

Article

Exploring of the first recorded spider (Arachenida: Aranae) species of Sheringal, Khyber Pakhtunkhwa, Pakistan

Farzana Perveen¹, Numan Khan²

¹Department of Zoology, Shaheed Benazir Bhutto University (SBBU), Main Campus, Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan

²Department of Zoology, SBBU, Main Campus, Sheringal, DU, KP, Pakistan

E-mail: farzana_san@hotmail.com

Received 15 June 2015; Accepted 6 July 2015; Published online 1 September 2015



Abstract

The spiders (Arthropoda: Arachenida) are one of the groups of grasping animals. Their carapaces are found on the dorsal side of the cephalothorax, which is an important characteristic of spiders. The present study was conducted to explore the first recorded spider species ($n_i=75$) of Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Dir Upper, Khyber Pakhtunkhwa, Pakistan. The 10 genera with 10 species under 7 families were recorded from June 2013-July 2014. According to length of legs, the largest spider was the huntsman spider, *Halconia insignis* Thorell having length of the first leg was 1.9 ± 0.20 , however, the same of the last leg was 1.44 ± 0.25 ($n=9$). In the same contest, the smallest spider was the ground spider, *Gnaphosa eucalyptus* Ghafoor and Beg having length of the first leg was 0.4 ± 0.08 , while the same of the last leg was 0.4 ± 0.08 ($n=3$). According to length of cephalothorax and abdomen, the largest spider was the wolf spider, *Hippasa partita* Takidar having length of the cephalothorax was 1.1 ± 0.01 , however, the same of the abdomen was 0.7 ± 0.1 ($n=6$). In the same contest, the smallest spider was the harvestmen, *Hadrobunus grandis* Sundevall having length of the cephalothorax was 0.1 ± 0.04 , while the same of the abdomen was 0.3 ± 0.04 ($n=12$). During present research, 10 spider species of Sheringal with different sizes were explored. The present research will be useful to educate and create awareness about spiders in the people of Sheringal.

Keywords Aranae; carapace; chelicerae; Sheringal; spinnerets.

Arthropods
ISSN 2224-4255
URL: <http://www.iaees.org/publications/journals/arthropods/online-version.asp>
RSS: <http://www.iaees.org/publications/journals/arthropods/rss.xml>
E-mail: arthropods@iaees.org
Editor-in-Chief: WenJun Zhang
Publisher: International Academy of Ecology and Environmental Sciences

1 Introduction

The spiders (Arthropoda: Arachenida) are one of the dreadful invertebrates groups and not like by the people (Riechert, 1984). On the dorsal side of their cephalothorax a carapace is found, which is an important characteristic of spiders. Their chelicerae consist on fangs, which are piercing and help for injecting venom. The trachea and book-lungs are their breathing organs (Nieuwenhuys, 2008). They are of different size and

colors. The giant bird eating spider, of the family Theraphosidae (Thorell) size is 75 mm with leg length up to 255 mm. Their metamorphosis takes place through molting, in which their size is increased with replacement of hard and old skin with new one (Kingsley, 1999). They always represent the hateful and injurious animals (Davey, 1994). In fact, they help us to protect crops from the pests (Fabre, 1999) as the biological control agents (Platnick, 1995). Their venom is less polluted than the pesticides used in agro-ecosystem (Novak, 2001) and testing for the treatment of heart diseases (Davey, 1994). They inhabit on the ground, underground, tunnels systems, under stones and near water but habitually, they like moist places. Some spiders live on the seaside, where they are sunken into the sea twice a day. Fresh water is also the territory for many species including the diving bell or water spider, *Argyroneta aquatica* (Clerck, 1758) (Karren, 2002).

The origin of spiders is doubtful, however, many scientists believe that the spiders originated in the sea. Later on, they evolved in 2 groups, one with and other without extensor leg muscles. The evolution of spiders is around 400 million years ago. The earliest spiders were larger in size and with segmented body, however, the recent spiders almost all species are having un-segmented abdomen. Only members of the suborder Mesothelae still reported with segmented abdomen, and they are generally considered the most ancient type of spiders. There is very little record about their fossils; however, the oldest spider fossil was found in rock from New York, USA, which dating back to the Devonian period (410-360 million years). This fossil was preserved and only spinnerets and chelicerae were documented. From Carboniferous period (360-290 million years), the fossil spiders with segmented abdomen were recognized. Little information is available about spiders found in Mesozoic era (240-65 million years). The webs of spiders are hardly fossilized. It is believe that early spiders built unstable webs near the ground; however, later on they developed aerial webs on flora for catching the flying insects. It is possibly to say that the evolution of spiders is related with evolution of insects (Karren, 2002).

