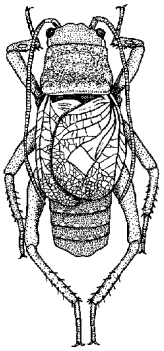

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NEW RECORDS OF ROBBER FLIES (DIPTERA, ASILIDAE) FOR THE IRANIAN FAUNA WITH THEIR PREY RECORDS

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Sixteen species of robber flies were encountered for the first time in Iran. Distributional data and prey records for each species are included.

KEY WORDS: Diptera, Asilidae, robber flies, fauna, prey, new record, Iran.

Х. Гахари[1)], П.А. Лер[2)], Дж. Лавинь[3)], Р. Хаят[4)], Г. Остован[5)]. Новые для фауны Ирана ктыри (Diptera, Asilidae) с указанием их добычи // Дальневосточный энтомолог. 2007. N 179. С. 1-9.

Впервые для Ирана указано 16 видов мух-ктырей. Для каждого вида приведены их добыча и сведения по распространению.

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INTRODUCTION

The robber flies or assassin flies (Diptera: Asilidae) are an abundant and diverse family in all zoogeographical regions. Asilidae diversity can be attributed to their broad distribution; most species tend to occupy a selective niche. As their common name implies, robber flies have voracious appetites and feed on a vast array of other arthropods, which may help to maintain a healthy balance between insect populations in various habitats (Joern & Rudd, 1982; Shurovnekov, 1962). The knowledge of all aspects of their biology is of importance in our understanding of arthropod communities in general. Such knowledge impacts on the management and conservation of major components of our biodiversity (Londt, 2006).

Asilidae are diurnal insects. They are generally found where their potential prey are active in sunny habitats, mainly during the hottest part of the day. Some species rest on the ground, others sit on the stems of plants vertically while others sit at the tips of branches, resting or waiting for their prey to pass by. They capture their prey in flight seizing the prey dorsally with their tarsi in such a fashion that stinging insects, for example, are unable to defend themselves. Then the piercing organ (hypopharynx) is inserted, primarily in the dorsal surface of the prey's thorax. Subsequently this organ is reinserted between the prey's head and thorax or into the abdomen so that the internal contents of the prey can more easily be obtained. After insertion, the prey is immobilized by the injection of saliva. Kahan (1964) showed that the secretion of the salivary glands is toxic, the toxicity of the venom varying in the different species. Part of the secretion of one gland killed a 1.0 g heavy *Locusta migratoria* (Linnaeus, 1758) (Orthoptera: Acrididae). The venom of 4 glands of *Promachus sinaiticus* Efflatoun, 1934 killed a White Mouse of 20 g weight after one day, that of 16 glands in 2 hours. The highest toxicity was found in *Promachus leoninus* Loew, 1848 (lethal dose for *Locusta*, 1/128 of a gland). The lethal dose for *L. migratoria* varied from 1/4 to 1/32 of a gland in other species. The toxin is apparently neurotoxic (Hayat, 1997).

The prey is then injected with a second type of saliva containing enzymes, which dissolve internal muscles so that the asilid is able to suck out the liquefied contents (Majer, 1987, 1990). The length of time spent feeding is positively correlated with size of the prey (Dennis, 1979; Dennis & Lavigne, 1979).

Most robber fly species are non-selective in their choice of prey, taking whatever insect strays into their hunting zone. Insects of several orders serve as prey as well as other arthropods, such as spiders, rarely ticks. Oligophages also exist: *Ancylorhynchus glaucius* (Rossi, 1790) feeds only on bugs; *Pegesimallus mesasiaticus* (Lehr, 1958) attacks only ant workers (Lehr, 1988). Within our region, Hayat (1997) has recorded prey records for many Turkish Asilidae. Worldwide, Lavigne (2003) has recorded 13,645 prey records for the vast array of asilid species. Londt (2006) has provided an analysis of the 2000 prey taken by African asilids.

Asilid larvae feed on the larvae of various insects or (rarely) the eggs in locust oothecae, and move actively to seek prey. For instance, young larvae of *Machimus annulipes* (Brullé, 1832) feed on black hunters while more mature larvae feed on the larvae of scarabaeid beetles. The entire development of some species may be associated with a single prey item. Larvae can live without food for an extended time (in such cases, the osmotic absorption of soil water with dissolved organic substances may be observed), and the complete developmental cycle lasts for 1-3 years (Lehr, 1988). Shurovnekov (1958, 1962) found that 35 to 82% of the larvae of *Anisoplia* (Coleoptera: Scarabaeoidea) were destroyed by *Epitriptus cingulatus* (Fabricius, 1781) in southern Russia in some years.

