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Taxonomic and functional diversity, distribution, and conservation status of spiders in urban habitats of Jorhat district in Assam, India

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Abstract
A study was conducted on the distribution, abundance, and diversity of spiders in urban habitats of Jorhat district in Assam, India, between 2023 and 2024 using standard sampling techniques (aerial and ground hand collection, beat sheet method, and household goods search). The study recorded 82 spider species belonging to 19 families and 9 ecological guilds. The highest species richness (42.7%) was recorded from Araneidae family, followed by Salticidae (17.1%). In the case of abundance, Pholcidae was found to be the most abundant family (42.8%), followed by Araneidae (30.9%), Salticidae (7%) and Sparassidae (6%). The remaining 15 families exhibited <5% species abundance. The Shannon-Weiner index indicated high species diversity (3.26) in the study area, with the highest diversity values in Araneidae (2.65) and Salticidae (2.39) families. Margalef's diversity value (10.7) also suggested a very high overall species richness. However, a high Simpson's diversity value (0.92) and a low Pielou's evenness value (0.43) indicated unequal distribution of species, highlighting the dominance of certain species and dispersal of others, further emphasizing their conservation importance. The peoples' perception of these tiny under-researched creatures also needs to be changed for the conservation of the same, failure of which will lead to ecosystem imbalance at the micro level.

Keywords: Spiders, Arachnida, abundance, urban biodiversity, ecological guild

Introduction

Spiders are cosmopolitan creatures; they occupy all habitats and niches of the globe [1]. All recorded spiders are carnivorous, living almost wholly on insects, except the facultative omnivore *Bagheera kiplingi* Peckham & Peckham, 1896 from Central America [2]. This makes spiders excellent biological agents of agricultural pest management [1]. Furthermore, they serve as food sources for many carnivores [3]. Most importantly, spiders act as bioindicators of ecosystem health owing to their extreme sensitivity to habitat disturbances [4-6]. Most spider species are harmless, and it is only because very few of the species contain venom in their glands that most people have a very antagonistic perspective toward all arachnids [1]. Despite the widespread belief that mygalomorph spiders are poisonous, there are very few real accounts of their bites [7]. Despite their practical uses, spiders are a very underappreciated group of fauna, with many cultures viewing them as ill omens. Even the scientific community has been affected by this, which explains the negligence of spider research worldwide. Although new species of spiders are reported in India [8, 9], only a few are included in the IUCN Red List [10]. Additionally, most species described from India are known solely for their type locality, indicating a lack of exploration [11].

Northeastern and eastern India has a greater number of spider species identical to those of China and Malaysia, than to Western India [1]. Assam and the entire region of Northeast India, despite being tremendously rich in biodiversity, is perhaps one of the least explored regions of the world. The study of the taxonomic diversity of spiders in Assam is still insubstantial with few notable exceptions [12-25]. Spider diversity studies in the Jorhat district have been conducted only in Gibbon Wildlife Sanctuary [12, 14] and tea gardens [13]. Moreover, the study of functional diversity of the same in Assam is negligible, with very few exceptions [23]. In most of the literature, there are several errors in the scientific names and classification of spiders, even in recent publications. The current study has attempted to correct those errors by providing revised classifications based on the WSC [26].

Despite being sensitive bioindicators of environmental changes, there is hardly any literature on the impact of urbanization on spider assemblages. Among the minuscule number of such studies, a noteworthy case study in Assam has recently been conducted in the context of the Kamrup Metropolitan district [23]. There is virtually negligible literature on urban biodiversity in India, not just about spiders but concerning all fauna. This study was thus conducted to better understand spider distribution, abundance, dominance, dispersal, anthropogenic stress, and conservation status in several urban settings in the Jorhat district of Assam, India.

Study Area

The current study was conducted in the urban habitats of Jorhat district located (26.75º N and 94.22º E) in eastern Assam, a state in Northeast India, lying at the foothills of the extended Eastern Himalayas. Geographically spanning 2,851 km^2, the district falls in the Eastern Brahmaputra Valley and on the Southern bank of the Brahmaputra. It shares boundaries with Majuli district in the North, Nagaland state in the South, Sivasagar district in the East, and Golaghat district in the West. The tributaries of the Brahmaputra River, primarily Bhogdoi, traverse through it.

