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Seasonal Variation and Habitat-wise Distribution of Spider Fauna in the Campus of Shri Chhatrapati Shivaji Mahavidyalaya, Shrigonda

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Abstract: ***The present study assessed seasonal and habitat-wise variation in spider fauna across the Botanical Garden, Lake area and Agricultural Field of Shri Chhatrapati Shivaji Mahavidyalaya, Shrigonda, Maharashtra. Observations were recorded during summer 2025, monsoon 2025 and winter 2025–26. A total of 756 individuals representing 12 provisionally identified taxa or morphotypes were documented. Monsoon showed the highest abundance with 366 individuals (48.41%), followed by summer with 229 (30.29%) and winter with 161 (21.30%). The Agricultural Field supported the highest abundance with 324 individuals (42.86%), followed by the Botanical Garden with 283 (37.43%) and the Lake area with 149 (19.71%). Lycosa sp. was the dominant taxon, followed by Hogna sp., Oxyopes shweta and Plexippus paykulli. The Botanical Garden showed the highest diversity and evenness, while the Agricultural Field was dominated by active hunting spiders. The Lake area supported a distinctive aquatic-associated morphotype. The findings indicate that season, vegetation structure, moisture and habitat complexity influence spider assemblages. As the study was based on pooled encounter counts, the results provide baseline descriptive information for future standardised biodiversity monitoring and taxonomic verification.***

Keywords: Araneae, Spider diversity, habitat association, seasonal abundance, spider assemblage

1. Introduction

Spiders are among the most diverse and ecologically important groups of terrestrial arthropods. They belong to the order Araneae and occupy a wide range of habitats, including forests, grasslands, agricultural fields, gardens, wetlands, buildings and urban landscapes. Their ability to survive in different environments is associated with varied hunting strategies, web-building behaviour, dispersal mechanisms and microhabitat preferences (Foelix, 2011; Wise, 1993).

Most spiders are generalist predators that feed on insects and other small arthropods. They consume flies, moths, beetles, leafhoppers, bugs, mosquitoes and several crop-associated insects. Through this predatory activity, spiders contribute to the natural regulation of arthropod populations and help maintain ecological balance. Their role is especially important in agricultural ecosystems, where they can supplement other biological-control agents and potentially reduce dependence on chemical pesticides (Riechert & Lockley, 1984; Nyffeler & Sunderland, 2003; Michalko et al., 2019).

Spider assemblages include both web-building and actively hunting forms. Wolf spiders generally hunt on the soil surface; lynx spiders search for prey among foliage; jumping spiders visually locate and pursue prey; crab spiders use ambush strategies; and several other groups construct specialised webs. The presence of these functional groups allows spiders to occupy different ecological niches and utilise prey found at various vegetation levels (Uetz, 1991; Cardoso et al., 2011).

The abundance and distribution of spiders are influenced by vegetation structure, canopy cover, leaf litter, soil moisture, temperature, humidity, prey availability and the degree of habitat disturbance. Habitats with greater structural complexity often provide more hunting surfaces, shelter, nesting sites and web-attachment points. Consequently, gardens with trees, shrubs, herbs and litter may support a more balanced spider assemblage than habitats with uniform vegetation (Greenstone, 1984; Hurd & Fagan, 1992).

Seasonal changes also affect spider activity and abundance. Temperature, rainfall, humidity, vegetation growth and insect availability vary throughout the year and influence reproduction, moulting, dispersal and foraging. In tropical and subtropical regions, the monsoon generally promotes rapid vegetation growth and increases insect abundance. These conditions may provide favourable shelter and food resources for spiders. In contrast, reduced vegetation and lower prey activity during winter may decrease the number of individuals observed.

Agricultural fields are dynamic habitats influenced by crop growth, irrigation, weed abundance, harvesting and pesticide use. Crop plants and associated weeds provide suitable hunting surfaces and shelter, while herbivorous insects serve as prey. Ground-running and foliage-hunting spiders are often abundant in such ecosystems and may help suppress crop pests (Sunderland & Samu, 2000; Nyffeler & Sunderland, 2003).

