



E-ISSN: 2320-7078

P-ISSN: 2349-6800

JEZS 2018; 6(2): 3186-3194

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Received: 06-01-2018

Accepted: 09-02-2018

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## Spider diversity on Mangalore University Campus

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**Abstract**

Arachnology is an attractive field of spiders, but it is largely ignored due to dislike of spiders. The objective of this study was to update the list of spiders in various patches of Mangalore University campus. Different sites of the Mangalore University campus were studied for spider diversity. A total of 32 species belonging to 16 genera were documented during the study period. Of these, ten genera were found to be arboreal, grassland ecosystem has species belonging to three genera and six were found to be in human constructions. Of all the 16 genera observed *Plexippus* was found to be abundant. *Oxyopes* was found to be more in number in arboreal spiders. Biodiversity indices revealed that the species richness in arboreal and dominance of some species over others in human constructions.

**Keywords:** Arachnology, arboreal, spider diversity, biodiversity indices

**Introduction**

Spiders are fascinating creatures with unique and unusual lifestyles. They being good hunters play vital role as predators, help maintaining ecological balance in nature. They have 7th place in of animal diversity in the world with count of 113 families 3873 genera with 43700 species. About 70 percent of the species are predators [1]. Spiders belong to Order Araneae, Class Arachnida of Phylum Arthropoda. Spiders constitute largest order and are different from other arachnids by the presence of pedicel, which joins cephalothorax and abdomen. Despite being highly ignored group, spiders are unique as they possess spinnerets near the hind end of the abdomen, which produce silk of which some are of economic importance [2]. Currently 1442 species have been identified in India, inhabiting various habitats like trees, plants, grasslands and buildings [3].

Many spiders are important as biological control agents to control several agricultural pests, especially in the paddy fields.[4] Though majority of Spiders are terrestrial, some live under water. Spiders differ significantly in habitat preferences, hunting strategies and active period. Thus study of Spider diversity provides knowledge which is highly essential in integrated pest management [5]. Spiders vary in their physiological tolerances thus temperature and humidity are two important limiting factors for their microclimatic preferences. The changes in vegetation parameters quality and disturbances of habitat are better monitored with the knowledge of spider diversity studies [6]. Several abiotic factors like seasonal changes and temperature as well as biotic factors like prey availability and their own guild-specific responses influence occurrence of spiders in different environments [7]. Studies are conducted to explore reasons for spider fauna variation and revealed that urbanization is one of the main causes of Biodiversity loss in Spiders, as they found that rural houses had higher species richness than urban houses [8].

spiders have been studied in different habitats. There are reports that reveals western Ghats Biodiversity Hotspots with 72% of endemism [9]. A group of researchers reported the occurrence of a female rock Tarantula in cashew plantations in Puttur [10]. exploring faunal biodiversity of spiders using Biodiversity indices is important as species richness is the only one way to assess habitat quality [11]. Even with such extensive research, data obtained about taxonomy and ecology of them is inadequate. As Spider diversity reports are scanty, it is necessary to update knowledge about them and update the current data. Therefore, a survey was carried out in the Mangalore University Campus. This information will enrich the base data on biodiversity in the Mangalore University campus.

## Materials and Methods

Spiders in different ecological niches of Mangalore University campus [located at Mangala Gangothi occupying 350 Acres of area 21 Km from Mangalore on the southern side (a triangular patch of 250.82 kms around the department of Applied Zoology,)] (Fig1) observed and documented. The MU campus (12°47'50"-12°52'03"N to 74° 52'45"-74°57'53"E) is located in Konaje on a plateau overlooking the Arabian Sea to the west and the Western Ghat to the East. Various habitats like grasslands, human constructions, trees and plant habitats (arboreal) were selected to study and count various types of spiders. They were photographed without disturbing their natural habitat. Some were collected by sweeping method using nets for small tree spiders, beating sheets for large trees and shrubs, active searching and handpicking methods for spiders from ground and grassland. They were brought to the laboratory and left to the habitat after identification. They were identified following keys provided by different taxonomists [2, 12, 13, 14, 15], [www.spiders.us/article/identification](http://www.spiders.us/article/identification), [www.projectnaoh.org/missions](http://www.projectnaoh.org/missions)] Spiders were counted at regular time period for three months. Everyday (5days/week) six hours (6-10AM,1-2PM,5-6PM) were spent on observation and photographing the spiders. The biodiversity indices for spiders were calculated using PAST software version 2.17C.

