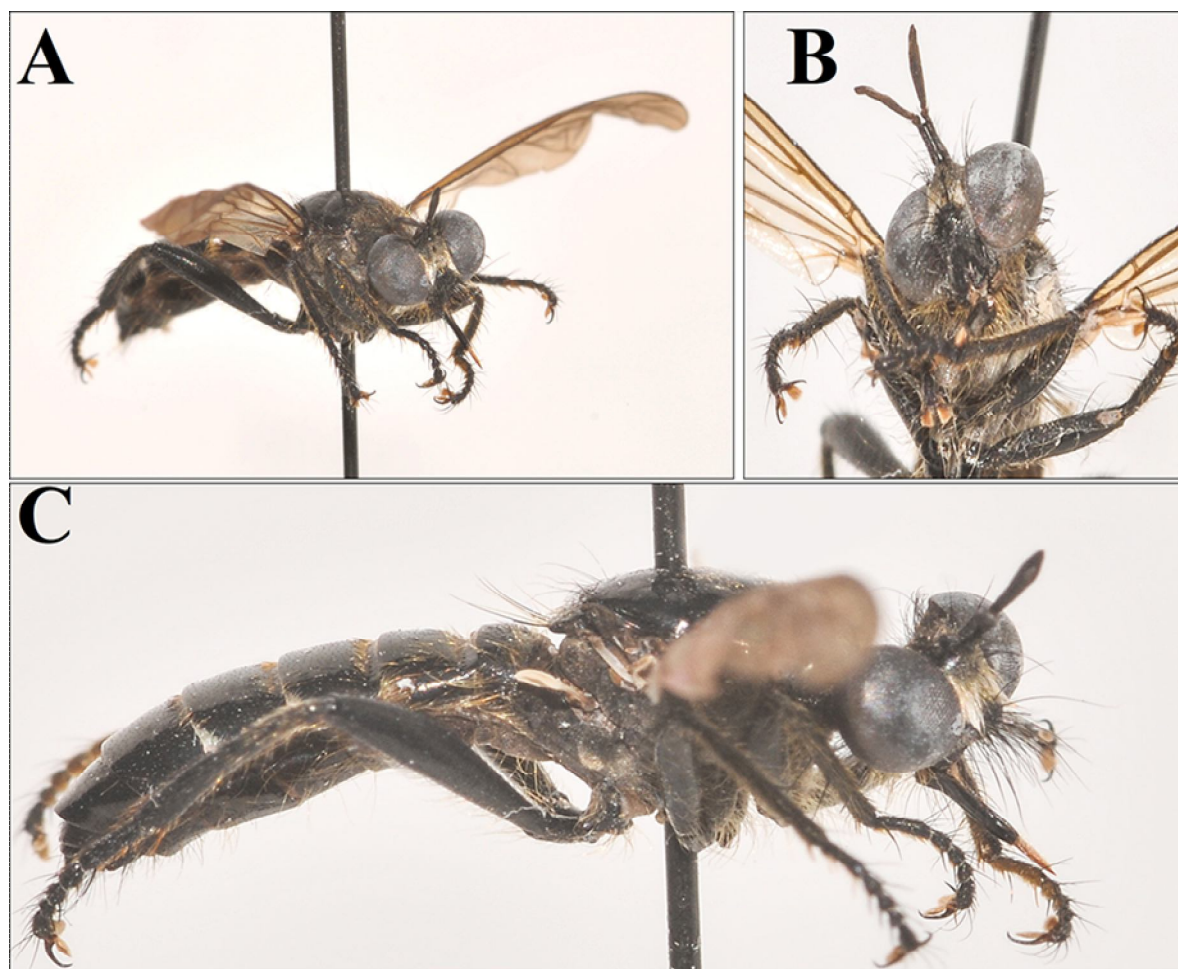
**General distribution:** Armenia, Azerbaijan, Iraq, Turkmenistan (Geller-Grimm *et al.*, 2016).

#### **Subfamily Leptogastrinae Schiner, 1862**

##### ***Leptogaster cylindrica* (De Geer, 1776)**

**Material examined.** Alborz province: Karadj (35°46'08" N, 50°56'55" E), 1277 m, 2.8.2014, 2♂♂, Leg.: R. Mohammadi; Guilan province: Roodsar, Rahimabad, Ghazichak (36°45'52" N, 50°20'01" E), 1787 m, 5.7.2010, 1♂, Leg.: A. Nadimi and M. Kheyrandish; Roodsar, Rahimabad, Orkom (36°45'44" N, 50°18'11" E), 1201 m, 16.8.2010, 1♀, Leg.: A. Nadimi and M. Kheyrandish; Mazandaran province: Babol, Sareh (36°14'33" N, 52° 37'18" E), 395m, 8.8.2014, 2♀♀, Leg.: A. Nadimi and M. Kheyrandish.





**Figure 4** *Choerades femorata* (Meigen, 1804), A-C: Female. A: general habitus, fronto-lateral view; B: head, the ratio of scape to pedicel; C: general habitus, lateral view.

**Distribution in Iran:** Fars (Saghaei et al. 2009), Alborz, Guilan, and Mazandaran provinces (current study).

**General distribution:** Albania, Algeria, Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, former Yugoslavia, Germany, Greece, Hungary, Italy, Kazakhstan (incl. Turkistan), Luxembourg, Mongolia, Norway, Poland, Romania, Russia (Central, North and South European Territory, East and West Siberia, Far East), Soviet Middle Asia, Spain, Sweden, Switzerland, The Netherlands, Transcaucasia, Turkey, United Kingdom (Geller-Grimm *et al.*, 2016).