Spiders of the family Pholcidae (Koch, 1851) are small to medium sized, having 6 or 8 eyes. They can be easily differentiated from other families by the following characters, prosoma about as long as wide; clypeus about as high as chelicerae; male palp with prominent retro-lateral paracymbium (precursors), which is rarely decreased; male chelicerae usually with sexual modifications, and tarsi usually pseudo-segmented. Pholcids occupy a wide range of ecosystems and habitats, ranging from deserts to rainforests, from sea level to over 3,500 m altitude, and from leaf litter to the canopy (Huber, 2005).

Spiders produce silk from their spinneret glands located at the tip of their abdomen. Each gland produces a thread for a special purpose for example a trailed safety line, sticky silk for trapping prey or fine silk for wrapping it. Spiders use different gland types to produce different silks, and some spiders are capable of producing up to 8 different silks during their life-span. Most spiders have 3 pairs of spinnerets, each having its own function. However, there are spiders with just 1 pair and others with as many as 4 pairs of spinnerets. Webs allow a spider to catch prey without having to expend energy by running it down. Thus, it is an efficient method of gathering food. However, constructing the web is itself an energetically costly process because of the large amount of protein required in the form of silk (Nieuwenhyes, 2008).

The Sheringal valley is located between the 72°-20° east longitudes and 35°-28° north latitude in Pakistan. Altitude is approximately 2000 m above the sea level. This is a small valley situated northern site of district Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan. Bajaur Agency and Jandool is located toward the west, while it is surrounded by district Swat and Malakand Agency from the east and south, respectively. Total area cover by this hilly valley is 7992.67 hec. The northern part is generally covered with forests. The river Panjkora flows towards the north-south. The climate is extremely cold in winter, however, moderately warm in summer for short period. The minimum and maximum temperature in January has been recorded as -2.3 and 11.22 °C, respectively (Fig. 1).

Sheringal is home to a number of wildlife species including mammals such as the snow leopard, *Panthera uncia* (Schreber, 1775) and common leopard, *Panthera pardus* (L, 1758), etc. The Himalayan monal pheasant, *Lophophorus impejanus* (Latham, 1790); Himalayan snow cock, *Tetraoggallus himalayensis* (Gray, 1848) and snow partridge, *Lerwa lerwa* (Hodgson, 1837) are some of the key bird species found here (Hazrat et al., 2011). The objective of the present research is to explore the first recorded spider species of Sheringal, DU, KP, Pakistan to educate the people about them.