## Results

In total 112 spiders were observed of 9 families, 16 genera and 32 species.(Table 1 and 2) Of the total number of each species observed *Pholcus phalangioides* and *Plexippes paykulli* were found to be abundant, followed by *Oxyopes* species. Whereas *Aranus* sp, *Neoscona* sp, *Gastrocantha* and *Phintella*

were least in terms of abundance. (Fig 4). Photographs of spiders observed have been presented in Fig 2.

## Distribution of spiders in different habitats

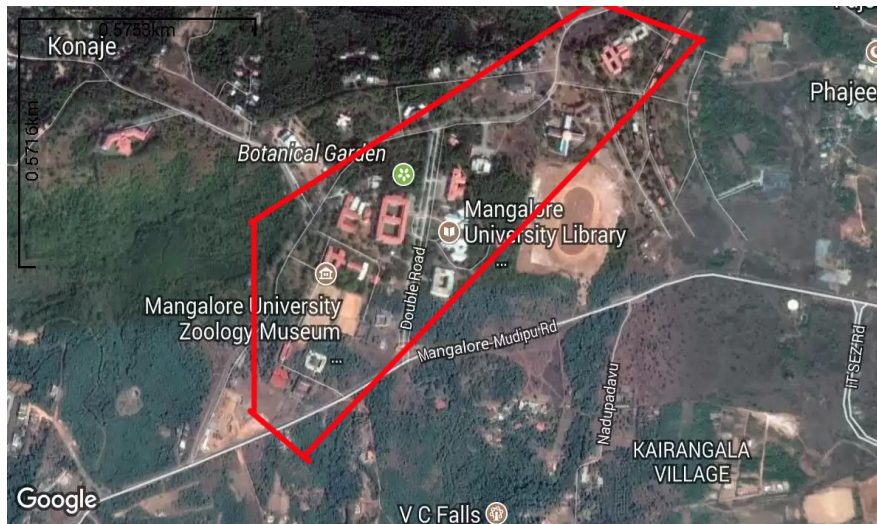
Arboreal habitats studied exhibited species richness with ten different genera having *Oxyopes* genus greater in number than others. Grassland habitats represented only three genera, of which *Hippasa* was more in number. *Argiope* and *Leucauge* were found in both the above habitats. About six different genera were observed in human constructions, where *Plexippes* dominated other genera. (Table 3)

## Monthly distribution of spiders

During the study period of three months p(September – November, 2016), of the different species observed,(Fig 3) *Plexippes paykulli* was found to be highest in the month of September. In the month of October *Plexippes petersi*, *Pholcus phalangioides* and *Hippasa agelenoides* were found to be dominant. *Oxyopes shweta* was dominant in the month of November.

## Species richness and species dominance

Arboreal habitat exhibited highest species richness, with 20 species belonging to 10 different genera with the Simpson index 1/D is 0.8423. Human constructions were next to arboreal habitats in species richness having six genera with one genus dominating others, showing species dominance. Grassland habitats showed high values for evenness (0.9601). Shannon – Wiener index value is greater in arboreal habitat indicating increased diversity and evenness of species distribution.( Values presented in Table-4 )



**Fig 1:** Area Covered In Mangalore University Campus For Study Of Spiders

**Table 1:** Spiders Found In and Around University Campus during the Study

S. No	Month of Observation		September	October	November
	Common name	Scientific name	Number of individuals observed		
1	White Lynx	<i>Oxyopes shweta</i>	3	1	4
2	Lined Lynx	<i>Oxyopes lineatipas</i>	2	1	0
3	Lynx	<i>Oxyopes sp. 1</i>	1	0	2
4	Lynx	<i>Oxyopes sp. 2</i>	1	1	0
5	Gaint wood spider	<i>Nephila pilipes</i>	1	1	0
6	Wood spider	<i>Nephila sp. 1</i>	1	1	0
7	Pond leucauge	<i>Leucauge pondae</i>	3	1	1
8	Three humped leucauge	<i>Leucauge decorata</i>	1	2	1
9	Electric blue banded phintella	<i>Phintella vittata</i>	3	0	1