Botanical gardens provide comparatively permanent and structurally varied vegetation. Trees, shrubs, herbs, ornamental plants, and leaf litter create distinct microhabitats for ground-active, foliage-dwelling, bark-associated, and web-building spiders. Such habitat complexity may increase diversity by allowing several taxa with different ecological requirements to coexist.

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Lake margins are moist habitats with shoreline vegetation, wet soil, and aquatic or semi-aquatic insects. Emerging aquatic insects may provide prey for spiders inhabiting vegetation around the water body. Although overall spider abundance may be lower in open or sparsely vegetated lake margins, such habitats can support taxa with specific moisture requirements or aquatic associations.

Educational campuses are often overlooked in biodiversity studies, even though they may contain gardens, water bodies, agricultural plots, tree plantations and open spaces. Together, these habitats form a small landscape mosaic capable of supporting varied plant and animal communities. Campus biodiversity surveys can generate baseline ecological information and provide students with practical experience in field observation, taxonomy, ecological sampling and diversity analysis.

India supports rich spider diversity because of its varied geography, climate and vegetation. However, the spider fauna of many localities, particularly institutional campuses and semi-urban habitats, remains insufficiently documented. Accurate identification is also challenging because many spiders require microscopic examination of adult reproductive structures. Field identifications based only on colour or external appearance should therefore be considered provisional unless confirmed using standard taxonomic keys, voucher specimens and updated catalogues (Tikader, 1987; Sebastian & Peter, 2009; World Spider Catalogue, 2026).

The campus of Shri Chhatrapati Shivaji Mahavidyalaya, Shrigonda, contains three ecologically distinct habitats: a Botanical Garden, a Lake area and an Agricultural Field. These habitats occur within the same campus and experience similar regional climatic conditions, but differ in vegetation structure, moisture availability, prey resources and management. Such habitat variation provides an opportunity to examine the seasonal and habitat-wise distribution of spider fauna at a local scale.

The present study was therefore undertaken to document spider abundance during summer 2025, monsoon 2025, and winter 2025–26, and to compare spider assemblages among the Botanical Garden, Lake area, and Agricultural Field. The study provides baseline information for future biodiversity monitoring, ecological education and conservation-oriented management of the college campus.

1.1 Objectives

The study was undertaken with the following objectives:
1) To document the spider taxa encountered in selected habitats of the college campus.
2) To determine the seasonal abundance of spiders during summer, monsoon and winter.
3) To compare spider abundance among the Botanical Garden, Lake area and Agricultural Field.
4) To identify the dominant and habitat-associated spider taxa.
5) To compare taxon richness, Shannon diversity, Simpson diversity and evenness among habitats and seasons.
6) To provide baseline information for long-term biodiversity monitoring and conservation within the college campus.