The climate of Jorhat is similar to that of other parts of Assam which is primarily humid subtropical, with hot summers, severe monsoons, and mild winters, receiving heavy rainfall, exceeding 360 cm annually. The area is a constituent of the Eastern Himalayan Biodiversity Hotspot of India and consists of a significant wildlife protected area (Hollongapar Gibbon Wildlife Sanctuary), a reserve forest (Molai Kathoni) and an Important Bird Area (Jhanjhimukh-Kokilamukh). The principal city of the district is Jorhat town, which is one of the fastest-growing cities in Assam. The population of Jorhat is 1,092,256 and its density is 383 people per sq. km.

Methods

A total of 36 quadrats, each 10x10m were plotted on the ground, separated by a minimum distance of 200m, for each habitat. For the residential complex, 36 houses were randomly selected from the survey plots [27]. Thirty minutes were taken for sampling in each quadrat or house. The randomly chosen study sites covering all habitats include AAU Campus, Bongal Pukhuri, Choladhora, DCB Road, Gandhi Park, Gar Ali, JBU Campus, Lichubari, Malow Ali, Mariani town, Millenium Park, Nehru Park, NEIST Campus, Rajabari Park, Rajamaidam, Rowriah, Sonari Gaon, Tarajan, Teok, Titabor town, and TRP Phukan Road.

Four standard techniques were used for locating spiders in different habitats [28, 29], which are as follows:

1. **Aerial Hand Collection:** The spiders were searched from the knee height to the top of the vegetation cover.
2. **Ground Hand Collection:** Spiders were searched on the surface of the ground, rocks, and plants below the knee level.
3. **Beat Sheet Method:** Keeping a light-coloured cloth under, the vegetation and plants were shaken rigorously to collect spiders.
4. **Household Goods:** All the hideout areas inside the houses and marketplace were thoroughly searched to locate spiders.

Once a spider was sighted, it was collected in a small sampling container for dry preservation and photographed later. For identification, keys from various published sources [30, 31] were used. If a spider species was identified only up to the generic level, it was counted as a separate species if no other species of that genus was reported. Data analysis to calculate the species diversity and evenness indices was conducted by the following methods:

1. **Abundance**: Spider abundance was counted as the number of spiders of each species encountered per sample per survey plot. Mean or total abundance was calculated as the number of spiders per survey plot and for each family and ecological guild [32].
2. **Richness**: The cumulative number of species found in each survey plot was represented as species richness. The richness estimates of different families and ecological guilds were compared [33].
3. **Shannon-Wiener Species Diversity Index**, **H':** The diversity of observed spiders was calculated using Shannon-Weiner Index [34] given below:
   $H' = -\Sigma (pi \ln pi)$
   H=Shannon-Wiener Species Diversity Index
   pi=Relative abundance of each group of organisms= n/N
   =Abundance of each species
   N=Total no. of individuals of all species
4. **Simpson's Diversity Index:** The diversity of observed spiders in different habitats was also calculated using Simpson's Diversity Index [35] which is as follows:
   $D=1-\Sigma(pi)^2$
   D=Simpson's Diversity Index
5. **Margalef's Diversity Index:** The diversity of observed spiders in different habitats was also calculated using Margalef's Diversity Index [36] which is as follows:
   $d=(S-1)/\ln N$
   d=Margalef's Diversity Index
   S=Species Richness
6. **Pielou's Evenness Index:** The distribution of observed spiders was calculated using Pielou's Evenness Index [37] which is as follows:
   J'=H/ H max
   J'=Pielou's Evenness Index
   H max=lnN

A survey was also conducted among 100 urban residents (54 female, 46 male) between age 15-75 years during the study period to conclude their perspective on the significance of spiders, and the conservation issues of the same in the study area. Ten questionnaires were provided to them and were asked if they agreed or disagreed with them.

