Original Article

Systematic, Bioecology, and Medical Importance of Widow Spiders (*Lathrodectus* spp.) in Khorasan Province, Iran

***J Rafinejad [1], S Tirgari [1], F Biglarian [2], K Shemshad [3]**

[1] Dept. of Medical Entomology and Vector Control, School of Public Health and Institute of health Research, Medical Sciences/ University of Tehran, Iran
[2] Ministry of Education and Training, Zone 2, Tehran, Iran
[3]Department of Entomology, Science and Research Branch, Islamic Azad University, Tehran, Iran

(Received 20 Oct 2006; accepted 15 Jan 2007)

ABSTRACT

Following the hospitalization of 195 individuals due to the spider bite in 1995 and three cases of recorded death in the year of 1993 which were referred to Emam Reza Hospital in Mashad, the present study was undertaken on bionomics and medical importance of *Lathrodectus* spp in Khorasan Province, during 1995-2005. A total cases of 195 bites were studied composing of 70.8 % males and 29.2% females. The most prevalence cases were observed in mid age (20-55 years old) and particularly among farmers (36.4%). A total number of 216 adult widow spiders and 258 egg sacs were collected from their habitats in different localities of 15 counties in the province. The following species have been recognized: *Lathrodectus tredecimgottatus* (62%), *L. dahli (32%), L. geometricus* (5%) and *L. pallidus* (1%). Here is the first report on the occurrence of males of *L. pallidus* as well as both sexes of *L. trdecimgottatus* and *L. geometricus* in the country. The sex ratio among collected specimens was 88% and 12% female and male, respectively. Summer provides the most suitable and favorable climatic condition for the activities of these spiders. However 65% of spiders were collected in this season. Among different cities, Mashad had (60%) the most reported cases in the study area. Foot was more injured than other parts. 96.5% of patients exhibited localized pain from which only 2% had no pain in the bitten part and 87% had a generalized pain in whole body.

Keywords: Black widow spiders, systematic, Iran

INTRODUCTION

Phylum arthropoda includes about 10 to 20 classes, depending on the classification adopted. Spider considered as one order of Arachnida (sub class) and class of Aranea (Cambridge 1902, Forster 1968, Jung and White 1993). These creatures normally spend their life cycle near human dwelling and work on farms. *Latrodectus* spp. are known as black widow spiders (Garb et al. 2004). Among 3500 spider species, widow spider is considered as one of the most poisonous and dangerous spiders the entire world (Pommier et al. 2005).

It has a wide distribution in the world and occurs mainly in south parts of former Soviet Union, Middle East and Mediterranean regions (Kaston 1970, Levi 1986, Lotz 1994, Miller 1993, Robert 1985, Zukowski 1993). The widow spiders characteristically spin tangled webs, which look similar to spun cotton candy. Their webs are usually built in or beneath objects close to the ground such as under porches, under foundations of buildings, the lose bark of trees, and in basements (Nicholson and Graudins 2002, Blackledge et al. 2005). The bite of the black widow is painful and may cause death if medical attention is not sought immediately. The

***Corresponging author:** Dr J Rafinejad Tel: +98 21 66465404, (Ext: 2179), E-mail: jrafinejad@yahoo.com

venom of this spider is highly neurotoxic and respiratory failure can occur if appropriate medications are not administered at once. *Latrodectus* is exclusively carnivorous and antagonistic. Ordinarily it feeds on insects; however, it also consumes wood lice, diplopods, chilopods and other arachnids (Garb et al. 2004). In Iran especially northeast of country (Khorasan Province) there were several reports of Latradoctism. Species of this genus were responsible for 3 cases of death in 1993. There were 195 hospitalization cases due to the spider bite in 1995. Most of cases were reported from 6 counties including Mashad, Sabzevar, Neishabour, Sarakhs, Qoochan and Chenaran. However, an attempt was made during 1995-2000 on the demographic and clinical characteristics of widow spider bite in order to highlight the systematic, ecology and biology of *Latrodectus* spp. and its medical importance in the study area because of the importance of the Khorasan Province for agriculture, industry and elsewhere in Iran and also the existence of farm areas which provide suitable habitats for spiders.

This investigation gives new data which will be valuable for future planning control and solving the public health problem, identification of different species of black widows, and different aspects of systematic such as feeding, egg sac, seasonal abundance, natural habitat, reproduction, longevity, nidification, tarnished and shape of net.

MATERIALS AND METHODS

Study area

This investigation was carried out in 15 counties in the north and central Khorasan Province, located in north east of Iran (Map 1) and according to zoogeography distribution it is located in the Palearctic Region.

Spider collection

All the specimens were collected by direct method from different parts of the study areas including flagging vegetation, hedgerow of farms, crevices and cracks of walls surrounded of gardens and rodents holes.

