J. Ent. Res. Soc., 12(1): 17-26, 2010 *ISSN:1302-0250*

Prey of some Robber Flies (Diptera: Asilidae) in Fars Province, Iran

Nazila SAGHAEI[1] Rüstem HAYAT[2] Hadi OSTOVAN[3] Majid FALLAHZADEH[4]

[1]Department of Plant Protection, Islamic Azad University, Marvdasht Branch, IRAN,
E-mail: nsaghaei@miau.ac.ir
[2]Vice Rector of Ardahan University, 75100 Ardahan, TURKEY
[3]Department of Entomology, Islamic Azad University,
Fars Science and Research Branch, IRAN
[4]Department of Entomology, Islamic Azad University, Jahrom Branch, IRAN

ABSTRACT

In the present research, the prey of asilid species (Diptera, Asilidae) from Fars province, Iran was identified during the years 2006–2008. The prey consisted mainly of Hymenoptera (Sphecidae, Vespidae, Apidae, Chrysididae, Megachilidae and Scoliidae), followed by Diptera (Tabanidae, Syrphidae, Therevidae, Tachinidae and Dolichopodidae), Orthoptera (Acrididae and Gryllidae), Coleoptera (Buprestidae, Alleculidae and Cerambycidae), Hemiptera (Cicadellidae and Coreidae), Neuroptera (Myrmeleontidae) and Odonata (Aeshnidae).

Key words: Asilidae, Diptera, Fars Province, Iran, Predator, Prey

INTRODUCTION

Robber flies (Diptera: Asilidae) are small to very large flies (3-80 mm) (Lehr, 1988), long and slender to short, robust, and bee-like (Wood, 1981). They are spread throughout the world with the exception of polar areas (Bosák & Barták, 2000). Some genera have a nearly world-wide distribution, but most genera are restricted to a zoogeographical region or to parts of it (Theodor, 1980). They are particularly abundant in the warm temperate and tropical areas of the world (Wood, 1981). Robber flies have been reported as preying on multiple orders of insects and some spiders (Londt, 1994; Dennis & Lavigne, 2007). They usually attack other flying insects, capturing them with their strong legs and piercing them with their well-developed proboscis (Londt, 1995). The prey is often larger than the asilid. When an asilid is caught with its prey the latter is invariably paralyzed (Theodor, 1980). Larvae of many genera live in soil while those of the Laphriinae and Laphystiinae usually occur in decaying logs and stumps, where they are predators of the larvae and pupae of other insects (Geller-Grimm, 2002). Lehr (1969), Lavigne & Dennis (1985), Londt (1993, 1994, 1995) and Hayat (1997) have commented on robber flies foraging in different zones within a habitat. Lavigne (2005) produced an Asilidae Predator-Prey Database, which currently contains over

58 thousand prey records. This database includes Londt's (2006) list of 2000 prey of Afrotropical Asilidae. Dennis and Lavigne (2007) recently analyzed hymenopteran prey in the database and added many new records .

Most studies of Iranian Asilidae are very restricted and have been conducted primarily by foreign researchers (Hayat *et al*., 2008). In recent years additional collecting and reporting of the occurrence of Iranian Asilidae has been carried out and currently the number of species of this family recorded in Iran stands at 233 species (Lehr *et al*., 2007; Ghahari *et al*., 2007a, b; Hayat *et al*., 2008; Saghaei *et al*., 2008 and Saghaei *et al*., 2009). However, biological information concerning Iranian species is scant and consists largely of habitat or prey records, ea. studies of Abbassian-Lintzen (1964a). Recently, Lehr *et al*. (2007) and Ghahari *et al*. (2007b) provided lists of Iranian species that had taken prey.