10	Banded phintella	<i>Phintella sp. 1</i>	1	0	0
11	Funnel web spider	<i>Hippasa agelenoides</i>	0	4	2
12	Gaint crab spider	<i>Heteropoda venatoria</i>	1	2	1
13	Longbodied cellar spider	<i>Pholcus phalangiodes</i>	4	4	2
14	Signature spider	<i>Argiope sp. 1</i>	2	1	0
15	Oval St. Andrew's Cross spider	<i>Argiope sp. 2</i>	2	0	0
16	Signature spider	<i>Argiope sp. 3</i>	1	0	1
17	Signature spider	<i>Argiope pulchella</i>	3	1	1
18	Spiny orb weaver	<i>Gasteracantha geminate</i>	1	0	0
19	Two tailed spider	<i>Hersilia savignyi</i>	2	2	0
20	Common housefly catcher	<i>Plexippus petersi</i>	2	4	1
21	Common zebra jumper	<i>Plexippus paykulli</i>	5	2	2
22	Jumping spider	<i>Plexippus sp. 1</i>	1	1	0
23	Jumping spider	<i>Plexippus sp. 2</i>	1	2	0
24	Adanson's house spider	<i>Hasarius adansoni</i>	3	1	1
25	Gray wall jumper	<i>Menemerus bivittatus</i>	0	2	0
26	Black and white jumper	<i>Carrhotus viduus</i>	2	1	0
27	Jumping spider	<i>Carrhotus sp. 1</i>	2	1	0
28	Orb weaver	<i>Neoscona sp. 1</i>	1	1	0
29	Orb weaver	<i>Neoscona sp. 2</i>	1	1	0
30	Orb weaver	<i>Neoscona sp. 3</i>	1	0	0
31	Orb weaver	<i>Neoscona sp. 4</i>	1	0	0
32	Orb weaver	<i>Araneus sp. 1</i>	0	1	0

Period (September 1<sup>st</sup> To November 20<sup>th</sup>)







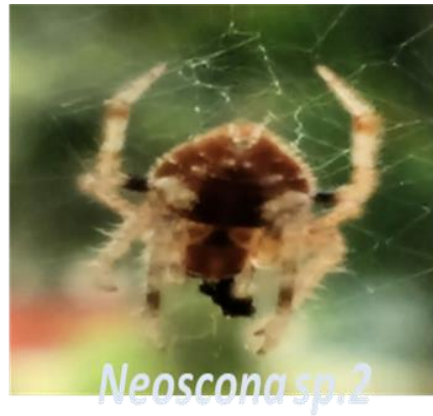
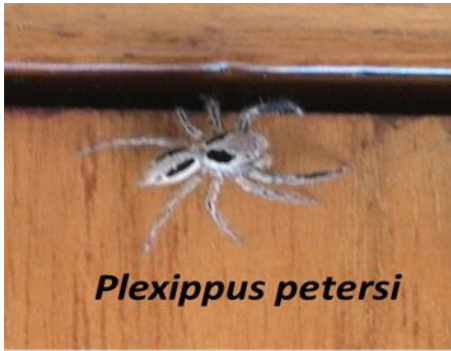






Fig 2: Spiders Found In And Around University Campus During The Study Period (September 1<sup>st</sup> To NOVEMBER 20<sup>th</sup>)

