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A survey report on the spider (Arachnida: Araneae) of Jabalpur division (Madhya Pradesh)

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Abstract
Ecological study still relies heavily on an understanding of the quantity, diversity, and composition of species within an ecosystem. Early naturalists were fascinated by the patterns of geographical and temporal variation in variety, and ecologists are still today. Only 15% of species have had their ranges formally defined, however measuring biological diversity within a system enables the discovery of new species and their distributions. It is this fundamental comprehension of the species that make up a system that enables us to pose more challenging ecological queries. The preliminary report on the spider fauna of Madhya Pradesh, India, provides the basis for the present article. Faunistic surveys were undertaken during 2019-2021 and a total of 97 individuals Arachnida (Araneae) belonging to recorded 18 Species, 15 Genera under 08 families from various localities in and around the Jabalpur division whereby the Araneidae family has a greater population than the other spider families. Shannon-Weiner diversity index of the study site is 2.643032269 showing high diversity which is inversely proportional to Simpson Index value that is 0.084281008.

Keywords: spider (Arachnida: Araneae), Araneidae, Jabalpur

Introduction

In almost all environments, spiders are numerous and widely distributed. Being one of the only predators of insects, particularly those dangerous to humans, and aiding in the maintenance of ecological equilibrium, it plays a crucial function in ecology. Spiders form one of the largest groups of invertebrate animals World Spider Catalog includes around 47,662 species in 4,097 genera and 117 families (WSC-NMBE, 2018: Version 19.5). They are distributed worldwide, occur on all continents except Antarctica, and are found in every conceivable terrestrial habitat, including caves, snow-covered tundra, high mountains and intertidal zones. The Indian spider list has been updated by Siliwal *et al*., (2005) [8] with 1442 species organized into 361 genera and 59 families. In India, 156 spider species from 145 genera and 60 families were reported by Sebastian *et al*., (2009) [7]. Overall 86 spider species, including 16 species from the Kanha National Park, 27 species from the Pench National Park, 29 species from the Satpura National Park and 14 species from the Indravati National Park are listed in Ramkrishna *et al*., (2006) [6] documentation of the faunal resources of all national parks in Madhya Pradesh and Chhattisgarh. 214 spider species from 68 genera and 22 families, including those from Chhattisgarh, were recently updated by Patil (2011) [3]. The ecological development of these types is attributed to various climatic, edaphic, and topographic factors. However biotic factors play a significant role depending upon their frequency and intensity. Therefore spider can consider as indicator in case of change in environmental condition or interference of human activities. Ironically, the spider diversity in central India is still not fully explored or understood.

Material and Methods

The spider fauna of several ecosystems in central India was collected from wild plants, crops, and agricultural fields. Spiders were caught using an insect net, pitfall trap, and stroking sticks umbrellas from various locations in the Jabalpur division. One of the major tourist sites in the nation is Jabalpur. Some of the top locations in the nation are found there. The coordinates of Jabalpur are 23°10'N latitude and 79°56'E longitude.

The samples were labelled and kept in 70% alcohol. We manually collected spiders from bushes, tree trunks, ferns, the forest floor, foliage, and grasslands using Tikader's advised method (1987) [9]. With the help of keys and catalogues provided by Kaston (1978), Tikader (1962, 1973, 1982) [10, 11, 12], (Biswas and Biswas, 1992) [1], Gajbe (1987) [2], and Platnick, identification of various body parts was carried out based on their morphometric characteristics (2004). After being photographed and documented while still alive, the spiders were then returned to their native environment.

Few spiders were observed under microscope for identification and study of some morphological characteristics. Mangurran (1988) used the Shannon-Weiner equation to calculate the Shannon-Weiner diversity index (H), and Sklar (1985) used the Simpson index (C) to obtain the dominance index.

1. Calculation of Shannon's Species Diversity Index (H)

$H = -\sum (ni/ N) * \log (ni / N)$ Or $-\sum Pi * \log Pi$

Where,

H = Shannon Index of Diversity.

Ni = Number of individual of each species.

N = Total number of individuals in the sample, (i.e., $N = \sum ni$).

Pi = Importance probability for each species, (i.e., Pi = ni / N)

2. Calculation of Simpson's Index of Dominance (C)

$C = \sum (ni / N)^2$ Or $\sum (Pi)^2$

Where,
C = Simpson's Index of Dominance
ni = Number of individual of each species.
N = Total number of individuals in the sample, (i.e., $N = \sum ni$).
Pi = Importance probability for each species, (i.e., Pi = ni / N)

Results and Discussion

In the present finding, over 97 specimens of Spiders (Order: Araneae) were examined and identified. Which resulted into 18 species belonging to 15 genera under 08 families (Table 1). Family Araneidae is outnumbering the other families which represents 32% spider diversity followed by Eresidae (12%) Lycosidae (17%), Nephilidae (16%) Tetragnathidae (10%) (Figure1). Family: Araneidae, Species Neoscona mukerjei and Neoscona sinhagadensis and Family: Lycosidae, species Pardosa pseudoannulata represented by single species (Table1). Abundance of Araneids was mainly due to dense forests with adequate tree foliage that caters enough prey-base for such typical Orb-weaving foliage dweller spiders. Hence, extensive faunistic surveys with long term ecological monitoring program will immensely help for the conservation and management of biodiversity of the sanctuary especially Araneae fauna.