After collection, specimens were transferred in to the holding tubes including alcohol (9 parts) and formalin (1 part). For species identification several parameters including morphology, biology and ecology of spiders and date, place, collector, habitats, number of spiders in each net, number of egg sac, distance of nest from earth, feeding preference and distance to water source and having net and clinical characteristics of widow spider bite have been considered. Recognition was carried out by morphological characteristics according to the international standard taxonomic key identification (Robert 1985, Wilson and King 1990). The data were analyzed using SPSS program.

RESULTS

In this research a total of 216 adult spiders and 258 egg sacs were collected from the study areas. One hundred ninety one specimens were female (88.43%) and 25 were male (11.57%). The frequency of spiders were more prevalent in Bojnourd County with 49 cases(22.69%) and Chenaran with 46 cases(21.30%) and the lowest cases was seen in Fariman (0.93%) and Tor-batejam (1.85%). The identified species were as follows:

L. tredecimgottatus (62%) was the most prevalent. One hundred seventeen specimens were female (87.31%). This species was more prevalent in Bojnourd (26.5%) and Chenaran (23.08%) and less prevalent in Kashmar, Gonabad, Fariman and Torbatejam with 1.71% in each county. *L. dahli* with 32% prevalence had the second abundance. Sixty two specimens were female (91.18%). This species was more prevalent in Bojnourd and Chenaran (22.58%) and less prevalent in Kashmar, Shiravan, and Torbateheidarieh with 1.61% in each county. *L. geometricus* (5%) had the third abundance. All of the specimens were female (100%). This species was more prevalent in mountainous roads

from Sabzevar to Bardeskan (54.54%) and less prevalent in Torbateheidarieh with 9.09%. *L. pallidus* had 1% abundance. One specimen was female and 2 of them were male (66.6%). All of the specimens were found in one burrow in the ground near the road of Torbateheidarieh to Gonabad. Considering the review on foreign and Iranian literatures on Iranian spiders, here is the first report on the occurrence of males of *L. pallidus* as well as both sexes of *L. trdecimgottatus* and *L. geometricus* in the country. Spider females, mate only once in their life and 3-13 egg sacs could be laid by each spider.

In each egg sac a total of 50-500 eggs may be seen. The time interval between each laying egg is estimated 15 d. The number of molting is 4-8 time, depending on species, and environmental condition. In nature, adult males die after several months but females can live several months. In laboratory condition they can live up to 18 mo. Females have one generation in each year. Generations in each year are not significantly different in various species. The activities of spiders initiate from May and continue until November.

The peak of activity is in July, which is synchronized with wheat harvesting time. In conclusion it should be emphasized that there is significant difference among species in terms of morphology, bioecology and life span. The sex ratio among collected specimens was 88% and 12% female and male, respectively. Cracks and crevices of mud walls that are traditionally constructed around the farms and gardens in the study area are the main shelters for hiding, breeding and egg laying of spiders. Furthermore the summer provides the most suitable and favorable climatic condition for the activities of these spiders when 52.8% of spiders were collected in this season. All the reported cases were checked in terms of their sex, age, occupational, geographical distribution and seasonal biting clinical manifestation. During the investigation 195 cases of biting were studied com-posing of 70.8 % male and 29.2% female. The most prevalence cases were observed in middle age (20-55 yr old) and particularly among farmers (36.4%).

Table 1 shows the percentage of species in whole study area. Seasonal activity of spiders has shown in Table 2. Prevalence of widow spiders and egg sac collected from natural habitat in north and central of Khorasan Province, 1995-97 are presented in Table 3.

Severe cases are hallmarked by difficulty in breathing and unconsciousness, which may lead to death due to asphyxia preceded by convulsions. Study showed that all of the people biting with spiders have 1 to 8 d hospitalization. During the investigation duration a total cases of 195 bites were studied composing of 70.8 % male and 29.2% female. The most prevalence cases were observed in midge (20-55 yr old). Biting were more prevalent particularly among farmers (36.4%), then house women (27.9%), students (16.4%), animal husbandman (9.7%), workers (6.7%) and etc (3%). Most of the patients had localized pain, pain in one organ and distributed pain. Victims experience abdominal cramps and abdominal cramps (36%), itching (34%) nausea (31.4%), eurhythmy (24%), edema in eye-lids (17.8%), tachycardia (11%) and muscle cramps (10.3%). Among different cities, Mashad had (60%) the most reported cases in the study area. After Mashad, Neishabour had 9.1% of cases, Chenaran 9.1%, and another part of the counties had 15.8% cases. Among different parts of the body, foot (47%) was more injured than the other parts of the body, followed by hands (28%), trunk (14%) and head and neck (11%). Seventeen percent of victims were baited outdoors and 83 percent were baited indoors. Summer was the peak of biting which is synchronized by spider activity. 96.5% of patients exhibited localized pain from which only 2% had no pain in the bitten part and 87% had a generalized pain in whole body. Hospitalization time of patients was 1-8 d. The peak of case reports were in 1995, whereas no any cases were found during 1998-2000.