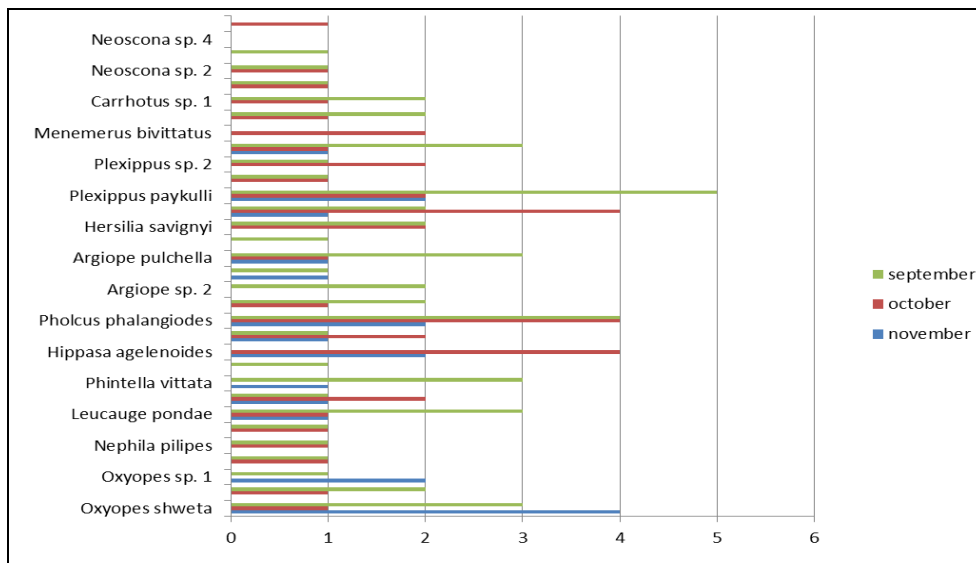


Fig 3: Monthly variation in spider species of mu campus found during study period

Table 2: List of Spider Species Observed In Mu Campus

S. No	Common Name	Scientific Name	Family	Habitat
1	White Lynx	<i>Oxyopes shweta</i>	Oxyopidae	Arboreal
2	Lined Lynx	<i>Oxyopes lineatipis</i>	Oxyopidae	Arboreal
3	Lynx	<i>Oxyopes sp. 1</i>	Oxyopidae	Arboreal
4	Lynx	<i>Oxyopes sp. 2</i>	Oxyopidae	Arboreal
5	Gaint wood spider	<i>Nephila pilipes</i>	Araneae	Arboreal
6	Wood spider	<i>Nephila sp. 1</i>	Araneae	Arboreal
7	Pond leucauge	<i>Leucauge pondae</i>	Tetragnathidae	Arboreal
8	Three humped leucauge	<i>Leucauge decorata</i>	Tetragnathidae	Grassland
9	Electric blue banded phintella	<i>Phintella vittata</i>	Salticidae	Arboreal
10	Banded phintella	<i>Phintella sp. 1</i>	Salticidae	Artificial Construction
11	Funnel web spider	<i>Hippasa agelenoides</i>	Lycosidae	Grassland
12	Gaint crab spider	<i>Heteropoda venatoria</i>	Sparassidae	Artificial construction
13	Longbodied cellar spider	<i>Pholcus phalangioides</i>	Pholcidae	Artificial Construction

14	Signature spider	<i>Argiope sp. 1</i>	Araneidae	Grassland
15	Oval St. Andrew's Cross spider	<i>Argiope sp. 2</i>	Araneidae	Arboreal
16	Signature spider	<i>Argiope sp. 3</i>	Araneidae	Arboreal
17	Signature spider	<i>Argiope pulchella</i>	Araneidae	Arboreal
18	Spiny orb weaver	<i>Gasteracantha geminate</i>	Araneidae	Arboreal
19	Two tailed spider	<i>Hersilia savignyi</i>	Hersiliidae	Arboreal
20	Common housefly catcher	<i>Plexippus petersi</i>	Salticidae	Artificial Construction
21	Common zebra jumper	<i>Plexippus paykulli</i>	Salticidae	Artificial Construction
22	Jumping spider	<i>Plexippus sp. 1</i>	Salticidae	Artificial Construction
23	Jumping spider	<i>Plexippus sp. 2</i>	Salticidae	Artificial Construction
24	Adanson's house spider	<i>Hasarius adansoni</i>	Salticidae	Artificial Construction
25	Gray wall jumper	<i>Menemerus bivittatus</i>	Salticidae	Artificial Construction
26	Black and white jumper	<i>Carrhotus viduus</i>	Salticidae	Arboreal
27	Jumping spider	<i>Carrhotus sp. 1</i>	Salticidae	Arboreal
28	Orb weaver	<i>Neoscona sp. 1</i>	Araneidae	Arboreal
29	Orb weaver	<i>Neoscona sp. 2</i>	Araneidae	Arboreal
30	Orb weaver	<i>Neoscona sp. 3</i>	Araneidae	Arboreal
31	Orb weaver	<i>Eriovixia sp.1</i>	Araneidae	Arboreal
32	Orb weaver	<i>Araneus sp. 1</i>	Araneidae	Arboreal