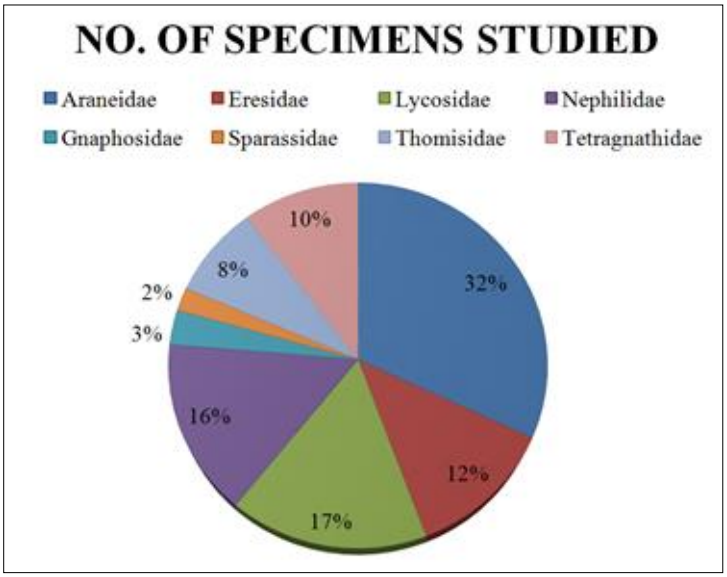


Fig 1: Family wise Spider Diversity.

Table 1: Taxonomic list of Spiders (Arachnida: Araneae) of Jabalpur Division, Madhya Pradesh.

S.N.	Taxa and Zoological Name	Habit	No. of Recorded Species
	Family: Araneidae Simon, 1895		
1.	*Argiope aemula* (Walckenaer, 1842)	Foliage Orb Weaver	6
2.	*Cyclosa hexatuberculata* Tikader, 1982	Foliage Orb Weaver	5
3.	*Neoscona chrysanthusi* Tikader & Bal, 1981	Foliage Orb Weaver	11
4.	*Neoscona mukerjei* Tikader, 1980	Foliage Orb Weaver	1
5.	*Neoscona sinhagadensis* (Tikader, 1975)	Foliage Orb Weaver	1
6.	*Neoscona bengalensis* Tikader & Bal, 1981	Foliage Orb Weaver	5
7.	*Zygeilla indica* Tikader & Bal, 1980	Foliage Orb Weaver	2
	Family: Eresidae C.L. Koch, 1851		
8.	*Stegodyphus sarasinorum* Karsch, 1891	Colonial Foliage Weaver	12
	Family: Lycosidae Sundevall, 1833		
9.	*Pardosa amkhasensis* Tikader & Malhotra, 1976	Ground Hunter	8
10.	*Lycosa poonaensis* Tikader & Malhotra, 1980	Ground Hunter	7
11.	*Pardosa pseudoannulata* (Bösenberg & Strand, 1906)	Ground Hunter	1
	Family: Nephilidae Simon, 1894		
12.	*Nephila pilipes* (Fabricius, 1793)	Foliage Orb Weaver	15
	Family: Gnaphosidae Pocock, 1898		
13.	*Scopoides maitraiae* (Tikader & Gajbe, 1977)	Ground Hunter	03
	Family: Sparassidae Bertkau, 1872		
14.	*Heteropoda venatoria* (Linnaeus, 1767)	Foliage Hunter	02
	Family: Thomisidae Sundevall, 1833		
15.	*Lysiteles brunettii* (Tikader)	Foliage Hunter	04
16.	*Thomisus pooneus* Tikader	Foliage Hunter	04
	Family: Tetragnathidae Menge, 1866		
17.	*Leucauge decorata* (Blackwall, 1864)	Foliage Orb Weaver	04
18.	*Tetragnatha mandibulata* Walckenaer, 1842	Foliage Weaver	06

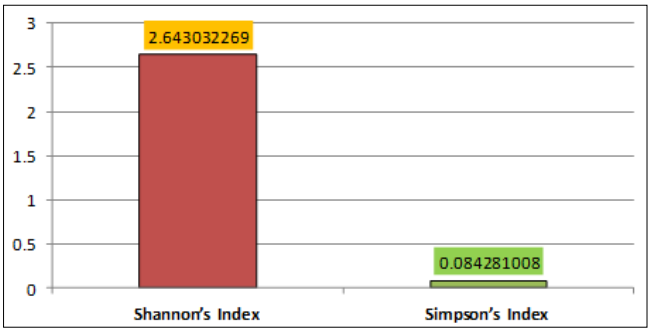
VC-Very Common (>10sightings), C-Common (05-10), R-Rare (03-05sightings), VR-Very Rare (1-2sightings)

Table 2: Shannon-Weiner Diversity Index calculation for (Arachnida: Araneae) of Jabalpur Division, Madhya Pradesh.

