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A Comparison of Habitat Variation and Spider Diversity at the Chinchholli Wildlife Sanctuary in India

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ABSTRACT

The seasonal change in spider diversity in the Chincholli Wildlife Sanctuary in Karnataka was the subject of the current study. According to the study, 5255 individuals, or 113 spider species belonging to 83 genera and 32 families, were counted in Kalaburagi District during several seasons, including summer, monsoon, post-monsoon, and winter. Post-monsoon sampling yielded the greatest number of species (N = 98), whereas summer sampling yielded the fewest species (N = 71). Certain species are more common in the post-monsoon period (32%) and less common in the Chandrampalli dam (12%). The Araneidae family of spiders accounts for 12.61% of all spider families identified in the research area, making it the most diverse family. Lycosidae (11.71%), Theridiidae (10.81%) and Salticidae (9.91%) are the next most diverse families. The current work is very helpful in achieving the goals of molecular taxonomy of spider fauna, ecological indication, and biocontrol issues.

Keywords: Chincholli, nature sanctuary, seasonal variation, spiders, and Kalaburagi

INTRODUCTION

The most varied predators on the planet, spiders have been here for 400 million years. Except for Antarctica, spiders can be found in every conceivable terrestrial habitat, such as caverns, high mountains, snow-covered tundra, intertidal zones, and aquatic environments (only *Argyroneta aquatica* is adapted to an aquatic lifestyle). Currently, 4,088 genera and 47,518 species from 117 families have been described globally. An excellent species to employ for quick assessments of biodiversity is the spider. Decision-makers can learn about the intrinsic biological value of a given habitat from its distribution; only spiders, not higher plants or vertebrates, can offer this kind of knowledge about a given habitat's value (Mittermeier et al., 1999).

Diversity and distribution of spiders from Gibbon Wildlife Sanctuary, Assam (Chetia et al., 2012) recorded 95 species from neglected semi-evergreen forest. A preliminary checklist of spiders (Araneae: Arachnida) in Chinnar Wildlife Sanctuary noticed 101 species belonging to 65 genera and 25 families, representing 6.98 % of Indian species (Nameer, 2016). Preliminary Investigation of Spider Diversity in Kedarnath Wildlife Sanctuary discovered 64 species under 40 genera and 19 families (2010). However, spiders are not extensively used as indicator species due to less information on habitat and taxonomy and (Kapoor, 2008; Noss, 1990).

The tropical forest boasts a wide array of spider species (Suana, 2004). Spiders thrive in habitats that offer protection from heat, easy web attachment, safety from nest or web destruction, and ample opportunities to hunt for prey (Morse, 1984; Pollard et al., 1995). Various factors influence the diversity of spiders in the ecosystem (Larrivee & Buddle, 2010). The transformation of the ecosystem from a tropical forest to a plantation or settlement area can impact the spider diversity within the ecosystem. A reduction in vegetation diversity in the tropical forest can lead to a decline in spider diversity (Samu et al., 1996; Reichert & Lockley, 1984). Spiders play a crucial role in terrestrial habitats like agricultural fields by regulating insect population density. Research indicates that spider density, behavior, and population dynamics help stabilize terrestrial arthropod populations (Turnball, 1973). Additionally, spider silk and venom have significant value. Ongoing research on spider silk explores its potential to replace Kevlar and create items such as bulletproof clothing, lightweight clothing, parachutes, surgical threads, and more (Hinman et al., 2003). The alteration of the Chincholli forest and its functions could impact the flora and fauna, including spiders, in the area. Therefore, it is essential to assess the current distribution and diversity of spiders

in the Chincholli forest. This study examines the distribution and diversity of spiders in the Chincholli forest.