Results

Taxonomic diversity

The study recorded a total of 1930 spiders belonging to 82 species, 60 genera and 19 families, namely Araneidae Clerck, 1757, Cheiracanthiidae Wagner, 1887, Clubionidae Simon, 1878 (Sac spiders/ Two-clawed hunting spiders), Corinnidae Karsch, 1880 (Ant- mimicking sac spiders), Ctenidae Keyserling, 1877, Gnaphosidae Banks, 1892, Hersiliidae Thorell, 1869 (Two- tailed spiders/ Bark Spiders), Linyphiidae Blackwall, 1859 (Money spiders/ Dwarf spiders), Lycosidae Sundevall, 1833 (Wolf spiders), Nephilidae Simon, 1894 (Long-legged orb weavers), Oxyopidae Thorell, 1869 (Lynx spiders), Pholcidae Koch, 1850 (Daddy-long-legged spiders), Salticidae Blackwall, 1841 (Jumping spiders), Scytodidae Blackwall, 1864 (Spitting spiders), Sparassidae Bertkau, 1872 (Giant crab spiders), Tetragnathidae Menge, 1866 (Long-jawed orb weavers), Theraphosidae Thorell, 1869 (Tarantulas), Theridiidae Sundevall, 1833 (Comb-footed spiders/ Cobweb spiders), and Thomisidae Sundevall, 1833 (Crab spiders/ Flower spiders) (Table 1). Among these, the family Araneidae was represented with the highest number of species (n=35; 42.7%) followed by Salticidae (n=14; 17.1%). However, all other families were represented by less than 5 species each (Fig. 1). The t-test further indicated a significant difference in the number of species belonging to different families ($t=2.35$, $p\leq0.05$). The Shannon-Weiner index indicated higher overall species diversity (3.26), with the highest diversity value in Araneidae family (2.65), followed by Salticidae (2.39). Margalef's diversity value

(10.7) suggested a higher overall species richness, with the highest richness value in Araneidae family (5.32), followed by Salticidae (2.65).

Table 1: Distribution and abundance of spiders recorded in Jorhat district of Assam.