2. Materials and Methods

2.1 Study Area

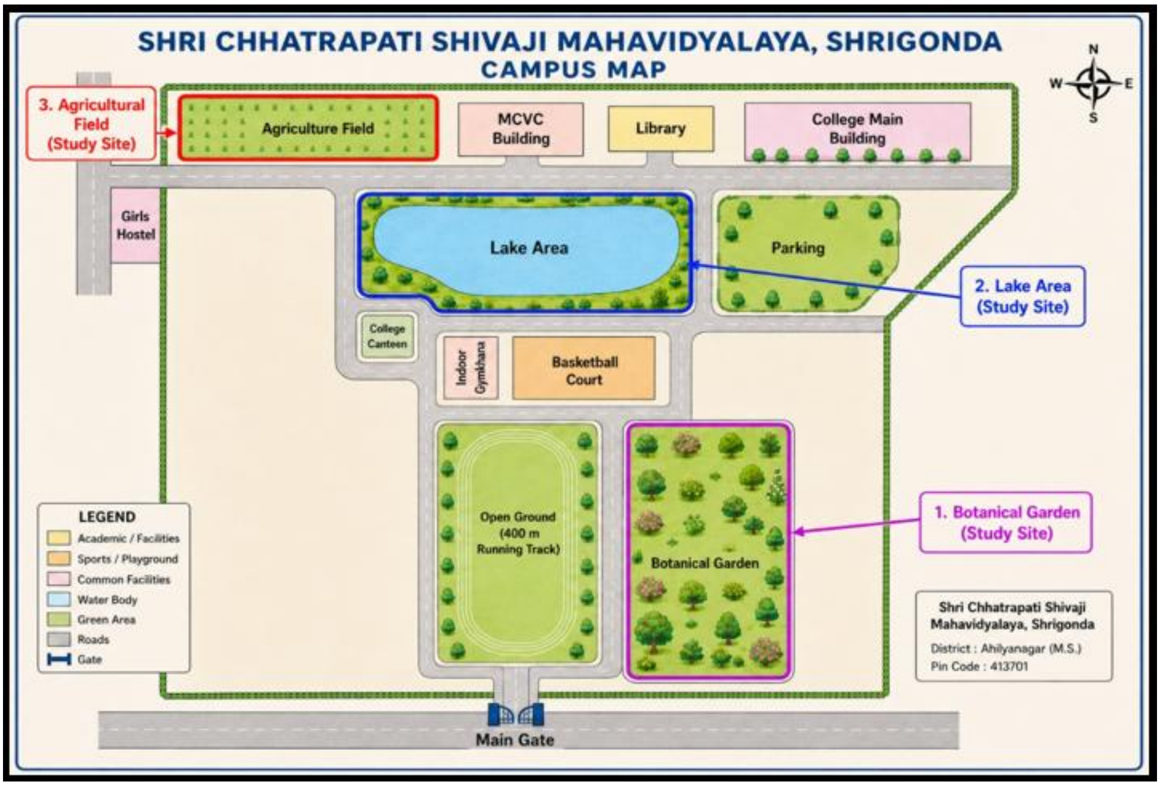

Figure 1: Schematic map of Shri Chhatrapati Shivaji Mahavidyalaya campus showing the three spider sampling sites: Botanical Garden, Lake Area and Agricultural Field.

The study was conducted within the campus of Shri Chhatrapati Shivaji Mahavidyalaya, Shrigonda, District Ahilyanagar, Maharashtra, India. Three habitats were selected for the investigation:

1) Botanical Garden
2) Lake area
3) Agricultural Field

All three study habitats are situated within the college campus.

2.2 Botanical Garden

The Botanical Garden contains trees, shrubs, herbs, ornamental plants, grasses and leaf litter. Differences in plant height and architecture create a variety of microhabitats for ground-active, foliage-dwelling and web-building spiders.

2.3 Lake Area

The Lake area includes the shoreline, surrounding vegetation and moist ground near the water body. This habitat differs from the other sites because of its greater moisture availability and the presence of aquatic and semi-aquatic insects.

2.4 Agricultural Field

The Agricultural Field contains cultivated plants, seasonal weeds, grasses and exposed soil. Crop-associated insects and varied ground and foliage surfaces provide potential prey and hunting areas for spiders.

2.5 Study Period

The observations covered one annual cycle from February 2025 to January 2026.

Season	Observation period
Summer 2025	February–May 2025
Monsoon 2025	June–September 2025
Winter 2025–26	October 2025–January 2026

2.6 Recording of Spider Abundance

Spiders encountered during field observations were recorded separately for each habitat and season. The number of individuals representing each recorded taxon was entered in seasonal field registers.

The observations were subsequently compiled into a season × habitat × taxon abundance matrix. The available data represented pooled encounter counts. Standardised sampling duration, number of observers, area searched, and replicate-level counts were not available in the original field records.

The recorded numbers were therefore treated as encounter abundance rather than estimates of population density.

2.7 Taxonomic Identification

Taxonomic names recorded in the field registers were reviewed before data analysis. Species names requiring further confirmation were retained at the genus or morphotype level by using standard literature.

These records should be confirmed by examining adult voucher specimens and diagnostic morphological structures.

2.8 Data Analysis

The compiled data were analysed for seasonal, habitat-wise and taxon-wise abundance, relative abundance, taxon richness, Shannon–Wiener diversity, Simpson diversity and Pielou’s evenness.

Relative abundance was calculated as:
Relative abundance (%) = $(n_i/N) \times 100$
where n_i represents the number of individuals of a particular taxon and N represents the total number of individuals.

