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Spider (Araneae: Arachnida) fauna of district Charsadda Khyber Pakhtunkhwa Pakistan

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Abstract

The present study was carried out to explore the diversity of spiders' fauna from District Charsadda KPK, Pakistan, from March, 2015 to January, 2017. A total of 2005 specimens were collected representing 44 species under 29 genera and 15 families. The family Araneidae was represented by 4 species, Clubionidae by 3 species, Corinnidae by 1 species, Gnaphosidae by 3 species, Hersiliidae by 1 specie, Lycosidae by 3 species, Oxyopidae by 4 species, Pisauridae by 1 species, Salticidae by 10 species, Scytodidae by 1 species, Sparassidae by 2 species, Tetragnathidae by 3 species, Theridiidae by 2 species, Thomisidae by 5 species and family Trochanteriidae by 1 species in the study area. The most dominant family in the area was Salticidae followed by Sparassidae. All of the species were reported for the first time from the study area.

Keywords: Spider, salticidae, sparassidae, thomisidae, Arenadai, clubionidae

1. Introduction

Spiders belong to the order Araneae of the Class Arachnida of the Phylum Arthropoda, the most abundant and species rich order of the Phylum with 38000 identified species from all over the world^[1]. The number may be greater and there is a possibility of 170,000 species^[2]. Others believe that about 200,000 species may exist. Although all species of the spiders are venomous, but only 40 species are potentially poisonous to humans^[3]. Spiders being the largest order of arachnids, rank seventh among all other orders of organisms in total species diversity^[4]. It is proposed that spiders existed round about 400 million years ago and the earliest reported spiders were larger in size having segmented body while all recent spider species have unsegmented abdomen except members of the suborder Mesothelae^[5]. Spiders are air-breathing having eight legs and chelicerae with fangs for injecting venom. During prey manipulation, a spider uses pedipalps which are located on the tarsi of the appendages and in this way provides chemosensory information^[6].

The Spiders are carnivorous and voracious predators feeding on various types of insects and their larvae protecting our crops from the dangerous insect pests^[7]. Due to there this function they can be used as good biocontrol agents^[8]. Spiders can also be used as bioindicators to evaluate anthropogenic disturbance in natural ecosystems^[9]. They are useful in many terrestrial habitats in regulating the population of insects^[10].

There is a lot of variation in the size and colour of spiders. The largest of the spiders is the giant bird eating spider, *Theraphosid* (Thorell) about 75 mm long with a leg length of 25 mm. The size of female spider is larger than male. During metamorphosis in spiders the hard old exoskeleton is replaced causing increase in size^[11].

Every habitat is virtually occupied by Spiders having wide range of life styles, morphological adaptation and behaviours^[12]. Spiders are literally found everywhere; on trees, under stone or logs, in rubbish and leaf litter on forest floor^[10]. They inhabit ground, underground tunnels systems, near water but they like moist places. Many species including the water spiders (*Argyroneta aquatica*) also use seaside and fresh water as their territory^[5].

According to an updated report, 110 families of spider fauna belonging to 3859 genera and 42751 species worldwide have been documented^[13].

Another recorded study from Turkey reports more than 42,055 described species in which 757 species of Araneae belonging to 265 genera and 48 families^[14]. 95 species of spiders belonging to 56 genera and 18 families are reported from India^[15]. Although the world spider fauna is well documented, the exact data for certain countries like Pakistan are lacking. Pakistan has rich and diverse habitats for spiders but there exists no consolidated account on

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its fauna. Therefore, there is a need to properly explore the area and document its diverse fauna. The present study was carried out to explore the diversity of spiders fauna from District Charsadda Pakistan.

2. Materials and Methods

2.1 Study Area

The district Charsadda lies between 71-28' and 71-53' east longitudes and 34-03' and 34-38' north latitudes and with an altitude of 276 metres (908 feet). The district Charsadda is bounded by Mardan district to the east, Malakand District to the north, Mohmand Agency of FATA to the west and Nowshera and Peshawar districts to the south [16] (Fig. 1).