Family	Scientific Name	Common Name	Relative abundance	Remark
Araneidae	*Acusilas* Simon, 1895 sp.	--	0.26	Orb web weaver
	Araneus diadematus Clerck, 1757	European garden spider	0.36	Orb web weaver
	Argiope aemula Walckenaer, 1841	Oval cross spider	0.47	Orb web weaver
	A. aetherea (Walckenaer, 1841)	Northern St. Andrew's cross spider	1.50	Orb web weaver
	A. anasuja Thorell, 1887	Signature spider	1.35	Orb web weaver
	A. bruennichi (Scopoli, 1772)	Wasp spider	1.04	Orb web weaver
	A. catenulata Doleschall, 1859	Grass cross spider	0.41	Orb web weaver
	A. pulchella Thorell, 1881	Garden cross spider	2.02	Orb web weaver
	A. versicolor (Doleschall, 1859)	St. Andrew's cross spider	0.57	Orb web weaver
	Bijoaraneus mitificus Simon, 1886	Pale orb weaver/ Kidney garden spider	0.41	Orb web weaver
	Chorizopes Cambridge, 1871 sp.	Spider-hunting orb web spider	0.10	Orb web weaver
	Cyclosa bifida (Doleschall, 1859)	Long-bellied Cyclosa spider	0.41	Orb web weaver
	C. confraga (Thorell, 1892)	Double-hump Cyclosa spider	0.26	Orb web weaver
	Cyrtarachne avimerdaria Tikader, 1963	--	0.10	Orb web weaver
	C. raniceps Pocock, 1900	--	0.52	Orb web weaver
	Cyrtophora cicatrosa Stoliczka, 1869	Garden tent weaver/ Dome spider	7.30	Orb web weaver
	C. citricola (Forskål, 1775)	Tropical tent web weaver	7.56	Orb web weaver
	C. moluccensis Doleschall 1857	Communal tent web weaver	1.50	Orb web weaver
	Eriophora Simon, 1864 sp.	Tropical orb weaver	0.05	Orb web weaver
	Eriovixia excelsa Simon, 1889	Bird-dropping spider	0.31	Orb web weaver
	Gasteracantha dalyi Pocock, 1900	Yellow spiny orb weaver	0.16	Orb web weaver
	G. diadesmia Thorell, 1887	Spiny orb web weaver	0.36	Orb web weaver
	G. kuhli Koch, 1837	Black and White spiny spider	0.31	Orb web weaver
	Gea spinipes Koch, 1843	--	0.16	Orb web weaver
	G. subarmata Thorell, 1890	--	0.16	Orb web weaver
	Hortophora transmarina (Keyserling, 1865)	Australian garden web weaver	0.16	Orb web weaver
	Larinia (Simon, 1874) sp.	--	0.05	Orb web weaver
	Macracantha arcuata (Fabricius, 1793)	--	0.16	Orb web weaver
	M. hasselti (Koch 1837)	Hasselt's spiny spider	0.16	Orb web weaver
	Neoscona bengalensis Tikader & Bal, 1981	Spotted orb web weaver	0.72	Orb web weaver
	N. mukerjei Tikader, 1980	Common garden spider	0.41	Orb web weaver
	N. nautica Koch, 1875	Gray sphere spider	0.31	Orb web weaver
	Parawixia dehaani Doleschall, 1859	Abandoned web spider	0.41	Orb web weaver
	Thelacantha brevispina (Doleschall, 1857)	Double spotted spiny spider	0.72	Orb web weaver
	Zygiella sp. Cambridge, 1902	--	0.16	Orb web weaver
Nephilidae	*Herennia multipuncta* Doleschall, 1859	Ornamental tree trunk spider	0.41	Orb web weaver
	Nephila kuhlii Doleschall, 1859	Black wood spider	0.47	Orb web weaver
	N. pilipes Fabricius, 1793	Giant Northern Golden orb web weaver	0.83	Orb web weaver
Tetragnathidae	*Leucauge decorata* (Walckenaer, 1842)	Decorative Silver orb web spider	1.76	Orb web weaver
	L. tessellata Thorell, 1887	Silver Leucauge spider	0.57	Orb web weaver
	Tetragnatha mandibulata Walckenaer, 1842	Dark Tetragnathid spider	0.47	Orb web weaver
	Tylorida striata (Thorell, 1877)	Striated Tylorida spider	0.72	Orb web weaver
Thomisidae	*Amyciaea forticeps* Cambridge, 1873	Red Ant spider	0.41	Ambusher
	Camaricus formosus Thorell, 1887	Brown flower spider	0.98	Ambusher
	Thomisus pugilis Stoliczka, 1869	Common Rose spider	0.47	Ambusher
Cheiracanthiidae	*Cheiracanthium danieli* Tikader, 1975	Yellow sac spider	0.36	Foliage hunter
Clubionidae	*Clubiona drassodes* Cambridge, 1874	Patchy sac spider	0.26	Foliage hunter
Hersiliidae	*Hersilia savignyi* Lucas, 1836	Two-tailed spider	0.26	Foliage hunter
Scytotidae	*Scytodes pallida* Doleschall, 1859	Yellow spitting spider	0.26	Foliage hunter
Sparassidae	*Heteropoda nilgirina* Pocock, 1901	Giant litter spider	1.60	Foliage hunter
Sparassidae	*H. venatoria* Linnaeus, 1767	Pantropical Huntsman spider	3.73	Foliage hunter
	Olios milleti Pocock, 1901	Green Crab spider	0.67	Foliage hunter
Corinnidae	*Castianeira zetes* Simon, 1897	Ant-like Corinnid sac spider	0.31	Ground hunter
Cteninidae	*Ctenus* Walckenaer, 1805 sp.	Tropical Wolf spider	0.16	Ground hunter
Gnaphosidae	*Poecilochroa* Westring, 1874 sp.	--	0.10	Ground hunter
	Scotophaeus Simon, 1893 sp.	--	0.10	Ground hunter
Lycosidae	*Pardosa pseudoannulata* Bösenberg & Strand, 1906	Pond Wolf spider	0.47	Ground hunter
	Schizocosa mccooki (Montgomery, 1904)	Wolf spider	1.19	Ground hunter
Theraphosidae	*Chilobrachys assamensis* Hirst, 1909	Tarantula	0.36	Other hunters
Theriididae	*Argyrodes flavescens* Cambridge, 1880	Red Silver spider	0.52	Scattered line