Fars province is located in the south of Iran. It is bordered by the provinces Yazd and Isfahan to the North, Kerman to the East, Bushehr to the West, Kohgiluyeh / Boyer-Ahmed to the Northwest and Hormozgan to the southeast. The location of Fars province is interesting from a biogeographic point of view. The Fars Nature Reserve (GPS coordinates 27°2'-31°4'N, 50°42'-55°36'E) occupies a surface of about 1,333,000 km^2, 12 percent of which is primarily forest with oak and pistachio species predominating; however, no asilids have as yet been collected within the confines of the Reserve. There are three distinct climatic regions in the Fars province. First, the mountainous area of the north and northwest has moderate cold winters and mild summers. Secondly, the central regions, has relatively rainy mild winters, and hot dry summers. The third region located in the south and southeast, has moderate winters and very hot summers. The average temperature of center region of Shiraz is 16.8 °C, ranging between 4.7° and 29.2°C. The geographical and climatic variation of within the province determines plant variation. The objectives of this study were to provide detailed information on the distribution of this family in Fars province, and to make an additional contribution to the knowledge of the Iranian asilid fauna.

MATERIALS AND METHODS

This study is a result of several collection trips to the different locations in Fars province during the years 2006-2008. A white sweep net with a handle about 150 cm long and with a rim about 50 cm in diameter made of fairly heavy wire was used for collecting asilids and their prey. Specimens were captured in flight or when they were landing on the ground.

Asilid identifications were made using published keys of Engel (1930), Oldroyd (1958), Abbasian-Lintzen (1964a, b), Tsacas (1968), Theodor (1980) and Lehr (1964-1996). In this paper we have retained the 11 subfamily classification of Geller-Grimm (2003). All prey items were identified at least to order and family level, and to generic and species level, where possible. Prey specimens were identified by different taxonomic specialists as follows: Dr. Martin Hauser, U.S.A (Therevidae); Dr. Hans-Peter Tschorsnig, Germany (Tachinidae); Dr. Andrej Gorochov, Russia (Gryllidae); Dr. Marc Pollet, Belgium (Dolichopodidae); Dr. André Prost, France

(Myrmeleontidae); Dr. Axel Hochkirch, Germany (Acrididae); Dr. Maurizio Gigli, Italy (Buprestidae); Mohammad Taghizadeh, Iran (Cicadellidae); Dr. Ali Salur, Turkey (*Aeshnidae*); Dr. Till Osten, Germany (Scoliidae); Dr. Abou Fazel Dousti, Iran (Syrphidae); Dr. A. Yavuz Kilic, Turkey (Tabanidae); Dr. Erol Yildirim, Turkey (Vespidae); Dr. Sébastien Patiny, Belgium (Apidae); Dr. Toshko Ljubomirov, Bulgaria and Dr. Wojciech J. Pulawski, U.S.A (Sphecidae); Dr. Rauno E. Linnavuori, Finland (Coreidae) and Dr. Yasemin Güler, Turkey (Megachilidae).

The asilid species and their prey collected have been deposited in the Insect Collection of the Department of Plant Protection, Marvdasht Islamic Azad University, Iran.

RESULTS

The asilid species and their prey collected and identified during this study are listed as follows:

Subfamily Apocleinae Papavero, 1973

Apoclea femoralis (Wiedemann, 1828)

Material Examined: Fars province, Shiraz: Hosein Abad, 18 May 2008, 1 ♂; predator of *Polistes* sp. (Hymenoptera, Vespidae).

Philodicus ponticus (Bigot, 1880)

Material Examined: Fars province, Shiraz: Akbar Abad, 16 July 2007, 1 ♂; predator of *Tabanus leleani* Austen 1920 (Diptera: Tabanidae).

Hayat *et al*. (2008) previously recorded *Vespula germanica* (Fabricius) and *Vespa orientalis* Linnaeus (Hymenoptera: Vespidae) as prey.

Philodicus spectabilis Loew, 1871

Material Examined: Fars province, Jahrom: Hakan, 12 May 2006, 1 ♀; predator of *Goniocercus walkeri* (McLachlan, 1894) (Neuroptera, Myrmeleontidae).

Promachus canus (Wiedemann, 1818)

Material Examined: Fars province, Shiraz: Palayeshgah (*Pinus* forest), 13 May 2007, 1 ♀; predator of *Trachypteris picta* (Fabricius, 1787) (Coleoptera, Buprestidae).