MATERIALS AND METHODS

Study Area

Kalaburagi (Gulbarga) district is situated in the north-eastern part of Karnataka, covering an area of 10,954 sq. km. Chincholli Wildlife Sanctuary is situated in North Eastern sector of the Karnataka state and physiographically defined as Deccan Plateau. It lies between the north latitudinal parallels of 16°41' and 17°46' and east longitudinal parallels of 76°3' and 77°41' (Fig.1). This is the first dry land Wildlife Sanctuary of India, established in 28th November 2011 to protect the distinctive geological topography and natural resources and also to protect wolf and hyena habitats. It is one of the typical Deciduous and semi-evergreen forests mixed with grassland patches, majorly having acacia and teak plantations. The forest is also home to fauna like Black Buck, Common Fox, Four-horned Antelope, Fruit Bat, Hyena, Indian Wolf, etc. Over 35 species of birds, including Black Drongo, Black-winged Kite, Blossom – headed Parakeet, Blue pigeon, Black-headed Oriole and Grey Patridge are also found. Wolves and Hyenas are the primary attractions of the Wildlife Sanctuary.

The study, conducted from February 2016 to February 2018, covered all four seasons of the year. Sampling of spiders was carried out during different times of the day due to their diurnal and nocturnal activities. The sampling was done between 7 A.M. to 11 A.M., 3 P.M. to 6 P.M., and 9 P.M. to 12 A.M. in suitable weather conditions.

The quadrate method was utilized to sample spiders from two distinct habitats across five sites with varying microhabitats, including Chikkalingadalli forest (Peripheral forest area), Sher camp (core area), Burugadoddi and Shangreela (semi-thick forest), and Chandrampalli Dam (Aquatic habitats). A 10 m x 10 m quadrat was employed for spider collection. Each year, 60 quadrates were sampled from each habitat type, totaling 120 quadrants per habitat over the study period. In total, 600 quadrates were sampled from all habitats over a two-year period within the Chincholli Wildlife Sanctuary.

Pitfall trapping was utilized to gather ground-active spiders, while sweep netting was employed to collect foliage spiders from low-level vegetation of shrubs (up to 2 m in height). Additionally, active search, kerchief method, vegetation beating, litter sampling, and night survey were also utilized as sampling methods.

To preserve the spiders, placing them directly into 70% alcohol is the simplest

method. It is important to periodically renew the alcohol (70%) and sort the spiders according to their species, genus, or family. Furthermore, the spiders should be labeled using Xerox copied labels or labels written with Indian ink or lead pencil. Live spiders should always be kept separately.

The specimens were taxonomically identified by referring to relevant literature and descriptions from various sources such as Tikadar (1987), Barrion and Litsinger (1995), Dippenaar-Schoeman and Jocque (1997), Deeleman-Reinhold (2001), Jocque (2006), Dippenaar-Schoeman and Jocque (2006), Levi (2002), Sebastian and Peter (2009), Le Peru (2011), and Murphy and Roberts (2015). Initially, the spiders were separated and identified up to the family or sub-family level using the most recent taxonomic keys available for Indian spiders (Sebastian & Peter, 2009).

RESULTS AND DISCUSSIONS

In various seasons, including summer, monsoon, post-monsoon, and winter, 5255 individuals belonging to 113 spider species from 83 genera and 32 families were recorded in the Kalaburagi district, and the post-monsoon season had the highest number of sampled species (N=98), while the summer season had the lowest (N=71). Species abundance was found to be highest during the post-monsoon season (32%) and lowest at Chandrampalli dam (12%) (Table 1). Please refer to Figure 1 and 2 for visual representation.