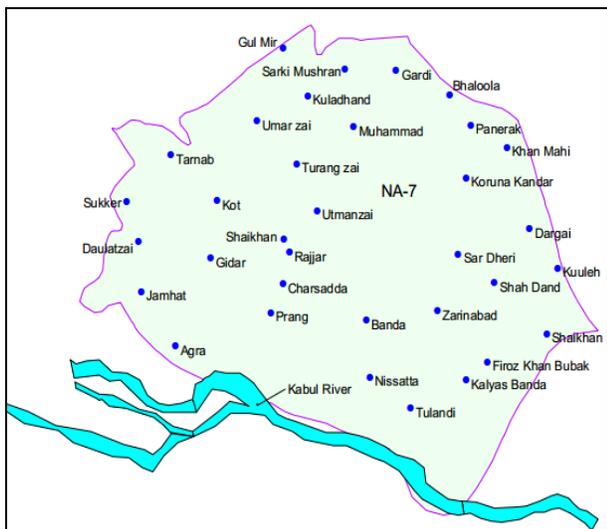


Fig 1: Map of the Study Area.

In the central plain of the Peshawar valley lies district Charsadda. At a point near the south west of the district,

enters the River Kabul which flows along the southern boundary of the district. Water of this river cross the district in the extreme south eastern corner. It covers an area of 2,296 km² and its population is round about 334,453 [16]. The Charsadda district has extreme climate. The summer season is extremely hot. A steep rise of temperature is observed from May to June. Even July, August and September record quite high temperatures. During May and June, dust storms are quite frequent at night. The temperature reaches to its maximum in the month of June. Due to the intensive cultivation and irrigation the tract is humid and the heat is oppressive. A rapid fall in temperature is recorded from October onwards. The coldest month is January. Towards the end of the cold weather there are occasional thunderstorms and hail storms. The maximum rainfall is received in July and August during which the weather becomes hot and humid. The relative humidity is quite high throughout the year. Maximum humidity is recorded in December. In the Charsadda, the average winter rainfall is higher than that of the summer rainfall [16].

Lands of Charsadda are very fertile producing various important crops. Most of the area is under cultivation of different types of crops providing habitat for different kinds of invertebrates. Among them spiders are dominating member of the community. Moreover, in the past, they have been rarely studied because most of the researchers call them as less important organisms [17].

2.2 Sample Collection

The spiders were collected from seven different localities of Charsadda (tangi, sherpao, umarzai, turangzai, utmanzai, rajjar, prang and forest of tharnao doaba) of District Charsadda during March 2015- January 2017 through active search by visiting various habitats like urban area, villages, homes, poultry farms, agricultural fields, unmanaged land and river/stream banks (Fig. 2).