**Subfamily Stenopogoninae Hull, 1962**

***Stenopogon sciron superbus* (Portschinsky, 1873)**

**Material examined.** Guilan province: Roodsar, Rahimabad, Ghazichak (36°45'52" N, 50°20'01" E), 1787 m, 25.8.2013, 1♂, Leg.: A. Nadimi and M. Kheyrandish.

**Distribution in Iran:** East Azarbaijan, West Azarbaijan (Shoeibi and Karimpour, 2010), Sistan and Baluchestan (Oldroyd, 1958), Guilan province (current study).

**General distribution:** Afghanistan, former South European territory, Kirgizstan, Transcaucasia (Geller-Grimm *et al.*, 2016).

**Subfamily Stichopogoninae Hardy, 1930**

***Stichopogon elegantulus* (Wiedemann in Meigen, 1820)**

**Material examined.** Qazvin province: Garmarod (36°24'06" N, 50°32'30" E), 1354 m, 8.5.2018, 1♀, Leg.: R. Mohammadi.

**Distribution in Iran:** East Azarbaijan, Golestan, Sistan, and Baluchestan (Ghahari *et al.*, 2007a).

**General distribution:** Algeria, Armenia, Austria, Azerbaijan, Bulgaria, Egypt, former South European territory, former Yugoslavia, France (Corse), Georgia, Germany, Hungary, Israel, Italy, Kirgizstan, Malta, Morocco, Portugal, Spain, Transcaucasia, Turkey (Geller-Grimm *et al.*, 2016).

## Discussion

In this study, materials from five northern provinces of Iran (including Alborz, Guilan, Mazandaran, Tehran, and Qazvin) were studied. A total of 25 species were collected and identified, of which four species are recorded for the first time from Iran. Some species are new records from northern provinces of the country (Alborz, five species; Guilan, 15 species; Mazandaran, five species; Qazvin eight species; Tehran, four species). Our findings showed that the most species-rich genus was *Dysmachus* (three species) followed by *Antifrisson* and *Laphria* (each genus with two species). The genus *Dysmachus* Loew, 1860 belonged to the subfamily Asilinae with more than 70 species worldwide, is one of the species-rich genera of the family (Geller-Grimm *et al.*, 2016). The members in both juvenile and adult stages are predators of other insects, mainly Diptera and Hymenoptera (Lehr *et al.*, 2007). They are often found in thick grass in forest clearings, meadows, along river banks, near ditches, and around the headlands of fields (Lehr, 1996; Lehr *et al.*, 2007). The first study on the taxonomy of the genus *Dysmachus* in Iran was conducted by Lehr *et al.* (2007), who recorded ten species from Golestan, Fars, Isfahan, Mazandaran, and Tehran provinces. Then, Mohammadi *et al.* (2017) added another new record of this genus for the Iranian fauna. According to a new record in the present study, the number of species of this genus has increased to 12 species in Iran.

The most abundant species was *Aneomochtherus mundus* (31 specimens, 29 %) followed by *Pycnopogon fasciculatus* (15 specimens, 14 %).

All studies conducted in recent years have led to the reporting of several new records and species from Iran, and the number of Asilidae in Iran have significantly increased (Lehr *et al.*, 2007; Ghahari *et al.*, 2007a, 2007b; Hayat *et al.*, 2008; Tomasovic and Saghaei, 2009; Shoeibi and Karimpour, 2010; Samin *et al.*, 2010; Ghahari *et al.*, 2014; Mohammadi and Khaghaninia, 2015, 2016; Mohammadi *et al.*, 2017, 2018, 2019, 2020). By adding the findings of this article, it seems that the fauna of Asilidae in Iran includes 308 species. The number of Iranian species of the family Asilidae compared with adjacent countries is as follows: 35 species in Armenia, 237 species in Turkey, 53 species in Azerbaijan, and 16 species in Turkmenistan (Geller-Grimm *et al.*, 2016; Tezcan, 2020).

Due to Iran is located at the crossing of three ecological zones (the Palearctic, Afrotropical and the Oriental) and having a rich fauna and flora (Kiani *et al.*, 2017), many species of robber flies are found in this region. However, many Iran provinces have not yet been fully sampled; it is expected that further studies will significantly increase the number of Asilidae in Iran.

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## Declaration of conflicting interests

The authors state that there is no conflict of interest.

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## مطالعه دوبالان خانواده (Asilidae (Diptera: Asilioidea) در شمال ایران، به همراه چهار رکورد جدید برای کشور

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**چکیده:** در این مطالعه، نمونه‌برداری از مناطق شمالی ایران با استفاده از تور حشره‌گیری و تله‌ی مالیز طی سال‌های ۲۰۱۹-۲۰۲۰ انجام شد. در مجموع ۲۵ گونه جمع‌آوری و شناسایی شدند که چهار گونه از آن‌ها برای اولین بار از ایران گزارش می‌شوند: *Dysmachus dentiger*، *Choerades femorata* (Meigen, 1804) و *Heteropogon ornatipes* Loew, 1851. Richter, 1962. علاوه بر این، هشت گونه برای استان‌های شمالی ایران رکوردهای جدیدی هستند. پراکنش محلی و جهانی هر ۲۵ گونه و همچنین ویژگی‌های افتراقی و عکس‌های تکمیلی از رکوردهای جدید برای ایران ارائه شده است.

**واژگان کلیدی:** Asilidae، شمال ایران، دزدمگس‌ها، گزارش‌های جدید