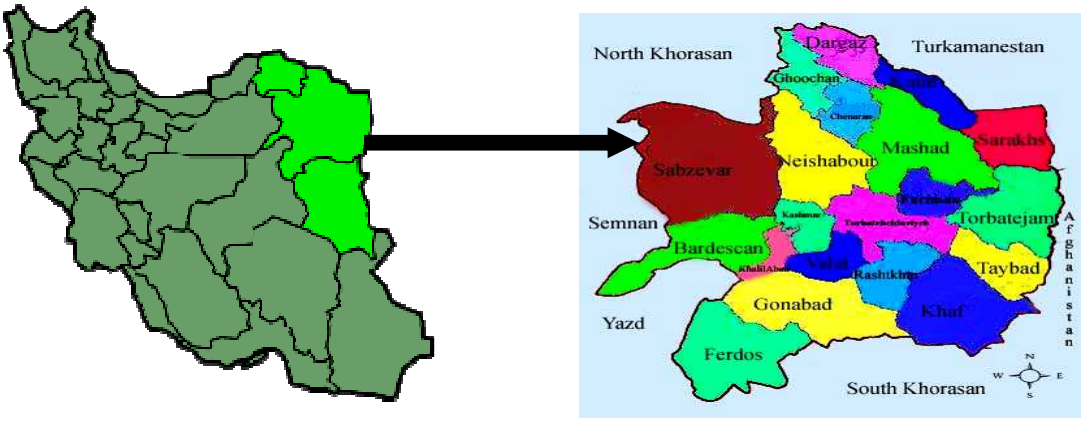

Fig. 1. Mashahad County (study area)

Table 1. Prevalence of adult widow spiders collected from north and central of Khorasan Province according to sex and species, 1995-97.

Species	Male		Female		Sum	
	No.	%	No.	%	No.	%
L. tredecimguttatus	17	7.87	117	54.17	134	62.04
L. dahli	6	2.78	62	28.70	68	31.48
L. geometricus	0	0	11	5.09	11	5.09
L. pallidus	2	0.93	1	0.46	3	1.39
Total	25	11.57	191	88.43	216	100

Table 2. Prevalence of widow spiders collected from north and central of Khorasan Province according to season and year

Year/Season	Spring		Summer		Autumn		Total	
	No.	%	No.	%	No.	%	No.	%
1995	24	11.11	82	37.96	8	3.7	114	52.78
1996	24	11.11	42	19.4	13	6.01	79	36.57
1997	6	2.8	17	7.9	0	0	23	10.65
Total	54	25	114	52.8	21	9.71	216	100

Table 3. Percentage of widow spiders and egg sac collected from natural habitat in north and central of Khorasan Province during study period

Natural habitat	Adult		Egg sac	
	No.	%	No.	%
Under or in split of stones	51	23.6	71	27.5
Around the farm and gardens	45	20.8	92	35.66
Cracks and crevices of mud walls	37	17.13	49	18.99
Rodent holes	35	16.2	19	7.36
Vegetation, trees and hedgerow	29	13.43	15	5.81
Ground holes	19	8.8	12	4.65
Total	216	100	258	100

DISCUSSION

Although most species of spiders are venomous, only ten or so are able to induce human envenomations (Dzelalija and Medic 2003). The black widows importance is directly related to its reputation as a poisonous spider (Nicholson and Graudins 2002), however, bites are uncommon and serious long-term complications or death is rare (Landeka and Plenkovic 2003). A comprehensive study was carried out during 1995-97 in northern part of Iran for the study of distribution, biology, ecology and systematic of widow spiders. A total of 216 adult spiders and 258 egg sac were collected form the study areas. The identified species were *L. tredecimgottatus* (62%), *L. dahli* (32%), *L. geometricus* (5%) and *L. pallidus* (1%). The sex ratio among collected specimens was 88% and 12% female and male, respectively. Female spiders, mate only once in their life and 3-13 egg sacs could be laid by each spider. In each egg sac a total of 50-500 eggs may be seen. The time interval between each laying egg is estimated 15 d. The number of molting is 4-8 time depending on species, and environmental condition. In nature, adult males die after several months but females can live several months. In laboratory condition they can live up to 18 mo. Females have one generation in each year.