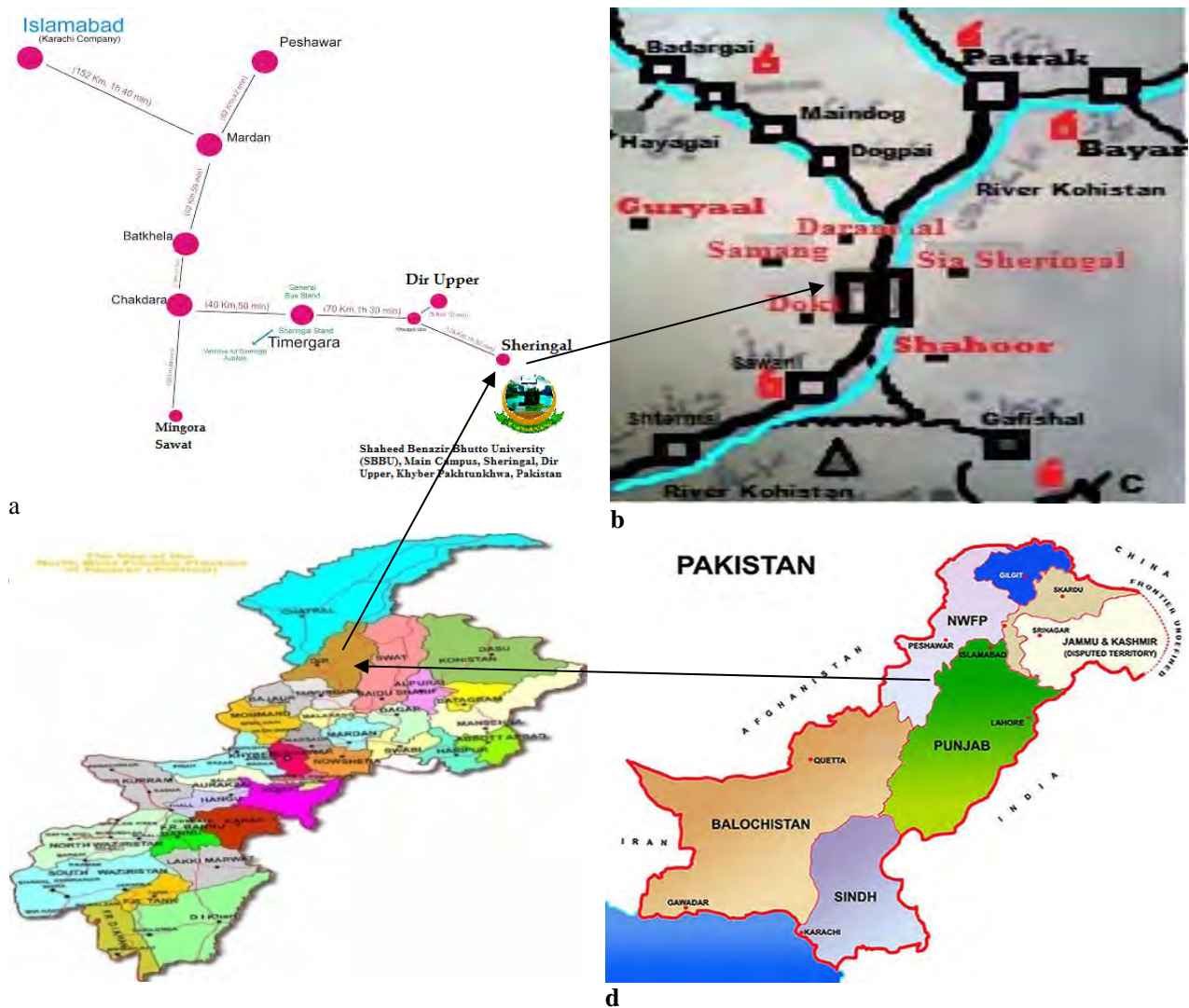


Fig. 1 Exploring of the first recorded spider species of Sheringal, Dir Upper, Khyber Pakhtunkhwa, Pakistan: arrows show map of the study area, Sheringal (a) where the present research was conducted (a), 6 quadrates of Sheringal (b), it is located in the Khyber Pakhtunkhwa (c), which is one of the provinces of Pakistan (d) (Online, 2013).

2 Materials and Methods

The people of Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan usually concern with agriculture. Total area covered by this hilly valley is 7992.7 acres. The population is about 20,000 and literacy rate is 51%. The present research was conducted during June 2013-August 2014 in 6 quadrates, i.e., Daramdala, Doki, Guryaal, Samang, Shahoor and Sia Sheringal of the study area, Sheringal, DU, KP, Pakistan (Fig. 1; Perveen and Khan, 2015).

The spiders were collected ($n_i=75$) from the study area of the quadrates by various methods like pitfall method and simply by hands picking etc (Buss et al., 2010) in plastic jars (50 cm in length and 10 cm in dm). The captured spiders were brought to the laboratory, Department of Zoology (DOZ), Shaheed Benazir Bhutto University (SBBU), Sheringal, DU, KP, Pakistan. They were faint by mortin[®] (CIC interpriser, Lahore, Pakistan) and then preserved in 90% ethanol with few drops of glycerin. They were identified by using keys (Levi and Randolph, 1975; Namkung et al., 2002), experts, internet and already preserved specimens. The morphometric measurements were done through scale (cm) of various body parts including legs, head, abdomen and cephalothorax and data were analyzed by using computer program Microsoft excel (CPMSE) (Perveen and Jamal, 2012 a, b and c; Perveen et al., 2012). They were labeled, tagged and submitted to Natural History Museum, DOZ, SBBU, Sheringal, Pakistan for record.

3 Results

The present research was conducted to explore the first recorded spider species ($n=75$) from Sheringal, Khyber Pakhtunkhwa, Pakistan during June 2013-August 2014. Total 120 specimens has been collected, in which 75 (n_i) specimens were identified to species level, moreover, 43 were unidentified due to unavoidable circumstances. The identified species belong to 7 families; however, the most dominant family among the present research was Lycosidae ($n=20$). Moreover, the less numbers of species were recorded from families Gnphosidae ($n=3$).