				weaver
	Chrysso argyrodiformis Yaginuma, 1952	Brush-legged spider	0.41	Scattered line weaver
Lyniphiidae	*Lyniphia* Latreille, 1804 sp.	Linyphid spider	0.36	Sheet web weaver
Pholcidae	*Artema atlanta* Walckenaer, 1837	Oval daddy-long-legged spider	14.18	Space web weaver
	Crossopriza lyoni Blackwall, 1867	Box spider	15.58	Space web weaver
	Pholcus phallangoides (Füssli, 1775)	Skull spider/ Cosmopolitan long-bodied cellar spider	13.04	Space web weaver
Oxyopidae	*Oxyopes birmanicus* Thorell, 1887	Crossed spider/ Burma Lynx spider	0.36	Stalker/ Specialist
	O. javanus Thorell, 1887	Striped Lynx spider	0.52	Stalker/ Specialist
	O. shweta Tikader, 1970	White Lynx spider	0.21	Stalker/ Specialist
Salticidae	*Asemonia tenuipes* Cambridge, 1869	Tailed Jumper	0.26	Stalker/ Specialist
	Bavia Simon, 1877 sp.	Scorpion Jumper	0.31	Stalker/ Specialist
	Brettus albolimbatus Simon, 1900	Crescented Jumper	0.41	Stalker/ Specialist
	Epeus indicus Prószyński, 1992	White spotted Green Jumper	0.26	Stalker/ Specialist
	E. tener Simon, 1877	Orange-crested Jumper	0.36	Stalker/ Specialist
	Hasarius adansoni Audouin, 1826	Adanson's house Jumper	1.60	Stalker/ Specialist
	Menemerus bivittatus (Dufour, 1831)	Gray wall Jumper	0.16	Stalker/ Specialist
	Myrmarachne plataleoides Cambridge, 1869	Red-ant mimicking spider	0.52	Stalker/ Specialist
	Phintella vittata (Koch, 1846)	Banded Phintella	0.57	Stalker/ Specialist
	Phintelloides brunne Kanesharatnam & Benjamin, 2019	--	0.10	Stalker/ Specialist
	Plexippus paykuli (Audouin, 1826)	Pantropical Jumping spider	0.78	Stalker/ Specialist
	Portia fimbriata Doleschall, 1859	Slender-legged clever Jumper	0.26	Stalker/ Specialist
	Rhene flavigera (Koch, 1846)	Zorro flat-head spider/ Beige beetle Jumper	1.04	Stalker/ Specialist
	Telamonia dimidiata Simon, 1899	Two-striped Jumper	0.36	Stalker/ Specialist