Hayat *et al*. (2008) had previously collected *Podalonia hirsuta hirsuta* (Scopoli, 1763) (Hymenoptera: Sphecidae) as prey in Iran. Hayat & Alaoglu (1996a) and Hayat (1997) recorded *Ontophagus* sp. (Coleoptera: Scarabaeoidea), *Andrena* sp. (Hymenoptera: Andrenidae), and *Apis mellifera* Linnaeus (Hymenoptera: Apidae) as prey in Turkey. Ozbek & Hayat (1999) recorded this species as an *Apis mellifera* Linnaeus hunter in Turkey.

Subfamily Asilinae Latreille, 1802

Aneomochtherus macropygus (Tsacas, 1968)

Material Examined: Fars province, Estahban (*Ficus carica* forest), 14 May 2008, 1 ♀; predator of *Philanthus triangulum* (Fabricius, 1775) (Hymenoptera, Sphecidae).

Aneomochtherus mundus (Loew, 1849)

Material Examined: Fars province, Shiraz: Kaftarak, 5 November 2007, 1 ♀; predator of *Salentia* sp. (Diptera, Therevidae).

Hayat *et al*. (2008) previously recorded grasshoppers, especially *Acridella robusta* Uvarov (Orthoptera: Acrididae) as prey**.**

Aneomochtherus ochriventris caucasicus (Tsacas, 1968)

Material Examined: Fars province, Fasa: Main-Jangle (*Amygdalus scoparia* forest), 12 August 2006, 1 ♂; predator of *Phyllomorpha* sp. (Hemiptera, Coreidae).

Antiphrisson adpressus (Loew, 1849)

Material Examined: Fars province, Shiraz: Ab Barik (mountain belt), 21 August 2006, 1 ♂; predator of *Bembecinus tridens* Fabricius, 1781 (Hymenoptera; Sphecidae); Fars province, Shiraz: Hosein Abad, 18 May 2008, 1 ♂; predator of *Eristalis tenax* (Linnaeus 1758) (Diptera, Syrphidae).

Antiphrisson trifarius (Loew, 1849)

Material Examined: Fars province, Kazeron, 2 July 2006, 1 ♀; predator of *Delta unguiculatum* (Villers, 1789) (Hymenoptera, Vespidae).

Dysmachus sp.

Material Examined: Fars province, Kavar (alfalfa), 28 September 2007, 1 ♀; predator of *Sphaerophoria scripta* (Linnaeus, 1758) (Diptera, Syrphidae).

Machimus annulipes (Brullé, 1832)

Material Examined: Fars province, Marvdasht (wheat field), 15 May 2008, 1 ♂; predator of *Psammotettix* sp. (Hemiptera, Cicadellidae).

Hayat *et al*. (2008) previously recorded *Sarcophaga* (*Liopygia*) *argyrostoma* Robineau-Desvoidy and *Sarcophaga* (*Sarcophaga*) *lehmanni* Mueller (Diptera: Sarcophagidae) as prey.

Machimus aradensis Theodor, 1980

Material Examined: Fars province, Jahrom, 19 April, 2008, 1 ♂; predator of *Ammophila sabulosa* (Linnaeus, 1758) (Hymenoptera, Sphecidae).

Machimus idiorrhytmicus Janssens, 1960

Material Examined: Fars province, Fasa: Mian-Jangle (*Amygdalus scoparia* forest), 1 August 2007, 1 ♀; predator of *Phycus* sp. (Diptera, Therevidae).

Machimus nahalalensis Theodor, 1980

Material Examined: Fars province, Marvdasht: Olia (bank of stream), 2 June 2006, 1 ♀; predator of *Syntormon* sp. (Diptera, Dolichopodidae).

Machimus rusticus (Meigen, 1820)

Material Examined: Fars province, Firoz Abad (rock surface), 8 May, 2008, 1 ♂; predator of *Delta unguiculatum* (Villers, 1789) (Hymenoptera, Vespidae).

Papilio demoleus demoleus L. (Lepidoptera: Papilionidae); *Amphicoma* sp. (Coleoptera: Scarabaeoidea); *Sphaerophoria scripta* (Linnaeus) (Diptera: Syrphidae), and *Thymelicus sylvestris* Poda (Lepidoptera: Hesperiidae) were determined as prey in Turkey (Hayat & Alaoglu, 1996b and Hayat, 1997).