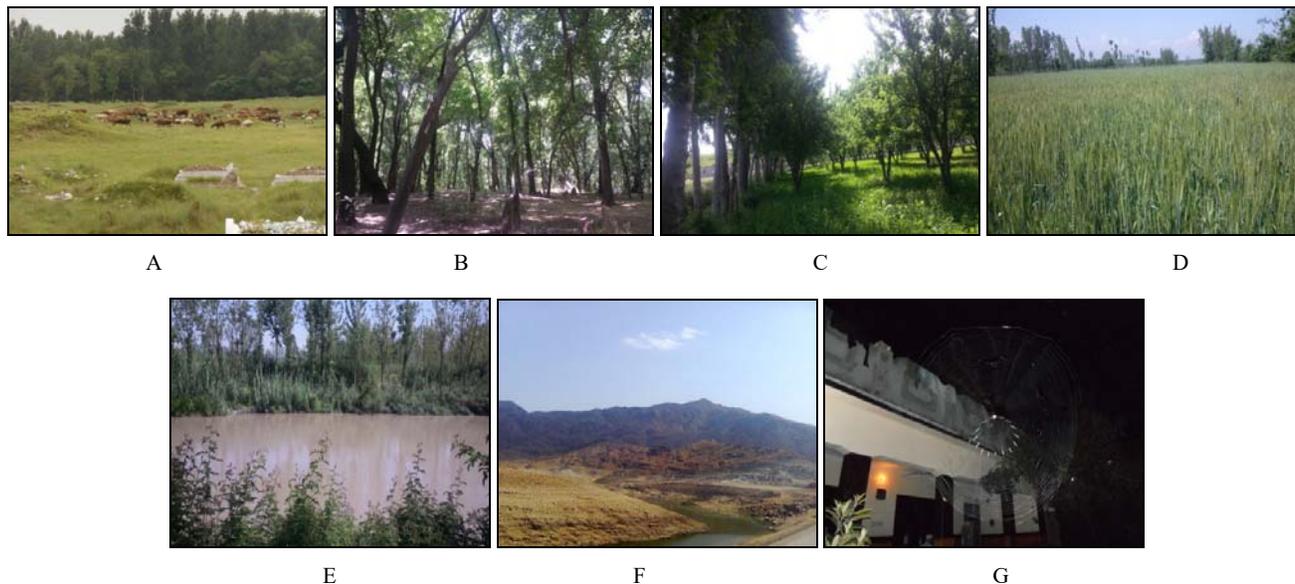


Fig 2: Various Habitats searched for spider collection (a) Meadow, (b) Forest, (c) Garden of plums (d) Wheat fields, (e) Stream bank, (f) Hills, (g) Home

2.3 Sampling methods

Sampling was carried out over three periods, summer (March 2015 – June 2015), monsoon (July 2015–October 2015) and winter (November 2015–February 2016) and same three periods were selected up to February 2017.

Aerial sampling (for upper layer spiders up to 1.5 m) involved searching leaves, branches, tree trunks, and spaces in between, from knee height up to maximum overhead arm’s reach.

2.3.1 Ground collection

(for ground layer spiders) involved searching on hands and knees, exploring the leaf litter, logs, rocks, and plants below low knee level. Beating (for middle layer spiders up to 1 m) consisted of striking vegetation with a 1m long stick and catching the falling spiders on a tray held horizontally below the vegetation. Litter sampling was done by hand sorting spiders from leaf litter collected in a litter collection tray.

2.3.2 Foliage dwelling spiders

Sweep netting (for middle layer spiders up to 1 m) will be carried out in order to access foliage dwelling spiders.

2.4 Preservation of spiders

The spiders were searched visually and collected from the surveyed areas generally at the time of morning and night. The sampling methods used were jarring when foliage spider's collections, and manual hand picking by plastic bags and jars, were labelled. Finally spiders were preserved in vials in 70% ethylene alcohol with 20% of glycerine prepared for ecological studies.

2.5 Identification of the specimens and photography

The specimens were brought to the laboratory and studied under stereo microscope (XTD-2A China) for various morphological and taxonomical characters. The specimens were then identified with the help of available literature^[17, 18, 19 & 20]. Photographs were taken using Nikon Camera (7.0 mega pixel; Nikon, Tokyo, Japan).

3. Results

The present study was conducted from March, 2015 to February, 2017 to determine the spiders' fauna of District Charsadda Pakistan. A total of 2005 specimens were collected representing 44 species under 29 genera and 15 families. The most dominant and species rich family observed during the study was Salticidae. Family wise distribution of the species was: Araneidae 4 species, Clubionidae 3 species, Corinnidae 1 species, Gnaphosidae 3 species, Hersilidae 1 specie, Lycosidae 3 species, Oxyopidae 4 species, Pisauridae 1 specie, Salticidae 10 species, Scytodidae 1 specie, Sparassidae 2 species, Tetragnathidae 3 species, Theridiidae 2 species, Thomisidae 5 species, Trochanteriidae 1 species (Table 1). The detailed of the families along with the reported species is given as under.