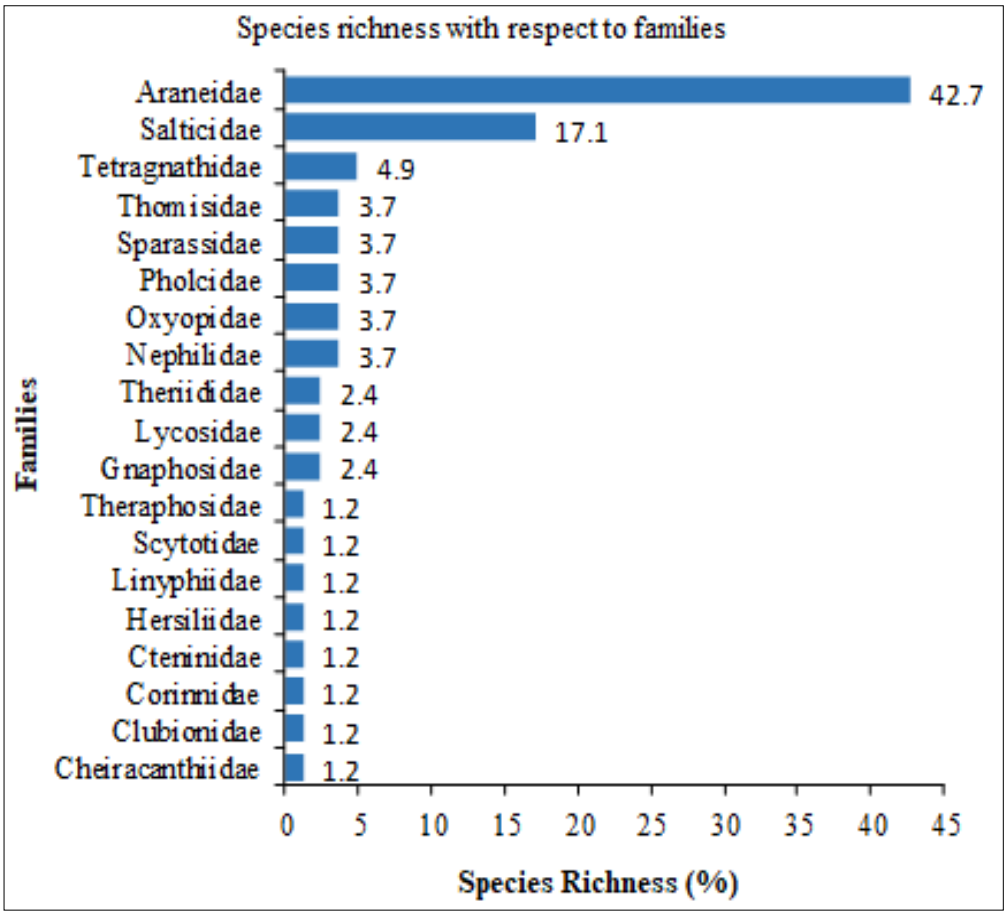

Fig 1: Species richness concerning families found in the study area

In the case of abundance, Pholcidae was found to be the most dominant family (n=827; 42.8%), followed by Araneidae (n=597; 30.9%), Salticidae (n=135; 7%), Sparassidae (n=116; 6%) and Tetragnathidae (n=68; 3.5%). The remaining 14 families exhibited <2% species abundance (Fig. 2). In context to relative species abundance, a high Simpson's species diversity value (0.92) and a low Pielou's evenness value (0.43) indicated unequal distribution of species, highlighting the dominance of certain species and dispersal of others, further emphasizing their conservation importance.

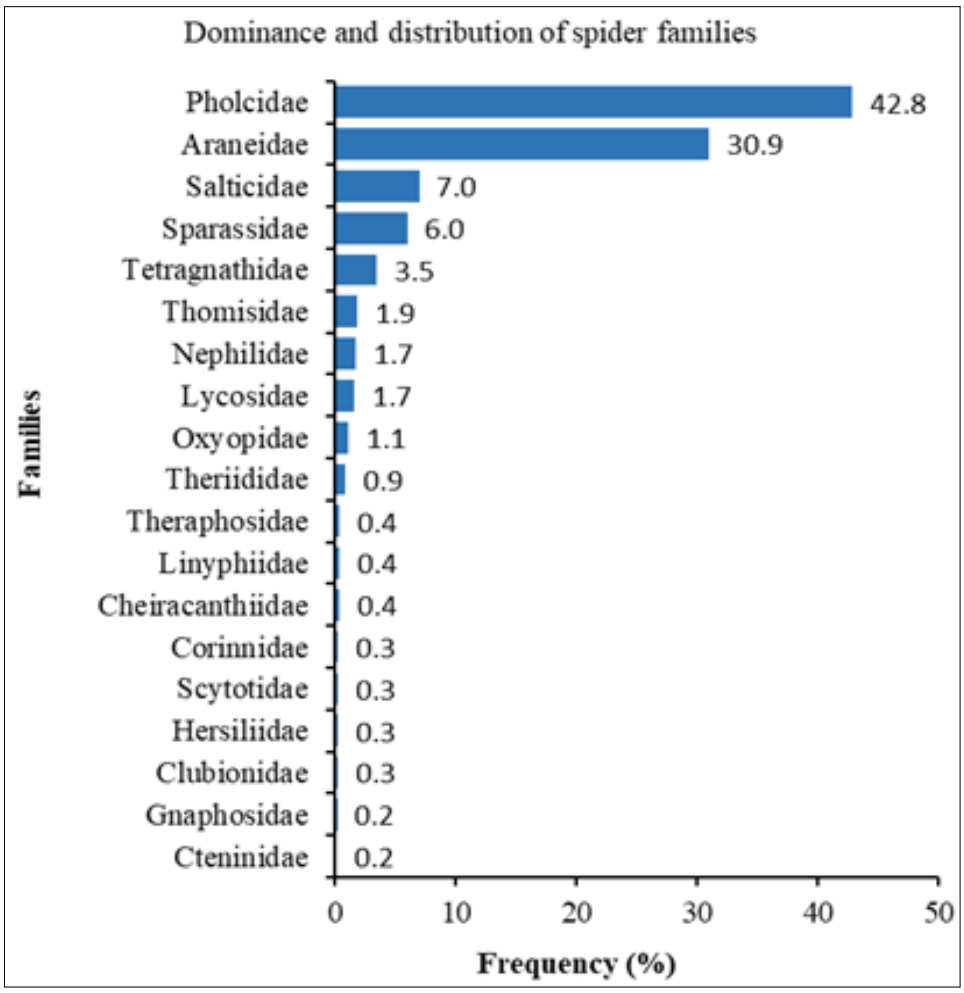

Fig 2: Spider abundance concerning families found in the study area

Functional diversity

Functional diversity of the spiders was prominent across 9 ecological guilds [38,39], namely Orb web weavers, Scattered line weavers, Space web weavers, Sheet web builders, Stalkers or Specialists, Ambushers or Ambush hunters, Foliage hunters, Ground hunters, and Other hunters (Fig. 3). Most of the observed spider species were orb-web weavers (51%), belonging to Araneidae, Nephilidae and Tetragnathidae families. The Stalkers or Specialists, consisting of the Oxyopidae and Salticidae families constituted the second largest ecological guild observed (21%). The remaining 7 guilds were represented by less than 10% species richness each. Moreover, Foliage hunters were represented by the highest number of families (26.3%), followed by Ground hunters (21%) and Orb web weavers (15.8%).

