

Spider diversity of Karnatak University Campus, Dharwad

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Abstract

Spiders are exclusively carnivorous and sociality among spiders is a rare phenomenon. They have established and adjusted themselves to various types of habitats and can be found throughout the world except Antarctica. Spiders are air-breathing arthropods whose body is divided into cephalothorax (bearing various jointed appendages such as chelicerae with fangs used for injecting venom and four pairs of legs) and abdomen (bears reproductive organs). Spiders belong to order Araneae which is the largest order among class Arachnida. With such a large numbers still it is difficult to find the spiders as majority of them exhibit camouflage. Hence, the present study was undertaken to survey and document spiders diversity in the Karnatak University, Dharwad campus which has different types of habitats. The results indicate that the KU campus has 41 species of spiders belonging to 32 genera falling under 15 families. Of which individuals belonging to Salticidae and Araneidae are dominant with 8 species each followed by Lycosidae (6), Pisauridae (2), Sparassidae (2), Thomisidae (2), Nephilidae (2), Hersilidae (1), Oxyopidae (1), Jerididae (1), Ctenidae (1), Filistatidae (1), Sicaridae (1) and Tetragnathidae (1). Among the 41 identified species, 26 species are common, 10 species are rare and remaining 5 species are found to be very rare. Individuals of all 41 species are found during all three seasons such as, Monsoon, Winter and Summer. Further, work is needed to look for the indoor and outdoor spider diversity and their webbing patterns.

Keywords: Diversity; Spiders; Karnatak University Campus Dharwad

1. Introduction

Spiders are air breathing exclusively carnivorous arthropods. The socialities among spiders are rare and are grouped in one of the eleven orders of the class Arachnida and rank seventh in total species

diversity among others orders of animal kingdom (Sebastin and Peter, 2009). Spiders are found worldwide on every continent except Antarctica. They have established in nearly every habitat with exception of air sea colonization.

The most important features of these spiders are abdominal appendages modified as spinnerets, silk glands and associated spigots, chemical venom glands, male pedipalpal tarsi modified as sperm transfer organs. The main groups of modern spiders are Mygalomorphae and Araneomorphae first appeared in the Triassic period well before 200 million years ago. This group accounts for the great majority of modern spiders including orb-shaped web weaved spiders (Coddington, 1986).

After November 2015, atleast 45,700 spider species and 114 families have been recorded by the taxonomist, it has been estimated that one hectare of tropical forest may support between 300 and 800 species of spiders at any given time (Coddington and Levi, 1991). They are the most numerous arthropods in all kinds of habitats (Basset, 1991).

Spiders are divided into Mesothelae and Opisthothelae suborders of which the later contains two infra orders, Mygalomorphae and Araneomorphae. At present, over 40,000 living species of spiders (order: Araneae) have been identified and are currently grouped into 110 families and about 3700 genera by Arachnologists.

Many spiders are active during night and their coloration are usually orange, brown, grey and black to reduce their visibility during day time, silk secreting systems of spiders and insects are homologous and linked to the crural gland and cuticular secretions (Saravan, 2006). The natural spinning processes of spider silk have shown a marvellous process of filament making from delicate glands at a very low temperature using water as solvents.

2. Objective:

The goal of the present study was to document the extent of spider assemblages that exists among various types of habitats, their identification and association pattern in the Karnatak University Campus, Dharwad.

3. Materials And Methods

Karnatak University, Dharwad campus is located at 15°26' 28.5'N and 74°59'2.1'E, with an elevation of 698.97 m above MSL. The Campus is commonly known as "Chota Mahabaleshwar Hill" on the Western frontier of Dharwad city. It is spread over 750 acres with undulating topography. It covers a botanical garden, fifty post graduate departments, hostels, staff quarters, two stadiums and many small gardens. The plants are distributed densely at botanical garden and less towards road sides, staff quarters, hostel and various departments. During summer grass totally dries up and its growth is initiated by onset of pre-monsoon and monsoon showers. Temperature ranges between 16 to 38°C throughout the year with an average annual rain fall of 800-900 mm.

The survey was carried out by dividing the campus area into five observation sites of different habitats (Photo 1 & 2) such as,

Site 1: University Gate 1 at Srinagar, Regional Science Centre, Dharwad, Rani Chennamma Girls hostel and surrounding areas.