Philonicus albiceps (Meigen, 1820)

Material Examined: Fars province, Kavar (alfalfa), 28 September 2007, 1 ♀; predator of *Anthidium florentinum* (Fabricius, 1775) (Hymenoptera, Megachilidae).

Ricardo (1920) observed that this asilid hunts house flies (*Musca domestica* Linnaeus), entering houses for this purpose at Enzeli in the early summer, and flying near windows; however, it was not abundant enough to be an effective control agent.

Satanas gigas (Eversmann, 1855)

Material Examined: Fars province, Kazeron: Nodan (*Quercus* forest), 15 June 2006, 1 ♀; predator of *Bryodema* sp. (Orthoptera, Acrididae); Fars province, Shiraz: Kaftarak (in low grass), 24 April 2008, 1 ♂; predator *Truxalis* sp. (Orthoptera, Acrididae).

Hayat *et al*. (2008) had previously recorded *Podalonia hirsuta hirsuta* (Scopoli) (Hymenoptera: Sphecidae) as prey.

Subfamily Dasypogoninae Macquart, 1838

Dasypogon irinelae Weinberg, 1986

Material Examined: Fars province, Shiraz: Kaftarak, 5 November 2007, 1 ♀; predator of *Delta dimidiatipenne* (Saussure, 1852) (Hymenoptera, Vespidae).

Hayat *et al*. (2008) has previously collected this species with *Chalybion* (*Chalybion*) *flebile* (Lepeletier de Saint-Fargeu, 1845) (Hymenoptera: Sphecidae) as prey. Other prey of this species, *Camptopus lateralis* (Germar) (Hemiptera: Alydidae), *Eristalis tenax* (Linnaeus) (Diptera: Syrphidae), *Systropha culvicornis* (Scopoli) (Hymenoptera: Halictidae), *Megabombus* (*Thoracobombus*) *sylvarum daghestanicus* (Radoszkowski), *Pyrobombus soroeensis* (Fabricius), and *Apis mellifera* Linnaeus (Hymenoptera: Apidae) have been noted (Hayat & Alaoglu, 1996a; Hayat, 1997; Ozbek & Hayat, 1999). Additionally, the ethology of this species has been studied by Hayat & Caliskan (2003).

Dasypogon magisi Tomasovic, 1999

Material Examined: Fars province, Zarghan (on sandy soil), 29 May 2007, 1 ♀; predator of *Gryllus bimaculatus* De Geer (Orthoptera, Gryllidae); Fars province, Fasa: Mian-Jangle (*Amygdalus scoparia* forest), 1 August 2007, 1 ♀; predator of *Xylocopa pubescens* Spinola, 1838 (Hymenoptera, Apidae); Fars province, Jahrom, 29 April 2008, 1 ♀; *Megascolia maculata maculata* (Drury, 1773) (Hymenoptera, Scoliidae).

Saropogon distinctus Becker, 1906

Material Examined: Fars province, Shiraz: Khanezenian, 8 June 2006, 1 ♂; predator of *Tabanus eggeri* Schiner 1868 (Diptera: Tabanidae).

Subfamily Laphriinae Macquart, 1838

Laphria dizonias Loew, 1847

Material Examined: Fars province, Shiraz: Dokohak (clay and rocky region), 17 June 2007, 1 ♂; predator of *Bembix oculata* Panzer, 1801 (Hymenoptera, Sphecidae).

Stiphrolamyra rubicunda Oldroyd, 1947

Material Examined: Fars province, Kazeron 14 June 2006, 1 ♂; predator of *Cylindromyia brassicaria* (Fabricius, 1775) (Diptera, Tachinidae).

Subfamily Laphystiinae Hendel, 1936

Laphystia erberi (Schiner, 1865)

Material Examined: Fars province, Jahrom: Hakan (clay and rocky region), 13 May 2006, 1 ♂; predator of unidentified species of Chrysididae (Hymenoptera).

Subfamily Leptogastrinae Schiner, 1862

Leptogaster cylindrica (De Geer, 1776)

Material Examined: Fars province, Marvdasht: Emad Abad (harvested wheat field), 15 June 2007, 1 ♀; predator of *Zyginidia sohrab* Zachvatkin, 1947 (Hemiptera, Cicadellidae).