Table 1

Seasonal variation of spider fauna

Parameters	Summer	Monsoon	Post-monsoon	Winter
Total number of individuals encountered	624	1511	1675	1445
No. of species	71	95	98	88
Shannon Index H'	4	4.33	4.39	4.3
Evenness	0.91	0.99	1	0.98
Simpson Index	0.978711	0.986296	0.986744	0.987059

Table 2

Seasonal abundance of spider diversity

Collection Site	No. of Family	No. of Species	No. of Individual	% of individual
Summer	19	71	624	12
Monsoon	27	95	1511	29
Post-monsoon	27	98	1675	32
Winter	17	88	1445	27
Total			**5255**	

Table 3

Summer variation of spider fauna from different sites

Parameters	Chikkalingadalli	Sher camp	Chandrampalli dam	Shangreela	Burugadoddi
No. of species	30	41	37	34	34
Individuals encountered	105	156	125	122	116
Shannon Index H'	3.349	3.633	3.531	3.462	3.478
Evenness	0.9496	0.9222	0.9236	0.9374	0.9529
Simpson Index	0.9625	0.9712	0.9679	0.9664	0.9674
Dominance	0.03746	0.02885	0.03206	0.03359	0.03255

During the summer season, a total of 624 individuals were observed, representing 71 different species, 52 genera, and 19 families (Table 1). In Chikkalingadalli, there were 105 individuals belonging to 30 species, while Sher camp had 156 individuals of 41 species. Chandrampalli dam recorded 125 individuals of 37 species, Shangreela had 122 individuals of 34 species, and Burugadoddi had 116 individuals of 34 species (Table 3). The diversity of the ecosystem is reflected in the Shannon Index H'=4, with an evenness of EH=0.91 and a Simpson Index D=0.978711 (Table 2). Comparing the diversity between habitats in the summer season, the Shannon diversity index is highest in Sher camp (H'=3.63) and lowest in Chikkalingadalli (H'=3.34). The evenness of species is highest in Burugadoddi (EH=0.952) and lowest in Sher camp (EH=0.922). Species dominance is greater in Chikkalingadalli (0.037) and lower

in Sher camp (0.028) (Table 3). Among the recorded species, Cyrba ocellata (6.25%) is the most abundant, followed by Crossopriza lyoni (5.61%), Plexippus paykulli (3.53%), Oxyopes sertatoides (3.21%), Tetragnatha makiharai (3.04), Neoscona theisi (2.72%), Pardosa birmanica (2.88%), Draposa burasantiensis (2.72%), Hippasa holmerae (2.72%), Zelotes tenuis (0.32%), and Neoscona punctigera (0.32%) with lower abundance (Table 7).

Table 4

Monsoon variation of spider fauna from different sites

Parameters	Chikkalin-gadalli	Sher camp	Chandrampalli dam	Shangreela	Burugadoddi
No. of species	59	74	65	75	65
Individuals encountered	278	362	266	296	294
Shannon Index H'	3.984	4.181	4.058	4.209	4.074
Evenness	3.984	4.181	4.058	4.209	4.074
Simpson Index	0.9798	0.9829	0.9802	0.9835	0.9815
Dominance	0.02021	0.01708	0.01976	0.0165	0.01846

During the monsoon season, a total of 1511 individuals were observed, comprising 95 species, 72 genera, and 27 families (Table 1). Specifically, in Chikkalingadalli, there were 278 individuals belonging to 59 species; in Sher camp, 362 individuals of 74 species; in Chandrampalli dam, 266 individuals of 65 species; in Shangreela, 296 individuals of 75 species; and in Burugadoddi, 294 individuals of 65 species were recorded (Table 4). The diversity metrics indicate a Shannon Index H' of 4.33, Evenness EH of 0.99, and Simpson Index 1-D of 0.986296 (Table 2). Upon comparing the diversity among different habitats during the monsoon season, it was found that the Shannon diversity index is highest in Shangreela (H' = 4.209) and lowest in Chikkalingadalli (H' = 3.98). The evenness of species is highest in Chikkalingadalli (EH = 0.91) and lowest in Sher camp (EH = 0.884), while species dominance is highest in Chikkalingadalli (D = 0.020) and lowest in Shangreela (0.016) (Table 15). Among the species observed, Cyrba ocellata (2.98%) was the most abundant, followed by Hersilia savignyi (2.58%), Crossopriza lyoni (2.58%), Euryodion katepagaa (2.58%), Oxyopes sertatoides (2.32%), Tropizodium kalami (2.32%), and Hamataliwa helia (2.32%). On the other hand, Brigittea civica (0.13%), Poecilochroa sedula (0.13%), Geolycosa sp. (0.20%), Prodidomus sp. (0.20%), Phintella sp. (0.20%), Leucauge tessellate (0.20%), Parasteatoda kompirensis (0.20%) were less abundant (Table 7).