Site 2: Department of Physics and Vivekananda Studies, University Canteen, and surrounding areas.

Site 3: Central Library, Computer Science Department and old stadium behind Research scholar hostel and surrounding areas.

Site 4: Nijalingappa and Bhima boys hostel, Golden Jubilee Building and surrounding areas.

Site 5: Green garden. Administrative building, Main building, Flower garden and surrounding areas.

A regular survey was carried out twice in a month during morning hours between 8-11 AM from August 2014 to March 2015. Along with the visual encounter method other methods such as, sweep net method, beating method, collection by hand and pitfall trap methods were used to study the spider diversity. Observed species were photographed using cannon DSLR 1200EOS Digital Camera and identified up to species level with the help of experts and available literature (Howell and Jenkins, 2004; Siliwal et al., 2005; and pictorial guides).

4. Results

During survey, the different groups of spiders were observed such as orb web spiders, long spinneret spiders, lynx spiders, nursery web, fishing spiders, jumping spiders, hunts man's spiders, comb footed spiders, crab spiders, daddy long leg spiders, false lycosids, crevice weavers, long legged orb weavers, violin spiders, long jawed orb weavers and various kinds of spider webs such as single line snare, the orb web, irregular webs/nets sheet webs, funnel webs and the triangle web were also seen during the survey.

Karnatak University campus, Dharwad has a rich spider diversity as we have recorded 41 species (Table 3) belonging to 32 genera under 15 families. Among these individuals Salticidae and Araneidae were found to be dominant with 8 species each followed by Lycosidae (6), Pholcidae (4), Pisauridae (2), Sparassidae (2), Thomisidae (2), Nephilidae (2), Hersiliidae (1), Oxyopidae (1), Teridiidae (1), Ctenidae (1), Filistatidae (1), Sicariidae (1) and Tetragnathidae (1).

The number of genera and percent representing in each family is given in the Table 1 and Graph 1. The highest numbers of genus (6) were observed in the Salticidae family followed by Araneidae (4) and Pholcidae (4) and accounts to 18.9 % and 12.5 % respectively. Least number of genus (1) was observed in Hersiliidae, Oxyopidae, Teridiidae, Ctenidae, Filistatidae, Sicariidae and Tetragnathidae having 3% each.

Table 1: Number and percentage of genus recorded in the present study under each family.

Sl. No	Family	Genus	
		Number	Percentage
1	Araneidae	4	12.5
2	Hersiliidae	1	3.1
3	Lycosidae	3	9.4
4	Oxyopidae	1	3.1
5	Pisauridae	2	6.2
6	Salticidae	6	18.9
7	Sparassidae	2	6.2
8	Teridiidae	1	3.1
9	Thomisidae	2	6.2
10	Ctenidae	1	3.1
11	Filistatidae	1	3.1
12	Nephilidae	2	6.2
13	Pholcidae	4	12.5
14	Sicariidae	1	3.1
15	Tetragnathidae	1	3.1

Table 2: Number of indoor, outdoor and endemic species distributed family wise.

Sl. No	Family	Species			
		Total No.	Indoor	Outdoor	Endemic
1.	Araneidae	8	0	8	1
2.	Hersiliidae	1	0	1	0
3.	Lycosidae	6	0	6	0
4.	Oxyopidae	1	0	1	0
5.	Pisauridae	2	0	2	0
6.	Salticidae	8	4	4	2
7.	Sparassidae	2	0	2	1
8.	Teridiidae	1	1	0	0
9.	Thomisidae	2	0	2	2
10.	Ctenidae	1	0	1	1
11.	Filistatidae	1	1	0	0
12.	Nephilidae	2	0	2	0
13.	Pholcidae	4	3	1	4
14.	Sicariidae	1	1	0	0
15.	Tetragnathidae	1	0	1	1
	Total	41	10	31	12