Subfamily Stenopogoninae Hull, 1962

Crobilocerus spinosus persianus Geller- Grimm & Hradsky, 1999

Material Examined: Fars province, Shiraz: Akbar Abad (mountain belt), 2 May, 2006, 1 ♂; predator of *Tabanus atropathenicus* Olsufjev, 1937 (Diptera: Tabanidae).

Galactopogon hispidus Engel, 1929

Material Examined: Fars province, Shiraz: Kavar, 17 July 2007, 1 ♀; predator of *Scaeva pyrastri* (Linnaeus, 1758) (Diptera, Syrphidae); Fars province, Shiraz: Kaftarak, 29 April 2008, 1 ♀; predator of *Hemianax ephippiger* (Burmeister, 1839) (Odonata, *Aeshnidae*).

Pycnopogon mixtus (Loew, 1847)

Material Examined: Fars province, Shiraz: Kaftarak (on sandy loam), 14 May 2006, 1 ♀; predator of *Episyrphus balteatus* (De Geer, 1776) (Diptera, Syrphidae).

Lehr et al (2007) previously recorded *Malachius* (*Malachius*) *labiatus* Brullé, 1832 (Coleoptera: Malachiidae) and *Melanotmethis fuscipennis* (Redtenbacher, 1889) (Orthoptera: Pamphagidae) as prey.

Stenopogon elongatus (Meigen, 1804)

Material Examined: Fars province, Jahrom (in a palm tree), 14 May 2006, 1 ♀; predator of *Jebusaea hammerschmidti* Reiche, 1877 (Coleoptera, Cerambycidae); Fars province, Kazeron, 29 April 2007, 1 ♂; predator of *Omophlus* sp. (Coleoptera, Alleculidae); Fars province, Kavar (alfalfa field), 28 September 2007, 1 ♀; predator of *Apis mellifera* Linnaeus (Hymenoptera, Apidae).

According to Khajehzadeh (2004) this species is an important predator of the grasshoppers, *Locusta migratoria* L., and *Dociostaurus maroccanus* (Thunberg) (Orthoptera: Acrididae) in Khuzestan province.

Stenopogon junceus (Wiedemann in Meigen, 1820)

Material Examined: Fars province, Kohmareh (*Quercus* forest), 5 June 2006, 1 ♀; predator of *Chalcophorella bagdadensis* Laporte & Gory, 1837 (Coleoptera, Buprestidae).

Abbassian-Lintzen (1964a) observed *S. junceus* preying on the Migratory Locusts, *Schistocerca gregaria* (Forskal) several times .

Stenopogon heteroneurus (Macquart, 1838)

Material Examined: Fars province, Fasa: Mian-Jangle (*Amygdalus scoparia* forest), 1 August 2007, 1 ♀; predator of *Apis mellifera* L. (Hymenoptera, Apidae).

Stenopogon sciron (Loew, 1873)

Material Examined: Fars province, Shiraz: Kaftarak (surface of bare ground), 2 June 2006, 1 ♀; predator of *Oedaleus* sp. (Orthoptera, Acrididae).

Stenopogon sp.

Material Examined: Fars province, Shiraz: Kaftarak (on grass), 3 July 2007, 1 ♂; predator of *Sphingonotus* cf. *rubescens* (Walker, 1870) (Orthoptera, Acrididae).

