Original Research Article

Investigation and identification of various garden spider species in two distinct locations

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ABSTRACT

Aim: Spiders require all environments in which they can survive, and they are regarded as a helpful indicator of the overall species richness and health of terrestrial communities. They are particularly sensitive to natural world disturbances. As a result, the current study was carried out to investigate and identify the diverse garden spider species at two distinct locations: a large college campus garden and a house garden (small).
Place and duration of study: Garden of Magadh Mahila College (Patna, India) and the house garden (Patna city, India), between July 2001 to March 2022.
Methodology: Visual examination and camera capture of photographs of spiders in both research sites, and identification based on general shape, size, distinctive colour pattern, number and positioning of eyes, length and arrangement of their legs, and so on.
Result: Spiders are among the most diverse groups of organisms that exist in almost all micro habitats, as evidenced by the presence of 07 families, 15 genus, and 25 species in a small area. Due to their small numbers, this group cannot be disproved in conservation studies. Less species were found in the small garden in the house that was located in a well-built area, whereas a large number of different species of spiders were found in the college campus garden with a larger area of vegetation.
Conclusion: This brief investigation discovered that there were various species present, each belonging to a separate genus and taxonomic group. This research represents a modest effort to advance our understanding of spider diversity and taxonomy.

Comment [T1]: According to this brief investigation, multiple species were present, each belonging to a different taxonomic group.

Comment [T2]: As a result of this research, we will be able to gain a better understanding of spider diversity and taxonomy.

Key words: Spider, Diversity, Species, Habitat, Genus

1. INTRODUCTION:

An essential component of ecological research continues to be comprehending the abundance, diversity, and composition of species within an ecosystem. Except for Antarctica, spiders can be found on every continent. They both hunt and are hunted. They catch their prey in a variety of ways, such as spinning a web and waiting for unsuspecting prey to fall into it, or jumping out of a hiding spot onto a passing meal. They rank seventh in the world in terms of animal diversity, with 113 families, 3873 genera, and 43700 species. Approximately 70% of the species are predators [1]. Spiders are ARACHNIDS, a Class of Arthropod phylum. There are over 45000 different species of spiders on the planet [2]. Spiders range in size from the tiny Samoan moss spider (.011 inch long) to the massive Goliath bird eater tarantula (leg span of nearly a foot) [3]. Though all species have venom to some degree, only a few are dangerous to humans. In India, 1686 spider species from 438 genera and 60 families have been recorded [4]. Spiders are the most diverse female-dominated and predatory arthropod order. They are clearly the most important component of the entire ecosystem in which they live [5]. Because it acts as a biological controlling agent and helps to reduce insect and pest populations that could otherwise destroy crops, spiders have great economic value to humans. They can be used as effective biological indicators to evaluate the health of the ecosystem because they are simple to identify and have varying responses to anthropogenic and natural disturbances [6].

Comment [T3]: The abundance, diversity, and composition of species within an ecosystem remain essential components of ecological research.

Despite their size, spiders are unquestionably important for the environment because they are more common predators than other forest arthropods [7]. A variety of spider species may live in a variety of biotopes and are likely to be active all day. As a result, spider species assemblages will leave fewer refuges for potential prey in both time and space. Usually, together with other natural enemies, spiders have a significant impact on the population of pests. Due to their polyphagous nature, spiders can also act as a biodiversity controller agent for a variety of insect pests. The roles mentioned indicate that spiders play a significant role in the food chain. Spiders are essential in protecting against pest insects in housing, agriculture, and plantations [8]. Additionally, spiders can serve as a biological indicator of environmental change [9]. Spiders are able to capture prey that is different in size and/or developmental stages due to variations in spider size and/or prey capture strategies [10]; Henaut et al., [11] According to some concepts, habitat heterogeneity plays a significant role in determining the abundance and diversity of spider species in natural systems [12]. The diversity of the vegetation, the architectural features, the degree of stratification of the vegetation, the availability of water, and the topsoil structure are the main indicators of the habitat heterogeneity [13]. Several factors have an impact on the ecosystem's spider diversity [14]. The variety of spiders living in the ecosystem will change as it transitions from a tropical forest to a plantation area and a settlement. Spider diversity will decrease as the variety of vegetation in tropical forests decreases [15].