Table 1 The morphometric measurements of the first recorded spider species from Sheringal, Dir Upper, Khyber Pukhtunkhwa, Pakistan during June 2013-August 2014.

SNo	Vernacular name	Scientific name	Family	n*	Measurements of length of legs (M±SD)* cm			
					1 st leg	2 nd leg	3 rd leg	4 th leg
1.	Garden spider	<i>Araneus diadematus</i>	Araneidae	05	0.4±0.1	0.9±0.1	0.3±0.06	0.5±0.1
2.	Ground spider	<i>Gnaphosa eucalyptus</i>	Gnphosidae	03	0.4±0.08	0.5±0.08	0.4±0.08	0.4±0.08
3.	Two-tail siders	<i>Harsilia savignyi</i>	Harsiliidae	06	0.9±0.1	1.1±0.4	0.2±0.04	0.7±0.3
4.	Wolf spider	<i>Arctosa littorali</i>	Lycosidae	08	0.6±0.2	1.2±0.12	1.02±0.36	1.06±0.15
		<i>Hippasa partita</i>		06	1.31±0.21	1.4±0.23	1.1±0.1	1.1±0.1
		<i>Pardosa distincta</i>		06	0.8±0.2	1.0±0.2	0.5±0.1	0.8±0.09
5.	Harvestmen	<i>Handrobunus grandis</i>	Opilionidae	12	1.15±0.3	1.5±0.24	1.0±0.2	1.08±0.1
6.	Cellar spider	<i>Crossopriza lyoni</i>	Pholcidae	10	0.4±0.08	1.5±0.23	1.2±0.1	1.2±0.4
7.	Huntsman spiders	<i>Halconia insignis</i>	Sparassidae	09	1.9±0.20	2.0±0.2	1.4±0.19	1.44±0.25
		<i>Isopeda tuhogniga</i>		10	1.3±0.44	1.43±0.42	1.3±0.42	0.9±0.44

*M: mean; SD: standard deviation; n: number of specimen collected and measured; sample size: $n_i=75$: total number of identified spiders species; data were analyzed by Computer Program Microsoft Excel (CPMSE).

The legs 1st-4th of the first recorded spider species ($n_i=75$; $n=3-12$) from Sheringal were measured. They were in ascending order as following: the huntsman spider, *Halconia insignis* Thorell > huntsman spider, *Isopeda tuhogniga* Barrion and Litsinger 1995 > wolf spider, *Hippasa partita* Takidar 1970 > harvestmen,

Hadrobunus grandis Sundevall 1833 > two-tail siders, *Harsilia savignyi* Lucas 1836 > wolf spider, *Pardosa distincta* Backwall 1867 > cellar spider, *Crossopriza lyoni* Backwall 1867 > wolf spider, *Arctosa littorali* Simon 1897 > garden spider, *Araneus diadematus* Clerck 1757 > ground spider, *Gnaphosa eucalyptus* Ghafoor and Beg 2002 (Table 1).

The measurement of cephalothorax of the first recorded spider species ($n_i=75$; $n=3-12$) from Sheringal in ascending order as following: *Hippasa partita* > *Isopeda tuhogniga* > *Halconia insignis* > *Arctosa littorali* > *Pardosa disttinctata* = *Araneus diadamatus* = *Gnaphosa eucalyptus* > *Harsilia savignyi* = *Crossopriza lyoni* > *Hadrobunus grandis* (Fig. 2).