Table 5

Post-monsoon variation of spider fauna from different sites

Parameters	Chikklingadalli	Sher camp	Chandrampalli dam	Shangreela	Burugadoddi
No. of species	56	77	55	77	76
Individuals encountered	304	412	280	338	339
Shannon Index H'	3.915	4.251	3.901	4.243	4.163
Evenness	0.8953	0.9114	0.8992	0.9045	0.8459
Simpson Index	0.978	0.9846	0.978	0.9845	0.9823
Dominance	0.02201	0.01542	0.02196	0.01553	0.01774

In the post-monsoon season, a total of 1675 individuals were observed, comprising 98 species, 78 genera, and 27 families (Table 1). Specifically, in Chikklingadalli, there were 304 individuals belonging to 56 species, while Sher camp had 412 individuals of 77 species. Chandrampalli dam recorded 280 individuals of 55 species, Shangreela had 338 individuals of 77 species, and Burugadoddi had 339 individuals of 76 species (Table 5). The diversity, as indicated by the Shannon Index H', was calculated to be 4.39, with complete evenness (EH=1) and a Simpson Index of 1-D=0.986744 (Table 2). When comparing the diversity between different habitats during the monsoon season, it was found that the Shannon diversity index was highest in Sher camp (H'=4.25) and lowest in Chandrampalli (H'=3.90). The evenness of species was highest in Sher camp (EH=0.91) and lowest in Shangreela (EH=0.84). Species dominance was observed to be higher in Chikkalingadalli (D=0.022) and relatively similar in Shangreela (0.0155) and Sher camp (0.0154) (Table 16). Among the recorded species, Hersilia scrupulosa (2.57%) was the most abundant, followed by Hersilia savignyi (2.03%), Crossopriza lyoni (2.45%), Olios tener (2.27%), and Euryodion katepagaa (2.09%). On the other hand, Poecilochroa sedula (0.12%), Lycosa tista (0.12%), Philodromus sp. 3 (0.12%), and Argyrodes sp. (0.18%) were less abundant (Table 7).

Table 6

Winter variation of spider fauna from different sites

Parameters	Chikkalin gadalli	Sher camp	Chandrampalli dam	Shangreela	Burugadoddi
No. of species	63	78	63	77	70
Individuals encountered	262	334	261	278	288
Shannon Index H'	4.071	4.266	4	4.231	4.17
Evenness	0.93	0.9133	0.8664	0.8934	0.9248
Simpson Index	0.9817	0.9847	0.979	0.9837	0.9835
Dominance	0.0183	0.01533	0.02101	0.0163	0.01649