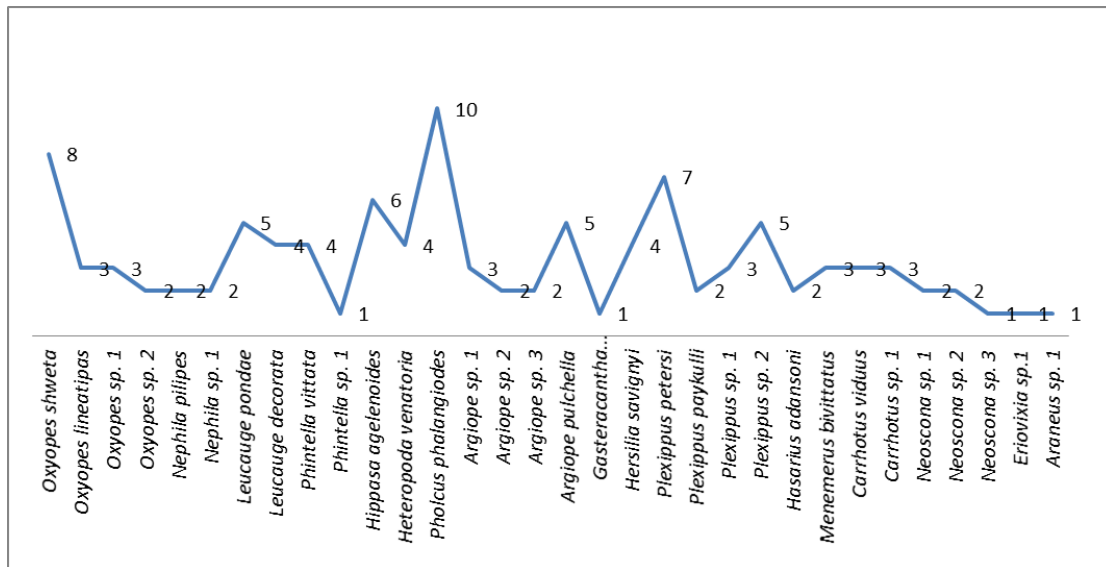


Fig 4: Total Number of Spiders in Each Species Observed During Study Period

Table 3: Distribution of Genera of Spiders In Different Habitats Of Mu Campus

S. No	Genera	Arboreal	Grassland	Artificial Construction
1	<i>Oxyopes</i>	16	0	0
2	<i>Nephila</i>	4	0	0
3	<i>Leucauge</i>	5	4	0
4	<i>Phintella</i>	3	0	1
5	<i>Hippasa</i>	0	6	0
6	<i>Heteropoda</i>	0	0	4
7	<i>Pholcus</i>	0	0	10
8	<i>Argiope</i>	9	3	0
9	<i>Gasteracantha</i>	1	0	0
10	<i>Hersilia</i>	4	0	0
11	<i>Plexippus</i>	0	0	21
12	<i>Hasarius</i>	0	0	5
13	<i>Menemerus</i>	0	0	2
14	<i>Carrhotus</i>	6	0	0
15	<i>Neoscona</i>	5	0	0
16	<i>Eriovixia</i>	1	0	0
17	<i>Araneus</i>	1	0	0