Studies on Asilidae in Iran have been very limited and sporadic. Becker (1913) reported on the entomological results of the expeditions of N.A. Zarudny 1898 and 1901 to Persia which included a listing of some species of Asilidae. A preliminary list of the Iranian asilid fauna was published by Abbassian-Lintzen (1964a) followed by a brief paper on the genus *Eremisca* (Abbassian-Lintzen, R. 1964b). Following Abbassian-Lintzen's contributions, no one worked on the Iranian fauna until Lehr et al. (2007) provided data for some species of Iranian asilids in the subfamilies Stenopogoninae and Asilinae. This paper provides new records for Asilidae in Iran along with data on prey taken by these species.

MATERIALS AND METHODS

Asilids and their prey were collected at various localities in Iran during the period 1997–2002. They were captured by sweep net either in flight or when they were landing on the substrate. Additionally, many specimens were obtained on loan from different entomological laboratories in Iranian universities. Also, specimens in different museums, especially SZMN, St. Petersburg, and Paris, were examined. These latter specimens had been identified by Tsacas (1968), Hull (1962), Theodor (1980) and Lehr (1991). Distributional data for regions outside Iran was obtained from Geller-Grimm (2005). All specimens collected during this study have been deposited in the collection of the 2nd author. Identifications of prey were provided by several specialists: Dr. Yavuz A. Kýlýc of Turkey (Tabanidae), Dr. V.V. Dubatolov of Russia and Dr. Toshko Ljubomirov of Bulgaria (Sphecidae), Dr. Vladimir Tichy of Czech Republic (Tenebrionidae), Dr. Vladimir Ivanov of Russia and Dr. Erol Yildirim of Turkey (Vespidae), Dr. René M. Richet of France (Sarcophagidae), Dr. Yu. M. Marusik of Finland (Aranei), Dr. Murat Aslan of Turkey (Coccinellidae), Dr. Jan Bezdek of Czech Republic (Chrysomelidae), and Dr. Ales Bezdek of Czech Republic (Scarabaeidae).

LIST OF THE SPECIES

This study has added 16 species to the list of Iranian asilids in the following subfamilies: Apocleinae (2), Dasypogoninae (4), Laphriinae (6), Laphystiinae (1), Leptogastrinae (1), Ommatiinae (1) and Stichopogoninae (1). The species are listed below with their prey records and distributional data.

Subfamily Apocleinae Papavero, 1973

Promachus microlabis Loew, 1857

MATERIAL EXAMINED: Isfahan prov., Koohpayeh (1755 m), 1♂, 2♀, August 1997; predator of *Eristalis tenax* (Linnaeus, 1758) (Diptera: Syrphidae) and *Tabanus tergestinus* Egger, 1859 (Diptera: Tabanidae).

DISTRIBUTION OUTSIDE IRAN: Syria, Turkey, Cyprus.

Subfamily Dasypogoninae Macquart, 1838

Leptarthrus brevirostris (Meigen, 1804)

MATERIAL EXAMINED: Mazandaran prov., Nooshahr (Sisangan Park) (48 m), 2♀, May 1998; predator of *Volucella inanis* (Linnaeus, 1758) (Diptera: Syrphidae). Golestan prov., Maraveh Tappeh (218 m), 1♂, July 1999; predator of *Polistes dominulus* (Christ, 1791) (Hymenoptera: Vespidae).

DISTRIBUTION OUTSIDE IRAN: Austria, Albania, Bulgaria, Czech Republic, Slovakia, Germany, Denmark, France, Great Britain, Italy, Romania, Sweden, former Yugoslavia, Russia (central European territory), Turkey.

Paraphamartania syriaca (Schiner, 1867)

MATERIAL EXAMINED: Tehran prov., Varamin (924 m), 2♂, July 2000; predator of *Chrysolina coerulans* Scribe, 1791 (Coleoptera: Chrysomelidae). Semnan prov., Damghan (1326 m), 2♀, August 2002; predator of *Thomisus onustus* (Walckenaer, 1805) (Aranei).

DISTRIBUTION OUTSIDE IRAN: Kazakhstan, Syria, Greece, Israel, Turkey.

Saropogon platynotus (Loew, 1847)

MATERIAL EXAMINED: Mazandaran prov., Behshahr (57 m), 1♂, 2♀, April 1998; predator of *Philanthus triangulum* (Fabricius, 1775) (Hymenoptera: Crabronidae). Golestan prov.: National Park (110 m), 1♂, August 1999; predator of *Ectemnius continuus* (Fabricius, 1804) (Hymenoptera: Crabronidae).

DISTRIBUTION OUTSIDE IRAN: Turkey.