Table 1: Percentage of spider families collected from different habitats

S No.	Families	Natural history	Percentage
1	Araneidae	Orb web spider	7.58%
2	Clubionidae	Bark sac spider	0.69%
3	Corinidae	Antmimic/ground sac spider	0.29%
4	Gnaphosidae	Ground spider	0.34%
5	Hersilidae	Two tailed/bark spider	1.04%
6	Lycosidae	Wolf spider	1.24%
7	Oxiopidae	Lynx spider	1.89%
8	Pisauridae	Fishing spider	1.99%
9	Salticidae	Jumping spider	23.74%
10	Scytodidae	Spitting spider	0.19%
11	Sparasidae	Huntsman spider	9.92%
12	Tetregnathidae	Stretched/long jawed spider	5.48%
13	Therididae	House spider	2.39%
14	Thomisidae	Crab spider	1.29%
15	Trochanteridae	Flat rock spider	0.09%

3.1 Family Araneidae (Simon, 1895)

Four species under four different genera of the family were identified as i) *Eriophora transmarina* (Keyserling, 1865) commonly known as Garden orb weaver spider; ii) *Argiope keyserlingi* (Karsch, 1878) generally known as St Andrew's cross spider; iii) *Neoscona crucifera* (Lucas, 1839) with a common name Hentz orb weaver; and iv) *Backobourkia heroine* (L. Koch, 1871) generally called Wheel weaver spider.

3.2 Family Clubionidae (Wagner, 1887)

Three species of this family representing one genus were collected during the present study from the area. i) *Clubiona corticalis* (Walckenaer, 1802) commonly called Sac spider, ii) *Clubiona comta* (C. L. Koch, 1839), iii) *Clubiona pallidula* (Clerck, 1757).

3.3 Family Corinnidae (Karsch 1880)

Only one species *Falconina gracilis* (Keyserling, 1891) commonly called ground dweller was collected.

3.4 Family Gnaphosidae (Pocock, 1898)

The family was represented in the area by three species of the same genus. i) *Zelotes duplex* Chamberlin 1922, ii) *Zelotes funestus* (Keyserling, 1887), iii) *Zelotes longipes* (L.Koch, 1866).

3.5 Family Hersilidae (Thorell, 1870)

One species of Bark spider *Hersilia savignyi* (Lucas, 1836) representing the family was collected.

3.6 Family Lycosidae (Sundevall, 1833)

Three species of three different genera of the family collected were i) *Schizocosa mccoocki* (Montgomery, 1904), ii) *Hogna carolinensis* (Walckenaer, 1805), and iii) *Tigrosa helluo* (Walckenaer, 1837).

3.7 Family Oxyopidae (Thorell, 1870)

Four species of the same genus were collected. Sometimes the members of this family is called Lynx spider. i) *Oxyopes variabilis* L. Koch 1878, ii) *Oxyopes salticus* (Hentz, 1845), iii) *Oxyopes macilentus* L. Koch, 1878, and iv) *Oxyopes javanus* Thorell, 1887.

3.8 Family Pisauridae (Simon, 1890)

Only one species of this family, *Dolomedes instabilis* (L. Koch, 1876) also commonly called as Nursery web of fishing spider was collected.

3.9 Family Salticidae (Blackwell, 1841)

The members of this family are also known as jumping spiders. This was the most abundant family of area and ten species were reported during the present study. i) *Trite auricoma* Urquhart, 1886, ii) *Menemerus bivittatus* (Dufour, 1831), iii) *Hentzia mitrata* (Hentz, 1846), iv) *Epocilla aurantiaca* (Simon, 1885), v) *Epocilla calcarata* (Karsch, 1880), vi) *Epocilla blairei* Zabka, 1985, vii) *Menemerus semilimbatus* (Carl Wilhelm Hahn 1827), viii) *Macarokeris nidicolens* (Walckenaer, 1802), ix) *Plexippus paykulli* (Audouin, 1826) and x) *Phintella vittate* (C L Koch 1846).

3.10 Family Scytodidae (Blackwall, 1864)

Only one species of this family, Spitting spider, *Scytodes thoracica* (Latreille, 1804) was collected.

3.11 Family Sparassidae (Bertkau, 1872)

Two species representing two different genera were collected.

i) *Holconia immanis* (L. Koch, 1867), ii) *Heteropoda venatoria* Linnaeus 1767).

3.12 Family Tetragnathidae (Menge, 1866)

The members of this family are commonly known as Long jawed or four jawed spiders. Two species representing one genus were collected. i) *Tetragnatha extensa* (Linnaeus, 1758), ii) *Tetragnatha montana* (Simon, 1874).