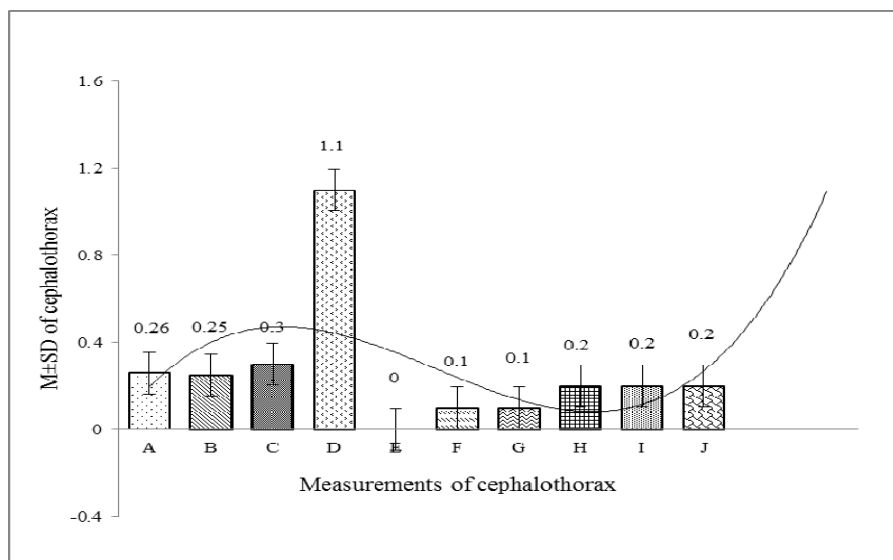


Fig. 2 Measurements of cephalothorax of the first recorded spider species from Sheringal, Dir Upper, Khyber Pukhtunkhwa, Pakistan during June 2013-August 2014: A: *Halconia insignis* Thorell 1836; B: *Arctosa littorali* Simon 1897; C: *Isopeda tuhogniga* Barrion and Litsinger 1995; D: *Hippasa partita* Takidar 1970; E: *Hadrobunus grandis* Sundevall 1833; F: *Harsilia savignyi* Lucas 1836; G: *Crossopriza lyoni* Backwall 1867; H: *Pardosa disttinctata* Backwall 1867; I: *Araneus diadamatus* Clerck 1757; J: *Gnaphosa eucalyptus* Ghafoor and Beg 2002; trend-line: polynomial line; data were analyzed by Computer Program Microsoft Excel (CPMSE); data were showing in M±SD: mean±standard deviation; samples size (N=75); number of each species collected ($n=3-10$); length is measured in centimeters (cm).

The Measurement of abdomen of the first recorded spider species ($n_i=75$; $n=3-12$) from Sheringal are in ascending order as below: *Hippasa partita* > *Isopeda tuhogniga* > *Halconia insignis* > *Arctosa littorali* > *Pardosa disttinctata* = *Araneus diadamatus* = *Gnaphosa eucalyptus* > *Harsilia savignyi* = *Crossopriza lyoni* > *Hadrobunus grandis* (Fig. 3).

The measurement of total body length of the first recorded spider species ($n_i=75$; $n=3-12$) from Sheringal are in ascending order as below: *Halconia insignis* = *Hippasa partita* > *Isopeda tuhogniga* > *Araneus diadamatus* > *Arctosa littorali* > *Pardosa disttinctata* > *Gnaphosa eucalyptus* > *Hadrobunus grandis* > *Crossopriza lyoni* > *Harsilia savignyi* (Fig. 4).

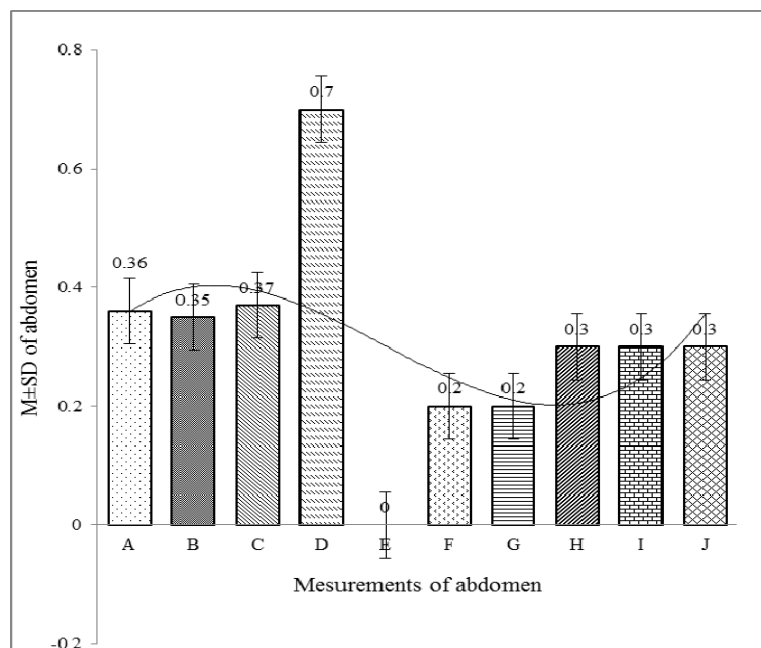


Fig. 3 Measurements of abdomen of the first recorded spider species from Sheringal, Dir Upper, Khyber Pukhtunkhwa, Pakistan during June 2013-August 2014: A: *Halconia insignis* Thorell 1836; B: *Arctosa littoralis* Simon 1897; C: *Isopeda tuhogniga* Barrion and Litsinger 1995; D: *Hippasa partita* Takidar 1970; E: *Hadrobunus grandis* Sundevall 1833; F: *Harsilia savignyi* Lucas 1836; G: *Crossopriza lyoni* Backwall 1867; H: *Pardosa distinctata* Backwall 1867; I: *Araneus diadamatus* Clerck 1757; J: *Gnaphosa eucalyptus* Ghafoor and Beg 2002; trend-line: polynomial line; data were analyzed by Computer Program Microsoft Excel (CPMSE); data were showing in M±SD: mean±standard deviation; samples size: N=75; number of each species collected and measured: n=3-10; length is measured in centimeters (cm).