Table 4: Diversity Indices for Spiders Studied On Mu Campus

Habitat	Arboreal	Grassland	Human Construction
Taxa	10	3	6
Individuals	56	13	43
Dominance	0.1577	0.3609	0.3175
Simpson's Index	0.8423	0.6391	0.6825

Shannon-Wiener Index	2.042	1.058	1.391
Evenness	0.7709	0.9601	0.6695

## Discussions

This paper presents a standardized survey of the spider fauna and statistical estimates of the diversity in three different habitats of MU campus. Spiders are taxonomically diverse and exhibit community level diversity, they are useful indicators of environmental change [16]. They are most important as regulators of herbivore populations especially pests. They are also good sources of food for higher trophic levels like birds, small mammals amphibians small reptiles and also for some predatory insects. Spiders can be used in conservation ecology and assessment of environmental changes as their richness correlates with the abundance of other animals like mollusks, orthopterans, carabids and birds. Spiders have been also shown to accumulate many trace metals and known to be good indicators of ecotoxicological studies [17]. From the time R I Pocock and B K Tikadar have spotlighted Indian Arachnology and described 112 new species from India, several others contributed to the field adding and updating the checklist [18]. Spiders, in particular, are highly diverse, with more than 45,000 species in 114 families (World Spider

Catalog 2015). According to some published data around 50 % of the deposited material in collections around the planet is composed of undescribed species [19].

In the present study, we described 32 species of 16 different genera of 9 families in different habitats as presented in Table 1 and Table 2. Most suitable months are August to October for many spiders as they are seen in abundance during these months [20]. In our studies we recorded highest number of spiders during September (53) followed by October (39) and November (20).

Spiders of families like Oxyopidae, Araneidae, Araneae and Tetragnathidae were found mainly on trees, flowering plants, shrubs and small herbs in our study. Most of the Salticidae members were found on artificial constructions except for *Phintella vittata*, *Carrhotus viduus*, *Carrhotus sp.1* which were seen on vegetation. Sparassidae and Pholcidae family members were found indoor with salticidae. *Hippasa agelenoides* of Lycosidae was found exclusively in grassland along with some of families Tetragnathidae, Araneidae. Spiders on trees and vegetation were abundant owing to their predatory habitat and self defence. *Oxyopes* was abundantly arboreal genus found. (Table 3). Grassland spiders found on coarse patches of grass were well protected by the litter from trees. Spiders observed during the study exhibited different coloration for camouflage and mimic the natural vegetation as reported earlier [21]. Diverse web builder spiders including orbweavers (Araneidae, Tetragnathidae), irregular web builders (Pholcidae), funnel web builders (Lycosidae) and nonweb builders (Salticidae) were found in the MU Campus. Most of the Pholcidae members were found in corners of walls and roofs [22]. Of the spiders observed *Leucauge pondae*, *Oxyopes sp* and *Neoscona sp* were found be endemic to India [23]. Although there were no significant differences in the diversity of spiders in grassland and artificial constructions, higher species richness and dominance were estimated for arboreal communities as per Table 4.

This documentation in a selected patch of Mangalore University campus may add information to the spider catalog. There are several threats to the spider communities like, habitat loss and degradation, land use management techniques, use of pesticides and fertilizers, introduction of

alien species and collection by pet traders. These threats have made some spiders even extinct which is not known due to lack of documentation [24].

Earlier reports on spiders of the campus revealed few families and are reported in project dissertations. Spiders play vital role in different ecosystems and indicators of environmental changes due to human interference. As measurement of biodiversity becomes important, this spider survey and assessment of biodiversity indices provide us with valuable information about diversity of spiders in diverse habitats in the environment.

## Conclusion

Present study updates the checklist of spiders in the selected habitats of Mangalore University campus. This type of survey of spiders and their documentation would be useful in the future assessment of environmental conditions as well to create awareness for their conservation. In conclusion it can be said that there is an urgent need to understand more about their diversity as they are important as bioindicators of our environmental changes.

## Acknowledgement

The author is grateful to Department of Applied Zoology, Mangalore University for the support during the study period.

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