3.13 Family Theridiidae (Sundevall, 1833)

Two species of this commonly known House Spider family were collected from the study area. i) *Steatoda Triangulosam*

(C. A. Walckenaer, 1802), ii) *Steatoda paykulliana* (Walckenaer, 1805).

3.14 Family Thomisidae (Sundevall, 1833)

Five species of the family commonly known as Crab spiders, belonging to three genera were collected. i) *Thomisus spectabilis* (Walckenaer, 1805), ii) *Thomisus stoliczka* (Thorell) 1887, iii) *Synalus angustus* (Koch, 1876), iv) *Tmarus angulatus* (Walckenaer, 1837), v) *Tmarus marmoreus* (L. Koch, 1876):

3.15 Family Trochanteridae (Karsch, 1879)

Only one species of the Flat Rock Spider, *Morebilus plagusium* (Walckenaer, 1837) was collected.

Table 2: Taxonomy of the collected Spider species recorded during the study

Class Arachnida Order Araneae					
S.no	Family	Genus/body length	Species (Scientific name)	Common name	Natural history
1	Araneidae (Simon, 1895)	Eriophora ♀ 20 – 25 mm ♂ 15 – 17 mm	<i>Eriophora transmarina</i> (Keyserling, 1865)	Garden orb weaver spider	Orb web spider
2		<i>Argiope</i>	<i>Argiope keyserlingi</i> Karsch, 1878	St Andrew's Cross spider	Orb web spider
3		<i>Neoscona</i> ♀ 8.5–19.7 mm ♂ 4.4–15mm	<i>Neoscona crucifera</i> (Lucas, 1839)	Hentz orbweaver	Orb-web weaving spiders
4		<i>Backbourkia</i> ♀ 15mm, ♂ 7mm	<i>Backbourkia heroine</i> (L. Koch, 1871)	Wheel weaver	Orb-web weaving spiders
<i>Total Araneidae: 4</i>					
5	Clubionidae (Wagner, 1887)	<i>Clubiona</i> ♀ are 7–10 mm, ♂ 6–10 mm	<i>Clubiona corticalis</i> (Walckenaer, 1802)	Bark sac spider	Bark of dead trees, sometimes in houses
6		<i>Clubiona</i> ♀ 3-6 mm, ♂ 3-5 mm,	<i>Clubiona comta</i> (C. L. Koch, 1839)	Sac spider	Under bark and sometimes in houses
7		<i>Clubiona</i> ♀ 7 to 13 mm, ♂ 6 to 9 mm	<i>Clubiona pallidula</i> (Clerck, 1757)	Sac spider	Tree tops and tree barks
<i>Total Clubionidae: 3</i>					
8	Corinnidae (Karsch 1880)	<i>Falconina</i> ♀ 5.9–8.9mm, ♂ 4.6–6.4mm	<i>Falconina gracilis</i> (Keyserling, 1891)	Antmimics and Ground Sac Spiders	Ground dweller
<i>Total Corionidae: 1</i>					
9	Gnaphosidae Pocock, 1898	<i>Zelotes</i> ♀ 9-19mm, ♂ 8-15mm	<i>Zelotes duplex</i> Chamberlin 1922	Ground Spiders	Ground dweller
10		<i>Zelotes</i> ♀ 4-7mm, ♂ 4-5mm	<i>Zelotes funestus</i> (Keyserling, 1887)	Ground Spiders	Ground dweller
11		<i>Zelotes</i> ♂ 4-6mm, ♀ 4-8mm	<i>Zelotes longipes</i> (L. Koch, 1866)	Ground spider	Outdoor hunts
<i>Total Gnaphosidae : 3</i>					
12	Hersilidae (Thorell, 1870)	<i>Hersilia</i> , ♀ 8-10mm ♂ 5-8mm	<i>Hersilia savignyi</i> (Lucas, 1836)	Two-tailed spider	Bark spider
<i>Total Hersilidae: 1</i>					
13	Lycosidae (Sundevall, 1833)	<i>Schizocosa</i> ♀ 9.6-22.7mm ♂ 9.1-15mm	<i>Schizocosa mccooki</i> (Montgomery, 1904)	Wolf Spider	Ground Dweller
14		<i>Hogna</i> ♀ 4-25mm ♂ 19mm	<i>Hogna carolinensis</i> (Walckenaer, 1805)	Carolina wolf spider	Ground Dweller
15		<i>Tigrosa</i> ♀ 21 mm, ♂ 12 mm	<i>Tigrosa helluo</i> (Walckenaer, 1837)	Wolf spider	Ground Dweller and under rocks
<i>Total Lycosidae: 3</i>					
16	Oxyopidae (Thorell, 1870)	<i>Oxyopes</i> ♀ 7mm ♂ 5mm	<i>Oxyopes variabilis</i> (L. Koch 1878)	Lynx spider	Vegetation, favouring grasses
17		<i>Oxyopes</i> ♀ 5-6mm, and ♂ 4-5mm	<i>Oxyopes salticus</i> (Hentz, 1845)	Striped Lynx Spider	Grasses and leafy vegetation; grassy, weedy fields, and row crops
18		<i>Oxyopes</i> ♀ 10 mm ♂ 9 mm	<i>Oxyopes macilentus</i> (L. Koch, 1878)	lean lynx spider	Grassy areas and rice fields
19		<i>Oxyopes</i> ♀ 6-8 mm, ♂ 5-7 mm	<i>Oxyopes javanus</i> (Thorell, 1887)	Striped lynx spider	Forage on the upper surfaces of green leaves and bushes.