Generations in each year have not significant difference in different species. The activities of spiders initiate from May and continue until November. The peak of activities is in July, which is synchronized with wheat harvesting time. Biting were more prevalent particularly among farmers and house women. Because of farming, among different parts of the body, feet and hands were more injured than the other parts of the body (no need to repeat the results). From table 1 it can be concluded that among spiders collected from study areas the species *L. tredecimgottatus* exhibit the more prevalence in the region, whereas the species *L. geometricus* had the lowest prevalence.

The spiders were more seasonal activity during summer, 1995 and less seasonal activity was seen in autumn 1997. In natural habitat spiders have more prevalent under or in split of stones and have less prevalent in ground holes. In the field studies it is concluded that species of Latrodectus genus have different morphologic and ecology and species identification without its bioecology is very difficult. Also more studies are needed to highlight the taxonomic situation of the species of the spider widows in other parts of country. Trash, lumber piles, bricks, weeds, and outside structures are good breeding places for spiders and should be cleaned up. Inside the home spider webs should be brushed down. The egg sacs should be destroyed to prevent hundreds of young spiders from emerging. Vacuum cleaner attachments may be used to clean walls, and the collected debris should be destroyed. Another recommenddation is environmental sanitation, quarantine, chemical control including residual spraying and biological control (Landeka and Plenkovic 2003). Control efforts should target black widow spider webs because that is where the spider spends most of its time. Control is best achieved by following an integrated pest management (IPM) strategy, which involves using multiple approaches such as preventive measures, exclusion, sanitation, and chemical treatment when necessary (Landeka and Plenkovic 2003). IPM requires a thorough inspection of the building to locate the pest. An inspection preferably should be done at night because the black widow spider is nocturnal (Landeka and Plenkovic 2003). All of the clinical symptoms might not be present. The bite of a black widow spider initially may go unnoticed, but some people report a short stabbing pain. The venom is neurotoxic, affecting the human nervous system. At first, there may be slight local swelling and two faint red spots, which are puncture points from the fangs. The physical reaction to a spider bite depends on the amount of venom injected and an individual's sensitivity including age and sensitivity to venom. Small children most severely affected (Landeka and Plenkovic, 2003).

The present studies show that widow spider biting is an important problem in the study areas, which periodically appear every several years. In conclusion it should be emphasized that spider bite is an important health problem in the region. For combating the problem health education for both local authorities as well as community is essential.

ACKNOWLEDGEMENTS

The authors would like to appreciate very much from Mr Afshar, Dr Balali and their colleagues in Health Center of Khorasan Province to help us to carry out the research and also to the staff of School of Public Health and Institute of Health Research, Medical Sciences/ Tehran University for their kind collaboration. This research was financially supported by the School of Public Health, Medical Sciences/Tehran University.

REFERENCES

Blackledge TA, Summers AP, Hayashi CY (2005) Gumfooted lines in black widow cobwebs and the mechanical properties of spider capture silk. Zoology (Jena). 108(1): 41-46.

Camberidge FP (1902) One of the spider of the genus *Latrodectus* Walckenaer. Proceedings of the Zoological Society of London. 1: 247-261.

Dzelalija B, Medic A (2003) *Latrodectus* bites in northern Dalmatia, Croatia: clinical, laboratory, epidemiological, and therapeutical aspects. Croat Med J. 44(2): 135-138.

Forster RR, Wilton CL (1968) The spider of New Zealand. Part 2 Ctenizidae, Dipluridae, Migidae. Otego Muss Bull. 2: 1-180.

Meier J, White J (1993). Handbook of clinical Toxicology of Venom and Poisons. A Biologists View, London.

Kaston BJ (1970). How to Know the Spiders. WMC Brown Company Publishers.

Landeka N, Plenkovic J (2003) The black widow spider- its appearance and control. Arh Hig Rada Toksikol. 54(1): 11-8.

Levi HW (1986). The geotropically orb weaver genera Alpaida (Araneae: Araneidae). Bull Muss Comp Zoo. 151: 365- 487.

Lotz LN (1994) Revision of the genus Latrodectus (Aranea: theridiidae) in Africa. Navors. Has. Mus. Blaemfontein. 10(1): 1-60.

Miller TA (1993) Treatment of black widow spider bite. J American Board. Family Practice. 2: 183-184.

Nicholson GM, Graudins A (2002) Spiders of medical importance in the Asia-Pacific: atracotoxin, latrotoxin and related spider neurotoxins. Clin Exp Pharmacol Physiol. 29(9): 785-794.

Pommier P, Rollard C, De Haro L (2005) Spider bites: araneidism of medical importance. Presse Med. 34: 49-56.

Roberts MJ (1985) The Spiders of Great Britain and Island. Harley Books.

Wilson DC, King LE (1990) Spiders and spider bites. Department Clinical. 8(2): 277-286.

Zukowski CW (1993) Black widow spider bite, Family practical. Department Noval Medical clinical, Quntico, Virginia. J American Board. 6(3): 279-281.