DISCUSSION

In this study the prey of 32 robber fly species was determined. The following division of total prey can be made: Hymenoptera 35.90% (Vespidae-4, Shecidae-4, Chrysidae-1, Megachilidae-1, Apidae-2, Scoliidae-1), Diptera 28.20% (Syrphidae-4, Tabanidae-3, Therevidae-2, Tachinidae-1, Dolichopodidae-1), Orthoptera 12.82% (Acrididae-4, Gryllidae-1), Coleoptera 10.26% (Buprestidae-2, Alleculidae-1, Cermbycidae-1), Hemiptera 7.70% (Cicadellidae-2, Coreidae-1), Neuroptera 2.56% (Myrmeleontidae-1) and Odonata 2.56% (*Aeshnidae-1*). Comparisons using current data, resolved at the robber fly subfamily level, are presented in Table 1. The presence of large numbers of Hymenoptera as prey of robber flies is probably due to their abundance and the fact that they occur in many of the same habitats as the predators (Dennis & Lavigne, 2007). O'Neill & Seibert (1996) observed that robber flies tend to congregate in the vicinity of flowering plants which are attractive to Hymenoptera. In data presented by Londt (1993) of 1068 prey of African robber flies, 51% were from the orders Hymenoptera (17.8%), Diptera (17%) and Orthoptera (16.2%). In the present study, a Comparison of the total number of prey taken by individual male and female Asilidae showed that female asilids are more often found with prey than males (Table 2). The results of this study indicate that for every male with prey there are 1.43 females. Most published studies confirm that female asilids are more commonly encountered feeding than males (Londt 1990, 1991, 1995, 1999, 2006). Since it is apparent that asilid species in Iran are important predators of other insects (Lehr *et al*., 2007 and Hayat *et al*., 2008), further study of their occurrence, biology, ethology, and especially prey specificity, should be encouraged.

Table 1. The arthropod prey of the Iranian subfamilies of Asilidae. Abbreviations: Apo = Apocleinae, Asi = Asilinae, Das = Dasypogoninae, Lar = Laphriinae, Lay = Laphystiinae, Lep = Leptogastrinae, Ste = Stenopogoninae. Dominant data are presented in bold face.

Prey order	Total no. %	Asilidae subfamily						
		Apo	Asi	Das	Lar	Lay	Lep	Ste
Coleoptera	10.26	1	0	0	0	0	0	3
Diptera	28.2	1	5	1	1	0	0	3
Hemiptera	7.70	0	2	0	0	0	1	0
Hymenoptera	35.9	1	6	3	1	1	0	2
Neuroptera	2.56	1	0	0	0	0	0	0
Odonata	2.56	0	0	0	0	0	0	1
Orthoptera	12.82	0	2	1	0	0	0	2
Total	100	4	15	5	2	1	1	11

Table 2. A comparison of the prey of male and female by Asilidae subfamily.

Subfamily	Male		Female		Total number
	Number	%	Number	%	
Apocleinae	2	5.75	2	5.12	4
Asilinae	7	17.94	8	20.51	15
Dasypogoninae	1	2.56	4	10.25	5
Laphriinae	2	5.12	0	0	2
Laphystiinae	1	2.56	0	0	1
Leptogastrinae	0	0	1	2.56	1
Stenopogoninae	3	7.69	8	20.51	11
Total	16	41.02	23	58.98	39

REFERENCES

Abbassian-Lintzen, R., 1964a, Asilidae (Diptera) of Iran. I. Robber flies belonging to the subfamilies Laphriinae and Dasypogoninae (with description of new species). *Annals and Magazine of Natural History,* London, 13: 417-435.

Abbassian-Lintzen, R., 1964b, Asilidae (Diptera) of Iran. II. Notes on the genus *Eremisca* Zin. and description of *E. schahgudiani* n. sp. *Annals and Magazine of Natural History,* London, 13: 547-552.

Bosák, J., Barták, M., 2000, *Asilidae*. *In*: Barták, M., Vanhara, J. (Eds.). Diptera in an industrially affected region (North-Western Bohemia, Bílina and Duchcov Environs) I. - Folia Facultatis Scientiarum Naturalium Universitatis Masarykianae Brunensis, Biologia, Brno. 104: 167-173 (240 pp.).

Dennis, D. S., Lavigne, R. J., 2007, Hymenoptera as prey of robber flies (Diptera: Asilidae) with new prey records. *Journal of the Entomological Research Society*, 9, 23–42.

Engel, E. O., 1930, *24. Asilidae*. *In*: Lindner, E. (Ed.). Die Fliegen der Palaarktischen Region Band IV(2). Stuttgart, 1-491.

Ghahari, H., Hayat, R., Ostovan, H., Lavigne R., 2007a, Robber flies (Diptera: Asilidae) of Iranian rice fields and surrounding grasslands. *Linzer Biologische Beitraege*, 39:2: 919-928.

Ghahari, H., Lehr, P. A., Lavigne, R. J., Hayat, R., Ostovan, H., 2007b, New records of robber flies (Diptera, Asilidae) for the Iranian fauna with their prey records. *Far Eastern Entomologist*, 179: 1-9.