4 Discussion

In the present study, collection, identification and morphometric measurement of the first recorded spider species from Sheringal, KP, Pakistan were conducted during June 2013-August 2014. In the present research, 10 spider species under 10 genera and 7 families were recorded from Sheringal.

The biodiversity and predatory efficacy of the spiders in rice field were studied from central Punjab, Pakistan, and 44 spider species were recorded from a huge collection of 28000 specimens (Tahir and Butt, 2009). While, the present research was a general survey reported total 123 specimens and only 7 families. Therefore, one can argue that both studies have different biodiversity. Moreover, the geographical occurrence, temperature and food availability were the factors responsible for diversity differences in both studied areas. The present research was conducted in very short time; therefore, number of specimens collected was small.

Mukhtar (2004) surveyed the spider fauna of the foliage from Punjab and reported 124 species belonging to 51 genera and 17 families and the most dominated family was Araneidae and the less number of species was reported from family Corinnidae. However, during the present research, 7 families were reported, where the largest family was Lycosidae with 3 species, while the smallest families were Opilionidae, Hersiliidae, Araneidae, and Gnaphosidae each with only one species. Therefore, in both studies, the diversity differences were due to habitat, environmental and geographical differences of both areas. The present study area was more toward the northern pole and away from equator and the climatic conditions were colder than Punjab, Pakistan.