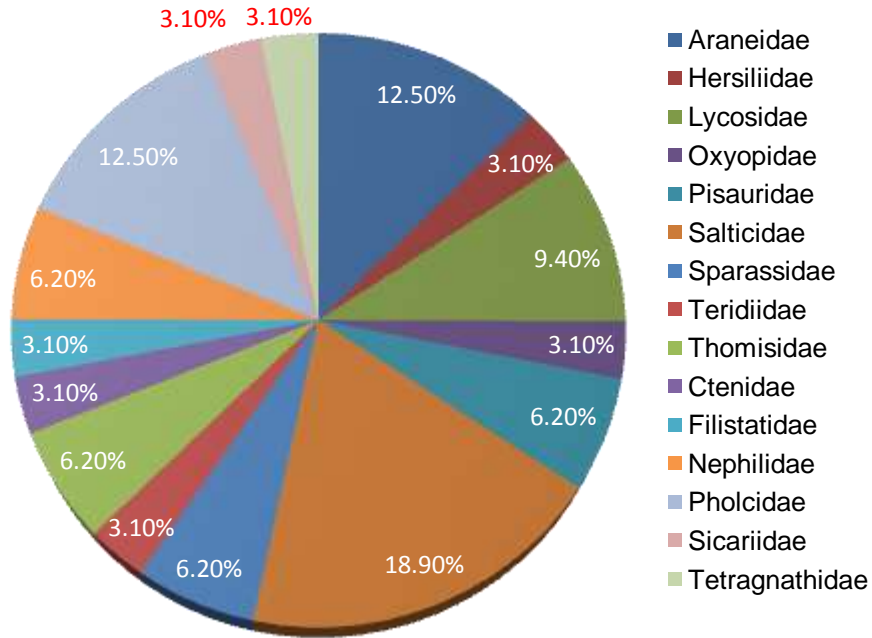
One important observation is that all 41 species were found during all the three seasons (monsoon, winter and summer) of which, 30 species belong to outdoor, 8 belong to indoor species and 12 were endemic species (Table 2 & Graph 2). About 16, 10, 10 & 5 species were common, very common, rare and very rare respectively in the habitats of KU campus (Table 3).

Table 3: Seasonal availability and status of different species.

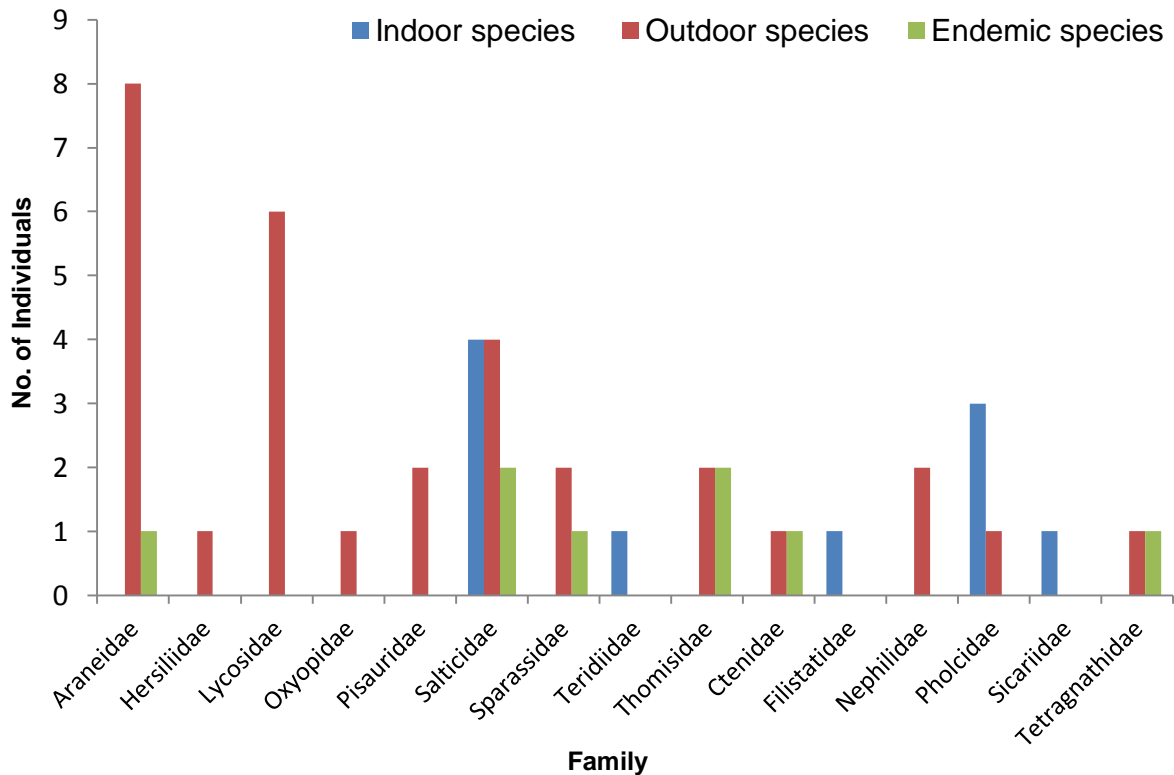
Sl. No	Species	Season *	Status
1	<i>Argiope aemula</i>	SM	Common
2	<i>Argiope anasuja</i>	SM	Common
3	<i>Argiope pulchella</i>	SM	Common
4	<i>Chorizopes bengalensis</i>	SM	Common
5	<i>Cyrtarachne keralayensis</i>	SM	Very Common
6	<i>Eriophora himalayaensis</i>	SM	Common
7	<i>Gasteracantha geminate</i>	W	Common
8	<i>Gasteracantha hasselti</i>	W	Common
9	<i>Hersilia savignyi</i>	SW	Common
10	<i>Paradosa pseudoannulata</i>	W	Common
11	<i>Hippasa</i>	W	Very