Saropogon pollinosus Loew, 1869

MATERIAL EXAMINED: Isfahan prov., Shahr-e-Za (1828 m), 1♂, October 2000; predator of *Philipomyia aprica* (Meigen, 1820) (Diptera: Tabanidae). Tehran prov., Firoozkooh (1909 m), 1♂, 1♀, April 2001; predator of *Polistes* (*Megapolistes*) *wattii* Cameron, 1900 (Hymenoptera: Vespidae).

DISTRIBUTION OUTSIDE IRAN: Spain, Turkey, Tunisia, Egypt.

Subfamily Laphriinae Macquart, 1838

Choerades loewi Lehr, 1991

MATERIAL EXAMINED: Yazd prov., Meibod (1090 m), 2♂, 2♀, August 1998; predator of *Sarcophaga* (*Sarcophaga*) *lehmani* Mueller, 1922 (Diptera: Sarcophagidae), and *Tabanus autumnalis* Linnaeus, 1761 (Diptera: Tabanidae).

DISTRIBUTION OUTSIDE IRAN: Greece, Turkey.

Choerades ursula (Loew, 1851)

MATERIAL EXAMINED: Khorasan prov., Birjand (1434 m), 2♂, July 1999; predator of *Chalybion walteri* (Kohl, 1889) (Hymenoptera: Sphecidae). Kerman prov., Kahnooj (485 m), 1♂, September 2000; predator of *Sphex leuconotus* Brullé, 1833 (Hymenoptera: Sphecidae). Isfahan prov., Isfahan (1551 m), 1♂, 1♀, October 2000; predator of *Podalonia tydei* (Le Guillou, 1841) (Hymenoptera: Sphecidae).

DISTRIBUTION OUTSIDE IRAN: Russia (West and East Siberia), Turkey.

Laphria aurea (Fabricius, 1794)

MATERIAL EXAMINED: Mazandaran prov., Ghaemshahr (44 m), Sari (25 m), 2♂, 3♀, April 1997; predator of *Oxythyrea cinctella* (Schaum, 1841) (Coleoptera: Scarabaeidae). Semnan prov., Damghan (1326 m), 2♂, 1♀, October 2000; predator of *Cephalostenus elegans* Brullé, 1832 (Coleoptera: Tenebrionidae). Qom prov., Qom (1468 m), 1♂, August 2001; predator of *Coccinella septempunctata septempunctata* Linnaeus, 1758 (Coleoptera: Coccinellidae).

DISTRIBUTION OUTSIDE IRAN: Austria, Bulgaria, France, Greece, Hungary, Italy, Romania, Czech Republic, Slovakia, former Yugoslavia, Russia (south European territory), Israel, Turkey.

COMMENT: *Laphria aurea* is a powerful predator of *Oxythyrea cinctella*, a serious pest of citrus in Northern Iran.

Laphria gibbosa (Linnaeus, 1758)

MATERIAL EXAMINED: Khorasan prov., Bojnord (1♀, 1♂), September 1999; predator of *Gonocephalum freudei* Kaszab, 1969 (Coleoptera: Tenebrionidae). Yazd prov., Abarkooh (1♂), June 1998; predator of ladybird beetle, *Coccinella septempunctata septempunctata* Linnaeus, 1758 (Coleoptera: Coccinellidae).

DISTRIBUTION OUTSIDE IRAN: Austria, Belgium, Switzerland, Czech Republic, Slovakia, Germany, Denmark, Spain, France, Great Britain, Italy, Norway, Poland, Romania, Sweden, Finland, former Yugoslavia, Russia (north, central and south European territory, West and East Siberia), Kazakhstan, Turkey.

Andrenosoma serratum Hermann, 1906

MATERIAL EXAMINED: Semnan prov., Shahrood (1311 m), 2♂, 1♀, April 1998; predator of *Allodynerus floricola* (Saussure, 1853) (Hymenoptera: Vespidae). Guilan prov., Talesh (77 m), 2♂, June 2001; predator of *Parapolybia escalerae* (Meade-Waldo, 1911) (Hymenoptera: Vespidae).

DISTRIBUTION OUTSIDE IRAN: Turkey.

Pogonosoma maroccanum (Fabricius, 1794)

MATERIAL EXAMINED: Mazandaran prov., Savadkooh (550 m), 1♂, September 1997; predator of *Podalonia hirsuta* (Scopoli, 1763) (Hymenoptera: Sphecidae). Semnan prov., Shahrood (1311 m), 1♂, 1♀, August 1999; predator of *Ischnogasteroides picteti picteti* (Saussure, 1852) (Hymenoptera: Vespidae).

DISTRIBUTION OUTSIDE IRAN: Austria, Albania, Bulgaria, Czech Republic, Slovakia, Germany, France, Greece, Hungary, Italy, Poland, Romania, former Yugoslavia, Russia (central and south European territory), Turkey, Morocco, Algeria, Malta.