On the other hand, an ecosystem's structure and complexity will also result in an increase in the number of spiders [16]. Web-building spiders are particularly more responsive to structural complexity because habitat structural complexity provides the spatial arrangement for web placement [17, 18]. However, studies on conservation have largely ignored them despite the fact that they play crucial roles in the majority of natural ecosystems [6].

Before developing a conservation strategy, we should also be aware of the diversity of spider species that exist. The richness and present distribution of spider species must therefore be evaluated. There are no spider species data available for Patna (Bihar), India. No study has been undertaken before this study. The study's objective is to investigate the various species of spiders that can be found in the house's garden and on the Magadh Mahila College campus (MMC). The study largely concentrated on the species' identification, diversity, and richness in these two particular places.

2. MATERIALS AND METHODS:

Study place: The study site is located in Patna, Bihar, India (N 25° 36' 45", E 85° 7' 41.9988"). Both the MMC campus garden and the house garden are situated near to the Ganga River. There were only a few different types of plants (shrubs) in the house garden, including Tulsi,

Rose, Hibiscus, Aloevera, Chilli, Sadabahar, etc. The MMC garden has a variety of plants, trees, shrubs, and herbs. Additionally, the fauna are diverse. During the growing season, this study was conducted. The spider community peaks during this growing season, making it a crucial time to study spider diversity. When temperatures, precipitation, and relative humidity are on average, that time is known as the growing season. Most suitable months are August to October for many spiders as they are seen in abundance during these months [19].

Sampling : No spiders were touched or injured by any objects during the study. The study was based on photography and visual search. The visual search method was used to search of spiders at both study sites. They were seen on the ground, under leaflets, on flowers, folded leaves, and in the bushes. Images of the specimen were taken with a mobile camera (a 16MP+2MP+8MP AI Triple Rear camera from the Vivo Z1 Pro). Spider photographs were taken at both study sites throughout the time period.Ongoing observations were made of their behaviour, feeding patterns, web-building activities, and size and shape.

Identification: Different types of spiders had been identified based on the general shape, size, distinctive colour pattern, number and placement of eyes, length and arrangement of their legs, etc., that were noted in each observation.

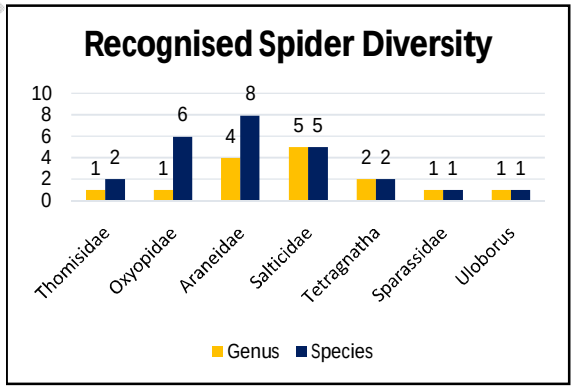
S.N.	Species	Family

Data Analysis: For the samples that were taken from the two study sites, data analysis was done to determine the richness and diversity of the species. The species of identified spiders were first taxonomically assigned to their appropriate order and family. Additionally, the relationship between species abundance and time and season was noticed.

3. RESULTS AND DISCUSSION:

In the current short-term study, two distinct sites' habitat and spider species diversity were identified and examined (house garden and MMC garden). The study showed the presence of various species belonging to various genera, taxonomically classified under various families, and systematically arranged under the order Araneae. Total 25 species belongs to 15 genera under 7 families. Among it, 8 Species under 4 genera of Araneidae, 6 Species under 1 genus of Oxyopidae, 5 Species under 5 genera of Salticidae, 2 Species under 2 genera of Tetragnathidae, 2 species under 1 genus of Thomisidae, 1 species of Sparassidae and 1 species of Uloboridae family was found (Fig-1, Table-1)

Comment [T4]: This study identified two distinct sites, all of which had a wide variety of spider species, and examined their habitats and diversity