Total Oxiopidae: 4					
20	Pisauridae (Simon, 1890)	<i>Dolomedes</i> ♀25 mm ♂ 12 mm	<i>Dolomedes instabilis</i> (L. Koch, 1876	fishing spiders, raft spiders, dock spiders or wharf spiders	Nursery web of fishing spider
Total Pisauridae: 1					
21	Salticidae (Blackwell, 1841)	<i>Trite</i> ♀ 7-9 mm, ♂ 5-7 mm	<i>Trite auricoma</i> (Urquhart, 1886)	Golden brown jumping spider	foliage and on the forest floor
22		<i>Plexippus</i> 9 to11 mm	<i>Plexippus paykulli</i> ♂ (Audouin, 1826)	Jumping spider	Associated with buildings
		<i>Plexippus</i> 9 to12 mm	<i>Plexippus paykulli</i> ♀ (Audouin, 1826)	Jumping spider	Associated with buildings
23		<i>Phintella</i> ♂3-5mm	<i>Phintella vittate</i> ♂ (C L Koch 1846)	Jumping spider	Flowers and leaves dwelling
		<i>Phintella</i> ♀4-5mm	<i>Phintella vittate</i> ♀ (C L Koch 1846)	Jumping spider	Flowers and leaves dwelling
24		<i>Menemerus</i> ♀9mm, ♂slightly smaller than female	<i>Menemerus bivittatus</i> (Dufour, 1831) Jumping spider	Grey wall jumper	Walls dwelling
25		<i>Menemerus</i> ♀7.25 mm ♂6.35mm	<i>Menemerus semilimbatus</i> (Carl Wilhelm Hahn 1827)	Jumping spider	Building walls, gardens and houses
26		<i>Epocilla</i> ♀ 8-9mm ♂ 6-8mm,	<i>Epocilla aurantiaca</i> (Simon, 1885)	Jolly epocilla, Jumping spider	Trees and leaves dwelling
27		<i>Epocilla</i> ♀8mm ♂6.7mm	<i>Epocilla calcarata</i> (Karsch, 1880)	Jumping spider	Vegetation

4. Discussion

The present study shows the dominance of ground dwelling spiders like Salticidae, Sparassidae and Aranidae in different habitats of District Charsadda KPK, Pakistan. The district has extreme climate with an extreme hot summer season. In district Charsadda, most of the area is under cultivation of different types of crops that provides different habitats for different kinds of invertebrates. A more diverse community of spiders is supported by complex herbs and shrubs [23]. Among them spiders are most dominating member of the community. Moreover, in the past, they have been rarely studied because most of the researchers call them as less important organisms [19]. A total of 44 species (Table 2 and 3) belonging to 29 genera and 15 families were recorded from the study area during March 2015- February 2017.