Table 7

Seasonal variation of percentage of spider fauna in study area

Sl. No.	Name of the species	Summer	Monsoon	Post-monsoon	Winter
1.	*Amaurobius sp.*	0	0	0	0
2.	*Argiope anasuja*	0.48	0	1.55	1.04
3.	*Araneus inustus*	1.28	0	0.66	1.04
4.	*Cyclosa insulana*	0.48	1.32	1.25	0
5.	*Cyclosa moonduensis*	1.92	0	0.90	0
6.	*Cyrtophora citricola*	0	0.86	1.07	0
7.	*Eriovixia excelsa*	0.96	0.86	0.66	0
8.	*Hypsosinga satpuraensis*	0	1.39	1.97	1.18
9.	*Lipocrea fusiformis*	1.76	0.86	0.84	0.97
10.	*Larinia sp. 1*	1.92	0.26	0.48	0
11.	*Neoscona theisi*	2.72	1.59	1.67	1.66
12.	*Neoscona punctigera*	0.32	0.93	0.60	1.25
13.	*Neoscona vigilance*	0.48	0.86	1.31	0
14.	*Nephila pilipes*	0	0	0.24	1.25
15.	*Poltys nagpurensis*	0	0	1.97	1.59
16.	*Clubiona filicata*	0	0	0.36	0.69
17.	*Cambalida sp.nov.*	0	0.40	0.72	1.04
18.	*Castianeira zetes*	1.12	1.39	1.61	1.66
19.	*Brigittea civica*	0	0.13	0	0
20.	*Indothele dumicola*	0	0.73	0.78	0.21
21.	*Filistata napadensis*	0	0.66	1.43	1.04
22.	*Gnaphosa kailana*	1.92	0.40	1.13	1.11
23.	*Gnaphosa rohtakensis*	0.48	0.60	0.24	0.62
24.	*Poecilochroa sedula*	0	0.13	0.12	0
25.	*Scopoides pritiae*	0	0.40	0.72	0.83
26.	*Setaphis subtilis*	0.96	0.73	0.96	0.42
27.	*Zelotes tenuis*	0.32	0.13	0.36	0.21
28.	*Hersilia savignyi*	2.40	2.58	2.03	2.35

Table 7 continued

Sl. No.	Name of the species	Summer	Monsoon	Post-monsoon	Winter
29.	*Hersilia scrupulosa*	1.92	1.72	2.57	1.59
30.	*Lepthyphantes*	0.80	0.60	0.36	0
31.	*Neriene*	0	0	0	0
32.	*Koppe* sp.	1.28	0.86	0.48	0.97
33.	*Oedignatha scrobiculata*	1.44	1.72	1.37	1.59
34.	*Sphingius delakharensis*	0	0.46	2.03	0.35
35.	*Arctosa himalayensis*	1.92	0.86	1.85	1.45
36.	*Arctosa indica*	0.32	0	0.18	0.48
37.	*Draposa burasantiensis*	2.72	1.39	1.07	1.59
38.	*Draposa oakleyi*	1.44	1.26	1.67	1.25
39.	*Evippa sohani*	0	0	1.13	1.73
40.	*Geolycosa carli*	0	1.52	1.25	1.18
41.	*Geolycosa* sp.	0	0.20	0.24	0
42.	*Hippasa holmerae*	2.72	1.65	0.96	1.73
43.	*Hippasa himalayensis*	0	0.86	0.42	0.83
44.	*Lycosa tista*	0.96	0.79	0.12	0.90
45.	*Wadicosa prasantae*	1.60	2.12	1.31	2.01
46.	*Pardosa birmanica*	2.88	2.12	1.19	0.97
47.	*Pardosa sutherlandi*	0	1.39	0.66	1.04
48.	*Pardosa sumatrana,*	0.48	0.93	1.43	1.45
49.	*Pardosa gopalai*	2.24	0.93	0.42	1.31
50.	*Mimetus indicus*	0	0.40	0.24	0.42
51.	*Brignolia* sp.	0	0.53	0	0.35
52.	*Oecobius marathaus*	0	1.19	0.36	0.83
53.	*Oecobius* sp.	0	0	0	0
54.	*Uroctea indica*	0	0.46	0.30	0
55.	*Hamataliwa helia*	0	2.25	1.79	1.73
56.	*Oxyopes sertatoides*	3.21	2.32	1.19	2.08
57.	*Oxyopes shweta*	0	1.06	0	0
58.	*Peucetia yogeshi*	1.76	1.19	1.91	1.45
59.	*Palpimanus* sp.	0	1.06	0.90	0
60.	*Philodromus* sp. 1	0.96	0.33	0.54	0.76
61.	*Philodromus* sp. 2	0.96	0.46	0.48	0
62.	*Philodromus* sp. 3	2.24	0	0.12	0.83
63.	*Thanatus fabricii*	0	0.53	0.72	1.04
64.	*Thanatus* sp. 2	0.48	0.26	0.30	0.62
65.	*Tibellus elongates*	1.12	0.60	0	0.76
66.	*Crossopriza lyoni*	5.61	2.58	2.45	2.56
67.	*Pholcus fragillimus*	0.32	0.99	0.72	1.31
68.	*Perenethis venusta*	0.48	1.72	1.79	1.87
69.	*Prodidomus* sp.	0.96	0.20	0.36	0.42