	<i>agelenoids</i>		Common
12	<i>Hippasa greenalliae</i>	W	Very Common
13	<i>Lycosa mackenziei</i>	W	Rare
14	<i>Pardosa birmanica</i>	W	Rare
15	<i>Pardosa sumatrana</i>	W	Rare
16	<i>Oxyopes birmanicus</i>	WS	Rare
17	<i>Perenethis venusta</i>	W	Very Rare
18	<i>Thalassius albocinctus</i>	SM	Rare
19	<i>Bavia kairali sp.</i>	WM	Rare
20	<i>Myrmarachne orientales</i>	M	Common
21	<i>Myrmarachne plataloids</i>	SM	Very Common
22	<i>Brettus albolimbatus</i>	M	Rare
23	<i>Phintella vittata</i>	WSM	Very Common
24	<i>Plexippus paykulli</i>	WSM	Very Common
25	<i>Plexippus petersi</i>	WSM	Very Common
26	<i>Rhene flavigera</i>	M	Very Rare
27	<i>Heteropoda nilgirina</i>	WSM	Very Common
28	<i>Olios milleti</i>	M	Common
29	<i>Achaearanea tepidariorum</i>	WM	Very Common
30	<i>Thomisus lobosus</i>	WSM	Very Common
31	<i>Xysticus minutus</i>	SM	Common
32	<i>Artema atlanta</i>	M	Common
33	<i>Crossopriza lyoni</i>	M	Rare
34	<i>Pholcus phalangioides</i>	M	Very Rare
35	<i>Uthina atrigularis</i>	M	Rare
36	<i>Ctenus cochinchensis</i>	S	Common
37	<i>Pritha spp</i>	M	Common
38	<i>Herennia multipuncta</i>	MW	Very Rare
39	<i>Nephila pilipes</i>	MW	Common
40	<i>Loxosceles rufescens</i>	W	Rare
41	<i>Leucauge pondae</i>	M	Very Rare

* (M = Monsoon, S = Summer, W = Winter)



Graph 1: Representation of genus percentage under each family



Graph 2: Representation of indoor, outdoor and endemic species under different families.

5. Discussion

From the present study it is evident that the spiders thrive in different types of habitats, as the spiders belonging to families Thomisidae, Salticidae, Tetragnathidae, Oxyopidae and Theridiidae were mainly found in vegetation, Thomisidae on flowering plants and tall grasses, Oxyopidae on grasses, Lycosids, Ctenids and some Salticids were located on the ground between dry leaves. *Hippasa agelenoides* found in sheet like webs with a funnel closed to the base of tree trunks and over holes in the ground. It has also been reported that, *Hersilia savignyi* (family Hersiliidae) is found on trees bark mimicking background colour (Eberhard, 1977). The spiders of Pholcidae family were found in corners of the building walls (Whipple, 2014). Most of the spiders are found in all kinds of habitats (Basset, 1991).