The Shannon–Wiener diversity index was calculated as:
$$H' = -\Sigma\, p_i \ln p_i$$

The Simpson diversity index was expressed as:
$$1 - D = 1 - \Sigma\, p_i^2$$

Pielou’s evenness index was calculated as:
$$J' = H'/\ln S$$
where S represents the total number of recorded taxa.

Inferential significance tests were not applied because independent replicate-level counts and standardised sampling-effort data were unavailable.

3. Results

3.1 Overall Spider Abundance

A total of **756 spider individuals**, representing **12 provisionally identified taxa or morphotaxa**, were recorded from the three campus habitats during the study period.

3.2 Seasonal Abundance

The monsoon season had the highest abundance, with 366 individuals, representing 48.41% of all observations. Summer accounted for 229 individuals, while winter recorded 161 individuals.

3.3 Habitat-wise Abundance

The Agricultural Field supported the highest number of spiders, with 324 individuals. The Botanical Garden recorded 283 individuals, while the Lake area supported 149 individuals.

Table 1: Seasonal and habitat-wise abundance of spiders

Season	Botanical Garden	Lake area	Agricultural Field	Total	Percentage
Summer 2025	84	38	107	229	30.29
Monsoon 2025	127	82	157	366	48.41
Winter 2025–26	72	29	60	161	21.30
Total	283	149	324	756	100.00

The highest individual season habitat count was observed in the Agricultural Field during the monsoon, where 157 spiders were recorded.

3.4 Taxon-wise Abundance

Table 2: Seasonal and habitat-wise distribution of recorded spider taxa

Recorded taxon	Summer	Monsoon	Winter	Botanical Garden	Lake area	Agricultural Field	Total	Relative abundance (%)
Oxyopes shweta	30	44	13	35	10	42	87	11.51
Pholcus phalangioides	11	19	10	28	6	6	40	5.29
Phidippus sp.	20	24	23	28	5	34	67	8.86
Enoplognatha sp.	12	18	15	21	14	10	45	5.95
Hersilia savignyi	22	28	4	28	2	24	54	7.14
Hogna sp.	25	55	15	23	29	43	95	12.57
Lycosa sp.	28	58	23	37	24	48	109	14.42
Thomisidae	15	36	11	25	6	31	62	8.20
Plexippus paykulli	25	39	15	31	7	41	79	10.45
Loxosceles sp.	9	6	8	11	1	11	23	3.04
Aquatic spider	11	18	12	1	40	0	41	5.42
Heteropoda venatoria	21	21	12	15	5	34	54	7.14
Total	229	366	161	283	149	324	756	100.00

3.5 Dominant Taxa

Lycosa sp. was the most abundant taxon, with 109 individuals representing 14.42% of the total abundance, followed by *Hogna* sp. with 95 individuals (12.57%), *Oxyopes shweta* with 87 (11.51%), *Plexippus paykulli* with 79 (10.45%), *Phidippus* sp. with 67 (8.86%) and the Thomisidae morphotype with 62 individuals (8.20%). *Loxosceles* sp. was the least abundant taxon, with 23 individuals contributing 3.04% of the total.

3.6 Habitat Associations

Lycosa sp. recorded its highest abundance in the Agricultural Field, where 48 individuals were observed. The same habitat also supported the highest numbers of *Hogna* sp., *Oxyopes shweta*, *Plexippus paykulli*, *Phidippus* sp., Thomisidae morphotype and *Heteropoda venatoria*.

Pholcus phalangioides showed its highest abundance in the Botanical Garden, with 28 individuals. The garden also supported comparatively high numbers of *Hersilia savignyi*, *Plexippus paykulli* and *Lycosa* sp.

The aquatic spider morphotype showed a strong association with the Lake area. Of the 41 recorded individuals, 40 were found in the Lake area and one in the Botanical Garden. It was not recorded in the Agricultural Field.