Most dominant species of domestic habitate were *Plexippus paykuli* and *Argiope keyserlingi*. In forest habitate *Leucage drumadaria* and *Macarokeris nidicolens* were dominant species. In the stream bank habitat, *Tetragnatha straminia* and *Oxyopes javanus* were dominant species. On the other hand in the crops fields' species *Phintella vitata* and *Oxyopis variabilis* and that of hilly habitat species *Plexippus paykuli* and *Holconia immanis* were most dominant. Similarly species *Uloborus diversus* and *Palystus castanus* were dominant in garden habitat, while the remaining species listed here were less frequent.

A total of 1098 araneid species including 38 species, 22 genera and 9 families were recorded from citrus field in Lahore, Pakistan [21]. The most dominant family was Lycosidae while higher numbers of spider specimens were in Gnaphosidae. From Gujranwala Pakistan, 178 spiders were collected belonging to 7 families, 10 genera and 22 species from fields of guava [22]. Family Araneidae comprised of five genera *Araneidae*, *Eriophora*, *Argiope*, *Neoscona*, and *Backobourkia*. There was found only one genus each in family Clubionidae as genus *Clubiona*, genus *Zelotes* in family Gnaphosidae and genus *Hersila* in family Hersilidae. In the current research it was studied that Family Lycosidae was represented by *Schizocosa*, *Hogna* and *Tigrosa*. One genus was studied as *Oxyopes* in family Oxyopidae and *Dolomedes* in family Pisauridae. Seven genera as *Trite*,

Phintella, *Plexippus*, *Menemerus*, *Epocilla*, *Hentzia*, *Macarokeris* were recorded in Family Salticidae. One genus *Scytodes* was recorded in family Scytodidae. Two genera as *Holconia* and *Heteropoda* in the family Sparassidae were found.

In the present study family Tetragnathidae consisted upon one genus as *Tetragnatha* and one genus *Steatoda* in family Theridiidae. Three genera as *Thomisus*, *Synalus* and *Tmarus* belong to family Thomisidae and one genus *Morebilus* was recorded in family Trochanteridae (Table 2).

The aim of the present research was to identify the spider families, genera and species present at district Charsadda in different habitats. An overview of the result showed that the most abundant among all fourteen families during the whole trapping session was family Salticidae. The order of abundance of the families was Salticidae > Thomisidae > Araneidae > Oxyopidae > Lycosidae > Clubionidae > Gnaphosidae > Tetragnathidae > Sparassidae > Theridiidae > Corinidae > Hersilidae > Scytodidae > Trochanteridae (Table 1).

There is a need of more research for determining relationship between patterns for spiders' distribution and management practices.

Further study is required for differences in the community compositions among different management practices which are helpful to determine spider inhabitants. This knowledge may prove to be helpful for manipulating agricultural habitats for maintaining and enhancing spider population in the field of integrated pest management.

5. Conclusion

This study provides baseline information for the occurrence, abundance and ecology of the different species of spiders.

The present study will help us to work for specifying the hidden benefits in spiders and the conservation of the species. Araneidae, Clubionidae, Corinnidae, Gnaphosidae, Hersilidae, Lycosidae, Oxyopidae, Pisauridae, Salticidae, Scytodidae, Sparassidae, Tetragnathidae, Theridiidae, Thomisidae and Trochanteridae are the predators in different habitats like meadows, Forest, garden, crops fields, stream banks, hills, tree trunks and domestic level. Spiders in these

areas are feeding on small insects like aphids, moths, beetles, grasshoppers and butterflies etc thus helps suppressing insect pest and provide maintenance of ecological equilibrium [23]. Therefore by rearing spiders can be used as biocontrol media where needed. The present study provides information about the distribution of different spider species in a particular habitat with response to disturbance, availability of food, and environment.

Reporting 44 species of 15 families show that the area has a great potential and diverse fauna therefore, a proper exploration of the area fauna is required.

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