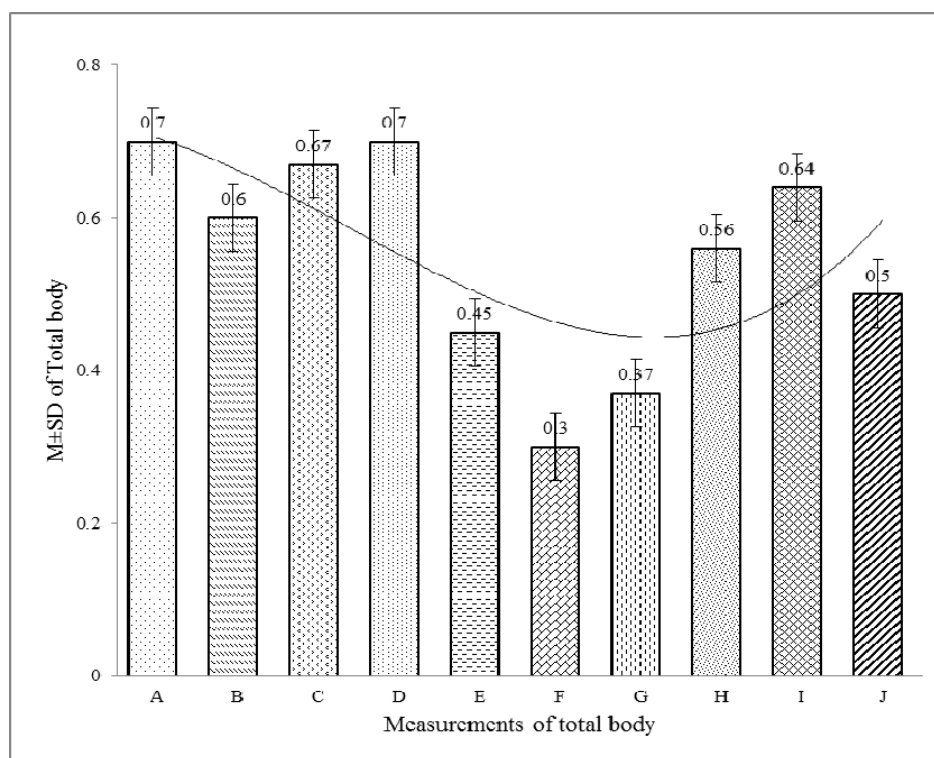


Fig. 4 Measurements of total body length of the first recorded spider species from Sheringal, Dir Upper, Khyber Pukhtunkhwa, Pakistan during June 2013-August 2014: A: *Halconia insignis* Thorell 1836; B: *Arctosa littoralis* Simon 1897; C: *Isopeda tuhogniga* Barrion and Litsinger 1995; D: *Hippasa partita* Takidar 1970; E: *Hadrobunus grandis* Sundevall 1833; F: *Harsilia savignyi* Lucas 1836; G: *Crossopriza lyoni* Backwall 1867; H: *Pardosa distinctata* Backwall 1867; I: *Araneus diadamatus* Clerck 1757; J: *Gnaphosa eucalyptus* Ghafoor and Beg 2002; trend-line: polynomial line; data were analyzed by Computer Program Microsoft Excel (CPMSE); data were showing in M±SD: mean±standard deviation; samples size: N=75; number of each species collected and measured: n=3-10; length is measured in centimeters (cm).

Ursani and Soomro (2010) updated the checklist of spider fauna from 16 districts of Sindh, province, Pakistan. A total of 132 species were recorded belonging to 24 families and 73 genera. Majority of these species were earlier defined, however, only the family Zodariidae for the first time was recorded from Pakistan. In the present research, 10 species were recorded from Sheringal, KP, Pakistan range. As insects are the main source of food for spiders, and are abundant in the warm areas, therefore, the diversity in spider fauna in both studies was due to geographical and ecological differences.

Namkung et al. (2002) reported a critical checklist of the spiders from Jeju Island, Korea with review of published reports during 1936-2001 and identified spider specimens collected from 1964-2001. Total of 166 genera and 347 species belonging to 36 families of spiders were classified from Jeju Island. In the present research, 10 genera and 10 species belonging to 7 families were reported during June 2013-August 2014 from Sheringal, KP, Pakistan. The time period for both researches was different; however, it was shorter in the present study.

Whitmore et al. (2014) reported that high number of spiders families were recorded in cultivated and open field habitats reflected vegetation complexity, which spiders rely on their life cycle, either for finding food, building retreats or for web building. During the present research, 7 spiders families were recorded from inside the buildings, closed houses and old shops. The habitats of spiders for both researches were different.

Sebata (2015) reported that spiders were collected during 10 weekly sessions, in which total of 663 individuals belonging to 28 species distributed among 11 families were found in the Hillside Dams Conservancy, Bulawayo, Zimbabwe. During the present research, the spiders were collected during 5 weeks,

in which total of 123 individuals belonging to 10 species distributed among 7 families are found, in which 77 were identified from 6 quadrates of Sheringal, i.e., Daramdala, Doki, Guryaal, Samang, Shahoor and Sia Sheringal. Difference in time period for the collection of the spiders was due to the extreme weather of the present study area.

During the present research, the majority of the spiders were collected from shops, buildings and crevices of the trees. However, the largest spider was of the family *Sparassidae* having the length of first leg was 1.9 ± 0.20 , while the length of fourth leg was 1.44 ± 0.25 . Moreover, the smallest spider was of *Gnaphosa* having the length of first leg was 0.4 ± 0.08 , while the length of fourth leg was 0.4 ± 0.08 . It was recorded that 50% of the species were allergenic and injurious in Sheringal.

The problems faced by authors during the research were the climatic condition of the study area, shortage of time period for the collection, unawareness of the people about the importance of spiders and initially inexperience of proper collecting practices. As it is the colder area of Pakistan, therefore, their breeding season was short than other warmer areas. The flood destructed the habitats of the most of organisms in Sheringal in 2010, therefore, a lot of organisms were lost. Due to this lesser number of spider fauna collected according to the requirement at the present. For detail biodiversity of the spider fauna of Sheringal, DU, KP, Pakistan a comprehensive survey should be conducted in future.

5 Conclusion

In the present research, it was concluded that *H. insignis* was the largest collected species belongs to the family Sparassidae, while *G. eucalyptus* was the smallest collected species belongs to the family Gnaphosidae.

6 Recommendation

For further research, it is recommended that a detail and advance study is required for further exploration of spider fauna with special reference to the taxonomy, physiology and ecology. Seminars, symposiums and workshops may be arranged for awareness of the community of Sheringal.