Subfamily Laphystiinae Hendel, 1936

Laphystia sabulicola Loew, 1847

MATERIAL EXAMINED: Fars prov., Abade (1997 m), 2♀, August 2000; predator of *Palmodes occitanicus puncticollis* (Kohl, 1888) (Hymenoptera: Sphecidae). Isfahan prov., Shahin-Shahr (1551 m), 2♂, August 1997; predator of *Cephus pygmaeus* (Linnaeus, 1767) (Hymenoptera: Cephidae).

DISTRIBUTION OUTSIDE IRAN: Austria, Greece, Italy, former Yugoslavia, Turkey, Kazakhstan, Uzbekistan, Turkmenia, Tajikistan, China, Tunisia.

Subfamily Leptogastrinae Schiner, 1862

Leptogaster calceata Engel, 1925

MATERIAL EXAMINED: Kordestan prov., Sanadaj (1500 m), 2♀, July 2000; predator of *Chalybion flebile* (Lepeletier, 1845) (Hymenoptera: Sphecidae). Ilam prov., Ilam (1403 m), 1♂, September 2000; predator of *Podalonia hirsuta* (Scopoli, 1763) (Hymenoptera: Sphecidae).

DISTRIBUTION OUTSIDE IRAN: Azerbaijan, Armenia, Georgia, Turkey.

Subfamily Ommatiinae Hardy, 1927

Ommatius stackelbergi (V. Richter, 1960)

MATERIAL EXAMINED: Semnan prov., Semnan (1163 m), 1♂, 2♀, April 1998; predator of *Sarcophaga* (*Liopygia*) *argyrostoma* Robineau-Desvoidy, 1830 (Diptera: Sarcophagidae). Tehran prov., Shahr-e-yar (608 m), 1♂, June 2002; predator of *Sarcophaga* (*Liopygia*) *africa* Wiedemann, 1824 (Diptera: Sarcophagidae).

DISTRIBUTION OUTSIDE IRAN: Armenia, Turkey.

Subfamily Stichopogoninae Hardy, 1930

Stichopogon elegantulus elegantulus (Wiedemann in Meigen, 1820)

MATERIAL EXAMINED: Golestan prov., Minoodasht (151 m), 1♂, April 1999; predator of *Bombus* (*Pyrobombus*) sp. (Hymenoptera: Apidae). Sistan & Baluchestan prov., Zahedan (1369 m), 1♀, November 2000; predator of *Delta dimidiatipenne* (Saussure, 1852) (Hymenoptera: Vespidae). East Azarbayjan prov., Arasbaran (778 m), 1♂, June 2001; predator of *Dolichovespula saxonica* (Fabricius, 1793) (Hymenoptera: Vespidae).

DISTRIBUTION OUTSIDE IRAN: Austria, Bulgaria, Germany, Spain, France (Corse), Italy, Hungary, Portugal, former Yugoslavia, Russia (south European territory), Georgia, Armenia, Azerbaijan, Kirgyzstan, Israel, Turkey, Morocco, Algeria, Egypt, Malta.

Subfamily Asilinae Latreille, 1802

Tolmerus tivonensis (Theodor, 1980)

MATERIAL EXAMINED: Golestan prov.: National Park (31 m), 1♂, September 1998; predator of *Hyperaspis femorata* (Motschulsky, 1837) (Coleoptera: Coccinellidae).

DISTRIBUTION OUTSIDE IRAN: Israel, Turkey.

DISCUSSION

In this paper a total of 16 asilid species are recorded for the first time for the Iranian fauna. In addition to these new distribution records, 34 prey records are included in this paper. The following division of the total prey can be made: Hymenoptera 52.94% (Sphecidae + Crabronidae 9, Vespidae 7, Apidae (*Bombus*) 1, Cephidae 1), Diptera 23.52% (Sarcophagidae 3, Syrphidae 2, Tabanidae 3), Coleoptera 20.58% (Coccinellidae 3, Tenebrionidae 2, Scarabaeidae 1, Chrysomelidae 1), and Aranei 2.94% (1 prey). Iran is a large country with various zoogeographical regions and climates, consequently the variety of prey taken by asilid species must be much greater than so far recorded.

Obviously only limited numbers of prey were collected by the 2nd author in relation to the total numbers taken by individual species of asilids. Estimates of numbers of prey taken on a daily basis can be derived from data that deals with the major period of foraging activity, average feeding and inter-feeding times, and the number of robber flies feeding in a given area. Thus, Lehr (1972) hypothesizes that asilids in Russia consume between 9 and 18 prey per day, while Dennis & Lavigne (1975) estimated the theoretical maximum number of prey Wyoming robber flies could devour would be between 6 and 35, depending on size of predator and prey. Additional studies need to be conducted on this topic for the Iranian asilid fauna.

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