Geller-Grimm, F., 2002, Robber flies (Diptera: Asilidae) of the Socotra Archipelago, Yemen. *Fauna of Arabia*, 19: 467-489.

Geller-Grimm, F., 2003, A world catalogue of the genera of the family Asilidae (Diptera). *Studia dipterologica,* 10(2): 473-526.

Hayat, R., 1997, Prey of some robber flies (Diptera: Asilidae) in Turkey. *Zoology in the Middle East*, 15: 87-94.

Hayat, R., Alaoglu, O., 1996a, Faunistic and systematic studies on the Asilidae (Diptera) species in Erzurum and neighboring provinces II. Laphystinae, Stichopogoninae, Dasypogoninae, Leptogastrinae and Apocleinae. *Journal of Agricultural College, Ataturk University*, 27: 111-120.

Hayat, R., Alaoglu, O., 1996b, Faunistic and systematic studies on the Asilidae (Diptera) species in Erzurum and neighboring provinces III. Asilinae. *Journal of Agricultural College, Ataturk University*, 27: 121-138.

Hayat, R., Çalışkan, H., 2003, Ethology of the robber fly *Dasypogon irinelae* Weinberg, 1986 (Diptera, Asilidae). *Zoology in the Middle East*, 30: 91-94.

Hayat, R., Ghahari, H., Lavigne, R., Ostovan, H., 2008, Iranian Asilidae (Insecta: Diptera). *Turkish Journal of Zoology*, 32:175-195.

Khajehzadeh, Y., 2004, Investigation on the grasshoppers and their natural enemies in Khuzestan province. *Proceeding of 16th Iranian Plant Protection Congress*, p. 93.

Lavigne, R. J., 2005, *Predator-prey database for the family Asilidae (Hexapoda: Diptera)*. http://www.geller-grimm.de/catalog.lavigne.htm. 12.10.2008.

Lavigne, R. J., Dennis, S., 1985, Ethology of three coexisting species of *Efferia* (Diptera: Asilidae) in Mexico. *Proceedings of the Entomological Society of Washington,* 87: 146-160.

Lehr, P.A., 1964, [New genera and new species of robber flies (Diptera, Asilidae) in the fauna of the USSR]. *Entomologiceskoe Obozreniye,* 43(4): 914-934. (In Russian)

Lehr, P.A., 1967, An ecological and morphological analysis of robber flies of the tribe Asilini (Diptera: Asilidae) with descriptions of new genera and species from Kazakhstan and Soviet Central Asia *Entomological Review*, 46(2): 391-408.

Lehr, P.A., 1969, An ecological and morphological analysis of the robber flies (Diptera, Asilidae). Communication II. *Entomological Review*, 48(3): 341-357.

Lehr, P. A., 1972, [Leptogastrinae and Asilinae (Diptera, Asilidae) of the Mongolian People's Republic]. *Insects of Mongolia Nauka, Leningrad*, 1: 791-844. (In Russian)

Lehr, P. A., 1977, Robber flies of the subfamilies Atomosinae and Laphriinae (Diptera, Asilidae) from Central Asia and Kazakhstan. *Entomological Review*, 56(4): 123-131.

Lehr, P. A., 1979, [Palearctic robber flies of the genus *Asilus* L. and a new genus *Reminasus* Lehr (Diptera, Asilidae)]. *Entomologiceskoe Obozreniye*, 58(3): 639-645. (In Russian)

Lehr, P. A., 1988, *Asilidae*. *In:* Catalogue of Palearctic Diptera (eds. A. Soos, L. Papp). Elsevier Science Publishing Co. Inc. Amsterdam, pp. 197-326.