3.7 Habitat-wise Diversity

Table 3: Habitat-wise spider diversity indices

Habitat	Abundance	Taxon richness	Shannon index H′	Simpson diversity 1−D	Pielou's evenness J′
Botanical Garden	283	12	2.367	0.902	0.952
Lake area	149	12	2.091	0.843	0.841
Agricultural Field	324	11	2.264	0.889	0.944

The Botanical Garden showed the highest Shannon diversity, Simpson diversity and evenness. The Agricultural Field recorded the highest abundance but slightly lower diversity than the Botanical Garden. The Lake area contained all 12 recorded taxa but showed the lowest diversity and evenness. This pattern was associated with the concentration of individuals among the aquatic spider morphotypes, *Hogna* sp. and *Lycosa* sp.

3.8 Season-wise Diversity

Table 4: Season-wise spider diversity indices

Season	Abundance	Taxon richness	Shannon index H′	Simpson diversity 1−D	Pielou's evenness J′
Summer	229	12	2.416	0.906	0.972
Monsoon	366	12	2.355	0.896	0.948
Winter	161	12	2.406	0.904	0.968

All 12 recorded taxa occurred during each season. Summer showed the highest Shannon diversity and evenness, while the monsoon supported the greatest abundance.

The slightly lower monsoon diversity and evenness resulted from the comparatively high abundance of a limited number of dominant taxa, particularly *Lycosa* sp., *Hogna* sp. and *Oxyopes shweta*.

4. Discussion

The present study recorded 756 spider individuals representing 12 provisionally identified taxa or morphotypes from the Botanical Garden, Lake area and Agricultural Field of Shri Chhatrapati Shivaji Mahavidyalaya, Shrigonda. The monsoon season showed the highest abundance, probably because increased rainfall, humidity, vegetation growth and prey availability created favourable conditions for spiders. Summer recorded intermediate abundance but the highest diversity and evenness, indicating a more balanced distribution of individuals among taxa. Winter showed the lowest abundance, possibly due to reduced temperature, vegetation productivity and insect activity.

Habitat-wise, the Agricultural Field supported the greatest abundance of spiders, particularly active hunters such as *Lycosa* sp., *Hogna* sp., *Oxyopes shweta*, *Plexippus paykulli* and *Phidippus* sp. Crop vegetation, weeds, exposed soil and abundant insect prey may have provided suitable hunting and sheltering conditions. The Botanical Garden showed the highest diversity and evenness, probably because its trees, shrubs, herbs, ornamental plants and leaf litter created varied and comparatively stable microhabitats. The Lake area recorded the lowest abundance and diversity, but it supported a distinctive aquatic-associated spider morphotype, indicating the ecological importance of moist shoreline habitats.

The dominance of wolf spiders, lynx spiders, and jumping spiders indicates that active-hunting spiders were an important component of the campus fauna. Web-building and bark-associated taxa, including *Pholcus phalangioides* and *Hersilia savignyi*, were also recorded, demonstrating habitat heterogeneity within the campus. Conservation of vegetation, leaf litter, and shoreline plants, and reduced pesticide use, may help maintain spider diversity.

The study was based on pooled encounter counts without standardised sampling effort or independent replicates; therefore, the results represent descriptive abundance rather than population density. Several species-level identifications also require confirmation through adult voucher specimens, examination of diagnostic structures and expert taxonomic verification. Future studies should use standardised monthly sampling, replicate observations and detailed photographic and specimen documentation.

5. Conclusion

The study documented a total of 756 spider individuals representing 12 provisionally identified taxa or morphotypes from the Botanical Garden, Lake area and Agricultural Field of Shri Chhatrapati Shivaji Mahavidyalaya, Shrigonda.

The monsoon season supported the highest abundance, followed by summer and winter. The Agricultural Field recorded the highest number of individuals, while the Botanical Garden exhibited the highest Shannon diversity, Simpson diversity and evenness. The Lake area supported the lowest abundance but contained a distinctive aquatic-associated spider morphotype.

Lycosa sp. was the dominant recorded taxon, followed by *Hogna* sp., *Oxyopes shweta* and *Plexippus paykulli*. The predominance of active hunting spiders demonstrates the importance of ground vegetation, crop plants, and prey availability on campus.

The findings provide baseline information for future spider surveys and campus biodiversity monitoring. Standardised monthly sampling, replication, documentation of sampling effort, preservation of voucher specimens and expert taxonomic confirmation are recommended for future investigations.

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