1	*Thomisus onustus*	Thomisidae
2	*Thomisus labefactus*	Thomisidae
3	*Oxyopes salticus*	Oxyopidae
4	*Oxyopes sertatus*	Oxyopidae
5	*Oxyopes papunus*	Oxyopidae
6	*Oxyopes javanus*	Oxyopidae
7	*Oxyopes*: Orange Backed Spider	Oxyopidae
8	*Oxyopes* : Black Backed Spider	Oxyopidae
9	*Larinoides cornutus*	Araneidae
10	*Cyrtophora citricola*	Araneidae
11	*Cyrtophora cicatrosa*	Araneidae
12	*Neoscona crucifera*	Araneidae
13	*Neoscona thesis*	Araneidae
14	*Argiope anasuja*	Araneidae
15	*Argiope aemula*	Araneidae
16	*Argiope kyserlingi*	Araneidae
17	*Telamonia dimidiata*	Salticidae
18	*Epocilla aurantiaca*	Salticidae
19	*Phidippus putnami*	Salticidae
20	*Myrnarachne gladstone*	Salticidae
21	*Evarcha*	Salticidae
22	*Leucauge decorata*	Tetragnathidae
23	*Tetragnatha*	Tetragnathidae
24	*Olios milleti*	Sparassidae
25	*Uloborus*	Uloboridae

Fig-1: Spider diversity at two distinct study areas.

Table 1 : List of the recognized spider species on both Study areas.

Comment [T5]: Need formatting in table 1

In comparison to a house garden, the MMC garden had a greater variety of species. Out of the total, 20 species recorded from the MMC garden and the 10 species recorded from house garden, 05 species were frequently found at both locations (Fig-2). The Araneidae, Oxyopidae, and Salticidae families were frequent ones.

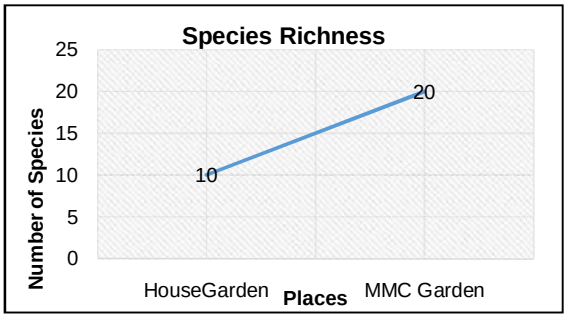
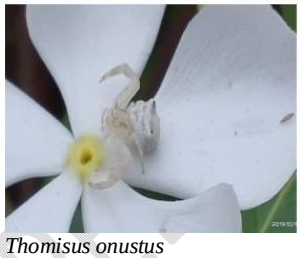
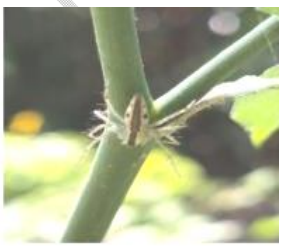


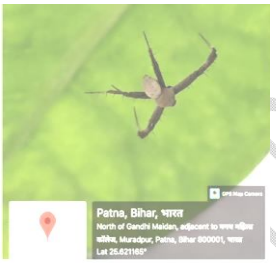
Fig-2 : Species Richness on both study areas.

There are 11 species of orb-web builders in the families Araneidae, Tetragnathidae, and Uloboridae. The families Salticidae and Oxyopidae contained 11 species collectively known as Stalker. 03 species of ambushers were classified in the families Thomisidae and Sparassidae. In this study, a total of 25 species from 15 genera and 7 families were identified from the investigation site (Pictures of few species has been given in the section of Images-1).

 *Thomisus labefactus*	 *Thomisus onustus*	 *Oxyopes salticus*
 *Oxyopes* :Orange backed spider	 *Oxyopes:* Black backed Lynx spider	 *Oxyopes javanus*
 *Leucauge decorata*	 *Telamonia dimidiata*	 *Neoscona crucifera*

 *Neoscona thesis*	 *Tetragnatha*	 *Olios milleti*

Images- 1 : Different species of spiders investigated in two distinct study areas of Patna (India):Magadh Mahila College Campus garden and House garden

 *Larinoides cornutus*	 *Phidippus putnami*	 *Myrmarachne Gladstone*
 *Argiope kyserlingi*	 *Argiope anasuja*	 *Argiope aemula*
 *Epocilla aurantiaca*	 *Cyrtophora cicatrosa*	 *Evarcha*