Lehr, P. A., 1992a, [Small 'genera of robber flies of the subfamily Asilinae (Diptera, Asilidae). 1.Taxonomy and Ecology]. *Zoologichesky Zhurnal*, 71(5): 91-105. (In Russian)

Lehr, P. A., 1992b, [Small 'genera of robber flies of the subfamily Asilinae (Diptera, Asilidae). 2. Phylogeny]. *Zoologichesky Zhurnal*, 71(9): 49-59. (In Russian)

Lehr P. A., 1996, [*The robber flies of subfamily Asilinae (Diptera, Asilidae) of Palaearctic. Ecological and morphological analysis, taxonomy and evolution*.] Vladivostok: Dalnauka. 184 pp. (In Russian)

Lehr P. A., Ghahari, H., Ostovan, H., 2007, A contribution to the robber flies of subfamilies Stenopogoninae and Asilidae (Diptera: Asilidae) from Iran. *Far Eastern Entomologist,* 173: 1-14.

Londt, J. G. H., 1990, Afrotropical Asilidae: prey survey of adult flies. *Abstract. 2nd International Congress of Dipterology*, Bratislava, p. 134.

Londt, J. G. H., 1991, Afrotropical Asilidae (Diptera) 21. Observations on the biology and immature stages of *Damalis femoralis* Ricardo, 1925 (Trigonomiminae). *Annals of the Natal Museum,* 32: 149–162.

Londt, J. G. H., 1993, Afrotropical robber fly (Diptera: Asilidae) predation of honey bees, *Apis mellifera* Linnaeus (Hymenoptera: Apidae). *African Entomology*, Pretoria, 1(2): 167-173.

Londt, J. G. H., 1994, Afrotropical Asilidae (Diptera) 26. Ethological observations, and a possible ecological classification based on habitats. *Annals of the Natal Museum,* 35: 97-122.

Londt, J. G. H., 1995, Afrotropical Asilidae (Diptera) 27. Predation of Asilidae by Asilidae. *Annals of the Natal Museum*, 36: 161-167.

Londt, J. G. H., 1999, Butterfly predation by robber flies (Diptera: Asilidae). *Metamorphosis,* 10(1): 24-30.

Londt, J. G. H., 2006, Predation by Afrotropical Asilidae (Diptera): an analysis of 2000 prey records. *African Entomology*, 14(2): 317-328.

O`Neill, K. M., Seibert, C.,1996, Foraging behavior of the robber fly, *Megaphorus willistoni* (Cole) (Diptera: Asilidae). *Journal of the Kansas Entomological Society*, 69: 317-325.

Oldroyd, H., 1958, Some Asilidae from Iran. *Stuttgarter Beitrage zur Naturkunde. Staatliches Museum fur Naturkunde*, 9: 1-10.

Ozbek, H., Hayat, R., 1999, Ülkemizde balarısı (*Apis mellifera* L.)'nın doğal düşmanı olarak saptanan bazı Hymenoptera ve Diptera türleri. *Turkiye'de Arıcılık Sorunları ve I. Ulusal Arıcılık Sempozyumu, Kemaliye, Erzincan*, pp. 53-63.

Ricardo, G., 1920, A Persian asilid attacking house-flies. *The Entomologist's Monthly Magazine*, 56: 278-280.

Saghaei, N., Ostovan, H., Shojai, M., 2008, A faunistic study of robber flies (Asilidae) in Fars province. *Proceedings of 18th Iranian Plant Protection Congress, 1: Pests*, p. 88.

Saghaei, N., Ostovan, H., Shojai, M., Hayat, R., 2009, Introduction to the Asilidae Fauna (Insecta: Diptera) of Fars Province, Iran. *Turkish Journal of Zoology*, 33: 187-200.

Theodor, O., 1980, *Diptera: Asilidae. Fauna Palaestina, Insecta II.* Israel Academy of Sciences & Humanities, Jerusalem, 448.

Tsacas, L., 1968, Revision des especes du genere *Neomochtherus* Osten- Sacken (Dipteres: Asilidae). I. Region palearctique. *Mémoires du Muséum National d'histoire Naturelle (N.S.), Ser. A, Zool.* 47: 129-328.

Wood, G. C., 1981, *Asilidae*. *In:* McAlpine, J. P., Peterson, B. V., Shewel, G. E., Teskey, H. J., Vockeroth, J. R., Wood, D. M. (Eds.). Manuel of Nearctic Diptera, Vol. 1; Ottawa: Research Branch, Agriculture Canada, Monograph, 27: 549-573.

Received: April 19, 2009 Accepted: December 12, 2009