Majority of spiders living on ground and vegetation exhibiting protective colouration for camouflage (Foelix, 1996), some of the best examples among observed species include an ant like *Myrmarachne plataleoides* and *M. Orientales* (Salticidae): *Hersilia savignyi*, which resembles the bark of the tree where it inhabits. *Hippasa agelenoides* and *Ctenus cochinesis* are difficult to locate between the dry leaves on the ground (Oxford and Gillespie, 1998). Structural colour occurs in some spider species which results by diffraction and scattering or by interference of light (Platnick, 2005). The pigments such as ommochromes, bilins and guanine are responsible for colouration in spiders. Their excretion can be blocked in spiders leading to an increase in its storage that in turn reflects colouration (Oxford and Gillespie, 1998).

Among Araneids the species *Herennia multipuncta* and *Nephila pilipes* were found to be constructing the largest webs even *Nephila maculate* and *Argiope aemula* were found to construct a large webs with X-shaped stabilimentum (Greenstone, 1984; Vollrath & Selden, 2007).

Spiders produce different types of silk by various gland that containing combination of different types of amino acids such as glycine, (37-44%), Alanine (18-37%), Prolin (11-21%), Serine (15-28%) Becker *et al.*, 2003). These amino acids helps in web construction and also during reproduction. The important properties of these amino acids in spider silk are mainly sticky spiral attachment and wrapping of prey (Sarvanan, 2006).

The species *Perenethis venusta* (Family: Pissauridae) *Phene flavigera* (Family: Salticidae) *Pholcus phalangioides* (Family: Pholcidae), *Herennia multipuncta* (Family: Nephilidae) and *Leucauge pondae* (Family: Tetragnathidae) are among very rare species documented in the Karnataka University Campus, Dharwad. The checklist of spiders given by Siliwal *et al.*, (2005) showed that 1442 species belonging to 361 genera under 59 families of the updated list of 2012 reported as 1985 species belonging to 438 genera under 60 families. According to Siliwal (2005), some of the spider species are endemic to particular area or region.

The behaviour of some spiders have also been studied and recorded namely *Hersilia savignyi* do not build webs but attack Pedestrian prey, they encircle and fix it to the bark with bands of silk emitting from the lay spinnerets. They rotate rapidly clockwise and anticlockwise so as to encapsulate the prey. *Myrmarachne* species make a thick oval silken retreat under leaves with front and back doors for their in and out movements, even polymorphism can also be observed in this species (Borges and Wunderlich, 2008). *Menemerus bivittatus* actively moves in a criss-cross pattern in search of small insects, often vibrates hairy palps up and down while walking. *Argiope aemula* moves to the opposite side of the stabilimentum to conceal when it is in trouble (Bruce, 2006).

The species that are found abundant in the KU campus are mostly orb-weaving spiders namely *Argiope pulchella*, *Argiope aemula*, *Argiope anasuja*, *Chorizopa benalensis*, *Cyrtarachne keralayaensis*, *Eriophora himalayensis*, *Gasteracantha species*, *Nephila pilipes*, *Herennia multipuncta*, *Leucauge pondae*. Among lycosids, *Hippasa agelenoides* are very commonly seen. *Myrmarachne* species were also observed in abundance among the Salticids. *Ctenus cochinesis* a false lycosid species endemic to India were also found more in number..

All the species of Hersiliidae and Araneidae (except *Cyrtarachne keralayensis*) were sited very rarely this may be because of change in environment or due to interference and disturbance by humans.

The result of the present study revealed that there exists a great spider diversity within the Karnataka University campus. Hence, one can undertake further survey/research work on individual species to reveal more interesting facts as a comprehensive work on any single spider species has not been done so far. Research work on biology of spiders including their web construction, food and feeding habits, physiology and life history can also

be carried out that adds a valuable information to the campus fauna.

Acknowledgement:

The authors wish to thank authorities of Karnatak University, Dharwad for providing necessary facilities to carry out this work in the campus and in Department of Zoology, they also acknowledge UGC, New Delhi for financial support under SAP-DSA-I programme.

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Observation sites



Observation sites



PLATE I



PLATE II



PLATE III



PLATE IV



PLATE V



PLATE VI



PLATE VII