Images- 2 : Different species of spiders investigated in two distinct study areas of Patna (India):Magadh Mahila College Campus garden and House garden

20 species have been identified from the MMC garden. They were typically encountered, and they belonged to the family Araneidae. Rao et al., [1] studied 32 species across 16 taxa on the campus of Mangalore University. The MMC campus is only 9 acres, which is a very minor portion of the 350 acres that make up the Mangalore University campus. However, the presence of several spider species demonstrates a vast diversity. The spider diversity in upper northern Rajasthan confirms the presence of the 39 species which belong to 11 families [18]. According to research by Koneri [20], there are 812 different types of spiders in Indonesia, which are divided into 15 families and 117 morphospecies. These studies have been looked into more thoroughly. As a result, they have a wide variety of spiders. However, the present study reports demonstrate a relatively very low diversity of spiders as a result of the extremely limited region investigated. The main component of any spider microhabitat is vegetation, and the MMC garden is comparatively rich in both flora and faunal diversity (flies, butterflies, dragonflies, wasps, beetles, ants, etc.). The house garden is a small area with a limited variety of plant species. The identification of 10 species across different groups took a while because the area was so limited and disturbed. According to Bonn and Kleinwachter [21], interspecies relationships and habitat divergence led to an increase in species richness. In this investigation, the majority of the spider species were discovered over trees, bushes, and plants. This proves that a variety of biotic and abiotic factors have an impact on the habitat selection of spiders.The identified spiders belonged to various functional groups, including ambushers, orb-web builders, and stalkers (Fig-3) .

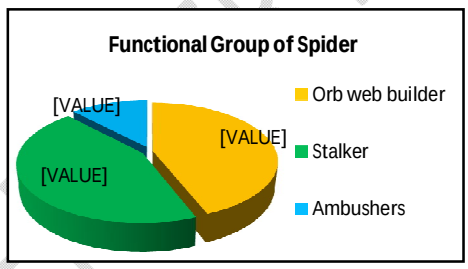


Fig-3 : Functional group of spider species.

The distinctive characteristics, habitat, behaviour, and feeding habits of spiders were also examined. Spiders prefer to live in less disturbed areas. Typically found on grass, flowers, leaves, and stems, mostly in lowland vegetation. Spiders exhibit mimicry and camouflage behaviors. Some spiders construct their own webs, while others do not. The majority of the time, web-building spiders construct their webs at night and hang themselves from the centre of the web to catch their prey. Because they enjoy the shade, spiders used to spend the day hiding inside their platform made of woven silk. Although some spiders have spinnerets, which are used to spin silk, they don't build webs to catch prey; instead, they use silk to climb or move from one plant to another, to form cocoons in folded leaves for egg laying, and to weave platforms of silk on which to rest and conceal themselves. In general, spiders eat tiny flies, bees, butterflies, and mosquitoes. Instead of eating the entire organism, they suck the fluid inside. Some of them consume flower nectar and pollen as well. *Thomisus onustus* eggs can also be obtained from folded leaves.

The diversity, distribution, and insect-eating habits of spiders are crucial to maintaining the natural order [22]. The house garden, where a variety of insects were found [23], provides a better habitat for them to live in.The abundance of spider species in the ecosystem is demonstrated by their presence in such a small area. Spiders are very attractive as a food source for birds, and the MMC garden draws a wide range of bird visitors [24]. It suggests

healthy environment conditions and good vegetation. Every type of less disturbed microhabitat that has spiders can be found. Their mimicking and camouflaging behaviors point to their capacity for environmental adaptation. They can be used to gauge how communities respond to environmental change or disturbance as potential biological indicators of natural habitat [25].

4. CONCLUSION:

There has never been a study like this one. Therefore, no documentary evidence was accessible. The findings of this study and the observations made regarding a number of factors led to the conclusion that environmental factors and habitat structure (such as shape, size, and vegetation arrangement) may be the most important factors affecting the complexity and makeup of the local spider community. Its variety may be impacted by the availability of plants and food resources. Identification and research into their habitat and behaviour yield a variety of data and expand our understanding of the ecosystem's spider diversity pattern. Spiders have a significant economic function in the environment and are excellent biological indicators.

Comment [T6]: This is the first study of its kind.

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