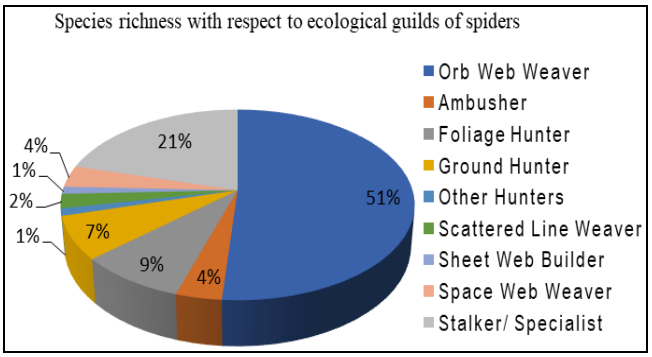

Fig 3: Species richness concerning ecological guilds of spiders

In the case of abundance, Space web weavers represented by Pholcidae family constituted the most dominant guild (42.8%), followed by Orb web weavers (36.1%). The remaining guilds were represented by less than 10% species abundance each (Fig. 4).

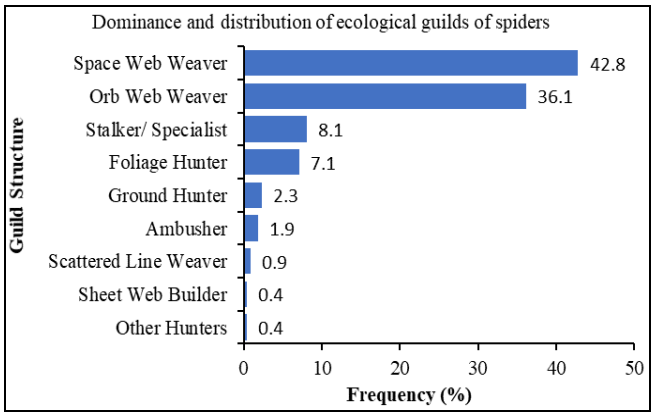

Fig 4: Species abundance concerning ecological guilds of spiders

Conservation issues

a. Public's perceptions of spiders

The survey indicated that 100% of the respondents considered spiders as pest species and venomous, with no medicinal and ethnozoological significance. About 64% of respondents were not aware of spider silk having industrial

importance. However, only 2% of the respondents believed in cultural or religious superstitions regarding spiders. Most of the spiders were killed out of fear and lack of awareness. Misbeliefs in Assam speculate around the completely innocuous black and hairy Tarantula, *Chilobrachys assamensis*, locally believed to be fatally venomous to people. 20% of respondents refused to consider spiders as economically important creatures, but only 3% doubted the probable scientific utility of spider research (Fig 5). Further, the t-test revealed a significant difference between the views where individuals agree ($t=5.33$, $p\leq0.05$) and disagree ($t=2.56$, $p\leq0.05$) to provided statements that indicate threat to spiders. Additionally, the views between agreed and disagreed individuals also varied statistically ($\chi2=60.00$, $p\leq0.05$).

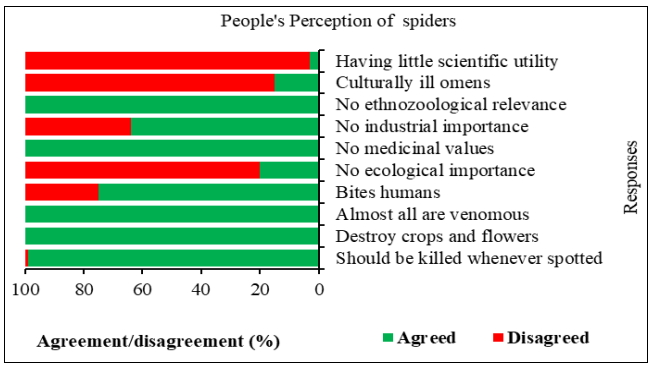

Fig 5: People's perceptions of spider

b. Threats to spider

None of the recorded spiders were included in the IUCN Red List of Threatened Species, although certain species recorded from other parts of the world, belonging to most of the recorded genera were included in the list. Apart from habitat destruction and fragmentation due to urbanization, monoculture, and other anthropogenic influences, the major threats to spider conservation were found to be a lack of scientific research and awareness among common people. Misunderstandings and wrong speculations regarding spiders circulate even in urban habitats and among educated sections of society. The two most prevalent wrong speculations regarding spiders were that they were pest species and mostly venomous.