S.N	Taxa and Zoological Name	No. of Recorded Species	Pi = (ni / N)	log Pi = ln (ni/N)	H=Pi x log Pi	C=Pi^2
1.	*Argiope aemula* (Walckenaer, 1842)	6	0.06185567	-2.782951509	-0.17214133	0.003826124
2.	*Cyclosa hexatuberculata* Tikader, 1982	5	0.051546392	-2.965273066	-0.152849127	0.002657031
3.	*Neoscona chrysanthusi* Tikader & Bal, 1981	11	0.113402062	-2.176815706	-0.246855389	0.012860028
4.	*Neoscona mukerjei* Tikader, 1980	1	0.010309278	-4.574710979	-0.047161969	0.000106281
5.	*Neoscona sinhagadensis* (Tikader, 1975)	1	0.010309278	-4.574710979	-0.047161969	0.000106281
6.	*Neoscona bengalensis* Tikader & Bal, 1981	5	0.051546392	-2.965273066	-0.152849127	0.002657031
7.	*Zygeilla indica* Tikader & Bal, 1980	2	0.020618557	-3.881563798	-0.080032243	0.000425125
8.	*Stegodyphus sarasinorum* Karsch, 1891	12	0.12371134	-2.089804329	-0.258532494	0.015304496
9.	*Pardosa amkhasensis* Tikader & Malhotra, 1976	8	0.082474227	-2.495269437	-0.205795417	0.006801998
10.	*Lycosa poonaensis* Tikader & Malhotra, 1980	7	0.072164948	-2.628800829	-0.189707276	0.00520778
11.	*Pardosa pseudoannulata* (Bösenberg & Strand, 1906)	1	0.010309278	-4.574710979	-0.047161969	0.000106281
12.	*Nephila pilipes* (Fabricius, 1793)	15	0.154639175	-1.866660777	-0.288658883	0.023913275
13.	*Scopoides maitraiae* (Tikader & Gajbe, 1977)	3	0.030927835	-3.47609869	-0.107508207	0.000956531
14.	*Heteropoda venatoria* (Linnaeus, 1767)	2	0.020618557	-3.881563798	-0.080032243	0.000425125
15.	*Lysiteles brunettii* (Tikader)	4	0.041237113	-3.188416617	-0.131481098	0.0017005
16.	*Thomisus pooneus* Tikader	4	0.041237113	-3.188416617	-0.131481098	0.0017005
17.	*Leucauge decorata* (Blackwall, 1864)	4	0.041237113	-3.188416617	-0.131481098	0.0017005
18.	*Tetragnatha mandibulata* Walckenaer, 1842	6	0.06185567	-2.782951509	-0.17214133	0.003826124
Grand Total		97			H = -2.643032269	C = 0.084281008

Shannon's Index (H) = - Pi * Log Pi = (-2.643032269) = 2.643032269
Simpson's Index (C) = (Pi)2 = 0.084281008

According to the current examination, the average Shannon-Wiener index (H) for the species diversity of (Arachnida: Araneae) in the Jabalpur region was determined to be 2.643032269, indicating significant diversity in the research area. It demonstrates the research area's species diversity and abundance. The Simpson Index (C) results indicated a species dominance index value of 0.084281108. The Simpson index values increased as Shannon diversity decreased (indicating a negative relationship between diversity and the index), as shown in (Table 2 and Graph 01).



Graph 1: Shannon-Wiener index and Simpson's dominance index of (Arachnida: Araneae) of Jabalpur Division, Madhya Pradesh.

Conclusion

In Central India, there are numerous spiders and a surprising variety of spider guilds. Future research on spiders in these habitats will use this study's findings as a starting point. However, more research is need to confirm. Only one year was spent conducting this investigation. Therefore, it will be necessary to study seasonal fluctuation in spider fauna variety and abundance. Clarifying the value of spiders as indicators, relevance to high taxon surrogacy, and developing uniform sample methodologies, however, still need a lot of study. The database has to be updated immediately. It is essential to investigate species diversity and to understand habitat ecology, behavior, and other factors that will result in a database for the Jabalpur region.

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