Acknowledgement

Authors are grateful to all those who assisted in conducting this survey. They would like to thank Mr Inayat ul Islam, a classmate for his kind suggestions and cooperation in data analysis. The authors declare no conflict of interest. The present research complies with the current laws of the institute and country, in which they were performed. The research work has been conducted in Department of Zoology, Shaheed Benazir Bhutto University (SBBU), Main Campus, Sheringal, Dir Upper (DU), Khyber Pakhtunkhwa (KP), Pakistan

References

- Davey GCL. 1994. The disgusting spider, the role of disease and illness in the perpetuation of fear of spiders. *Society and Animals, the Academy of Science*, 2: 17-25
- Fabre JH. 1999. *The Life of the Spider*. 1-13, Mellon University, Mellon, UK
- Gill HK, McSorley R, Buss L. 2010. The insect community on the soil surface. Online: <http://edis.ifas.ufl.edu/in876> (Accessed 20/6/2015)
- Hazrat A, Shah J, Nisar M. 2011. Medicinal plants of Sheringal valley, Dir Upper, KP, Pakistan. *FUUAST Journal of Biology*, 1(2): 1-31

- Huber BA. 2005. Revision of the genus *Spermophora* in Southeast Asia and on the Pacific Islands with descriptions of three new genera (Araneae: Pholcidae). *Zoologische Mededelingen Leiden*, 79(2): 61-114
- Karren JB. 2002. Spiders. 22-34, Utah University, Utah, USA
- Kingsley R. 1999. The Spiders. 2-34, New Star Standard Industries (Pvt) Ltd., Singapore
- Levi HW, Randolph DE. 1975. A key and checklist of American spiders of the family Theridiidae north of Mexico (Araneae). *Journal of Arachnida*, 3: 31-51
- Mukhtar MK. 2004. Taxonomic studies on the foliage spider fauna of Punjab. Department of Zoology and Fisheries, University of Agriculture, Faisalabad, Pakistan, 6: 1-76
- Namkung J, Im' MS, Kim ST, Lee JH. 2002. Spider fauna of Jeju Island in Korea. *Journal Asia-Pacific Entomology*, 5(1): 55-74
- Nieuwenhuys A. 2008. Spider information. Online: <http://ednieuw.home.xs4all.nl/Spiders> (Accessed 20/07/2011)
- Novak K. 2001. Spider venom helps hearts keep their rhythm. *Nature Medicine*. <http://insects.about.com/od/noninsectarthropods/p/arachnida.htm> (Accessed 8/2/2010)
- Perveen F, Jamal A. 2012. Checklist of spider fauna of FR Peshawar, FATA, Pakistan. *Arthropods*, 1(1): 35-39
- Perveen F, Jamal J. 2012. Exploring spider fauna of FR Peshawar, FATA, Pakistan. *Signpost Open Access Journal of Entomological Studies*, 1: 55-67
- Perveen F, Jamal A. 2012. Biodiversity of spiders' fauna in FR Peshawar, FATA, Pakistan. *Journal of Entomology and Nematology*, 4(3): 22-33
- Perveen F, Jamal A, Yasmin N, Khatak KU. 2012. Key for identification of spiders fauna of FR Peshawar, FATA, Pakistan. *Pakistan Journal of Entomology Karachi*, 27(1): 39-48
- Perveen F, Khan N. 2015. Checklist of the first recorded spider fauna in Sheringal, Khyber Pakhtunkhwa, Pakistan. *Advances in Entomology*, 3: 94-100
- Online maps 2013. www.google.com (Accessed 07/12/2013)
- Perveen F, Khan N. 2015. Checklist of the first recorded spider fauna in Sheringal, Khyber Pakhtunkhwa, Pakistan. *Advances in Entomology*, 3: 94-100
- Platnick N. 1995. An abundance of spiders. *Natural History Museum USA*, 104: 50-53
- Riechert SE, Lockely T. 1984. Spiders as biological control agents. *Annual Revision of Entomology*, 29: 299-320
- Sebata S. 2015. Species composition and abundance of the spider fauna of the Hillside Dams Conservancy, Bulawayo, Zimbabwe. *Researcher*, 7(2): 44-49
- Tahir M, Butt A. 2009. Some new species of family Lycosidae from agricultural fields of Punjab, Pakistan. *Pakistan Journal of Zoology*, 38: 185-189
- Ursani TJ, Soomro NM. 2010. Checklist of spider fauna of Sindh Province, Pakistan. *Pakistan Journal of Entomology*, 32(1): 61-73.
- Whitmore C, Slotow R, Crouch TE, Schoeman DAS. 2002. Diversity of spiders (Aranea) in a Savanna Reserve, Northern Province, South Africa. *Journal of Arachnology*, 30: 344-356