Discussion

The present study recorded 1930 spiders belonging to 82 species, 60 genera, 19 families, and 9 ecological guilds in Jorhat district of Assam, India. This is higher than the average data recorded in other districts in previous literature: Kamrup Metro district- 64 species belonging to 19 families [17]; Kokrajhar district- 65 species belonging to 47 genera and 16 families [20]; Tinsukia district- 80 species belonging to 52 genera and 18 families [22]; Barpeta district- 70 species belonging to 43 genera and 15 families [15]; and Goalpara district- 37 species belonging to 24 genera and 12 families [21].

Diversity analysis of the observed spiders showed a greater species richness and diversity according to Margalef's Diversity Index and Shannon-Wiener Diversity Index. Araneidae and Salticidae families constituted the highest species richness, while the Pholcidae family displayed the highest species abundance. All the studied literature [14-15, 17, 20, 22, 24] have reported highest richness and diversity in Aranidae and Salticidae in different districts of Assam, except one report based on Goalpara district, which stated highest diversity in Araneidae followed by Tetragnathidae and Pholcidae families [21].

Pielou's Evenness Index and Simpson's Diversity Index indicated lower species evenness in the study area, proposing species dominance and dispersal. Certain species such as *Crossopriza lyoni*, *Pholcus phalangioides*, *Artema Atlanta*, *Cyrtophora cicatrosa*, and *Cyrtophora citricola* were observed in very high numbers in the same web whereas non-web weaving spiders were always found in solitary state. An interesting phenomenon observed during data collection was that even within the urban scenario, in residential complexes and marketplaces, species sightings did not seem to decrease, but species richness decreased than that of parks, lawns, and vegetable and flower gardens, indicating species-specific variation of ecological response towards anthropogenic activities. Reduced diversity in urban regions was also reported in a recent study based on Kamrup Metro district due to the dominance of a few synanthropic species such as *Cyrtophora cicatrosa* [23]. With fewer species and an equal number of sightings, species abundance also seemed to increase in areas of residential complexes and marketplaces. This observation contrasts to results of certain global urban diversity-based studies [40-43] but aligns with a recent report from Kamrup Metro district [23].

More than 50% of the recorded spiders were orb web weavers. Of the 9 recorded ecological guilds, 7 were represented by a species abundance of less than 10% each. Reduction in the functional diversity of spiders in urban habitats has also been reported in global literatures [23, 44-46]. Interspecific variations in coloration among different spiders were observed during sampling, which showed that garden spiders such as *Phintella vittata*, *Cyclosa* species were more colorful in comparison to house and ground spiders such as *Hasarius adansoni* and *Heteropoda venatoria* which were darker, indicating potentiality of adaptive camouflage. Similar phenomena of morphological variance in relation to ecological variance were also observed in the Tinsukia and Kamrup Metro districts previously [17, 22]. Jumping spiders (Salticidae) were the most difficult to observe and collect, since they were not only very fast jumpers but were also very sensitive to kinetic and mechanical stimuli. The beat sheet method was found to be the most efficient in collecting spiders from trees and shrubs [24].

None of the recorded spiders were included in the IUCN Red List of Threatened Species, although some other species from most of the recorded genera were included in the list [47]. Lack of scientific research and awareness among common people were the major threats to spiders in the study area. Misbeliefs regarding spiders circulated even in urban habitats and among educated sections of society, considering spiders to be pest species and mostly venomous. The results of this study can be replicated for other districts of the state since the climatic and demographic conditions of different parts of the state are almost similar. The study highlights Assam's significant potential as a hub for many taxonomically, morphologically, and ecologically diverse spider species, providing vast opportunities for diverse scientific research and exploration.

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Conflict of interest statement

There is no conflict of interest among the authors.

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