Table 7 continued

Sl. No.	Name of the species	Summer	Monsoon	Post-monsoon	Winter
70.	*Aelurillus* sp. 1	1.44	0.60	0.96	1.45
71.	*Langona bristowei*	1.92	1.39	1.55	1.31
72.	*Asianellus potanini*	0.96	0.93	0.42	1.80
73.	*Cyrba ocellata*	6.25	2.98	1.91	2.70
74.	*Harmochirus brachiatus*	0	1.06	0.96	1.25
75.	*Menemerus bivittatus*	1.44	1.39	1.55	1.73
76.	*Plexippus paykulli*	3.53	1.39	1.79	2.08
77.	*Phintella* sp.	0	0.20	0	0.21
78.	*Hyllus semicupreus*	1.28	0.46	0.84	0.83
79.	*Stenaelurillus arambagensis*	0.96	1.79	1.31	0.97
80.	*Stenaelurillus jagannathae*	0.48	1.85	1.31	1.45
81.	*Thyene imperialis*	0	0	0.60	0.42
82.	*Scytodes univittata*	0	1.79	1.55	1.25
83.	*Segestria* sp.	0.48	0.33	0.24	0
84.	*Loxosceles rufescens*	0	0.60	0.66	1.45
85.	*Heteropoda* sp. nov.	0.64	0.40	1.43	1.31
86.	*Heteropoda bhaikakai*	0.96	0.66	0	0.90
87.	*Olios tener*	1.44	1.46	2.27	1.45
88.	*Olios* sp. 2	0	0	0	0
89.	*Guizygiella shivui*	0	1.65	1.67	1.45
90.	*Leucauge decorata*	0	1.39	1.49	1.25
91.	*Leucauge tessellata*	0.48	0.20	0	0.42
92.	*Tetragnatha makiharai*	3.04	1.52	1.61	1.52
93.	*Achaearanea* sp. 1	0	0.66	0.06	0
94.	*Parasteatoda kompirensis*	0.64	0.20	0.96	0.76
95.	Argyrodes fasciatus	0.96	0.86	0.72	0.76
96.	*Argyrodes gazedes*	0	0	0.18	0
97.	*Euryopis cyclosisa*	0.96	1.52	1.25	0.48
98.	*Rhomphaea* sp.	0.48	0	0.54	0.62
99.	*Steatoda* sp. 1	1.44	1.79	0.60	0.76
100.	*Steatoda* sp. 2	0.48	0.86	0.66	0
101.	*Parasteatoda oxymaculata*	0.48	0.86	0.12	1.11
102.	*Theridion indicum*	2.24	1.26	1.49	0.28
103.	*Theridion melanostictum*	0.48	1.26	1.79	0.55
104.	*Theridion varians*	1.76	0.79	0.96	0.69
105.	*Ozyptila* sp.	0	1.06	0.84	0.55
106.	*Runcinia* sp.	0	0.33	0	0.48

Table 7 continued

Sl. No.	Name of the species	Summer	Monsoon	Post-monsoon	Winter
107.	*Thomisus whitakeri*	0.48	0.99	1.19	0.76
108.	*Tmarus* sp.	0	0.66	0	0
109.	*Uloborus* sp. 1	0	0	0	0
110.	*Zosis* sp.	0	0	0	0
111.	*Euryodion katepagaa*	1.44	2.58	2.09	1.45
112.	*Tropizodium kalami*	0.96	2.32	0.96	1.73
113.	*Pandava laminata*	1.44	0.26	0.90	0.69

In the winter season, a total of 1445 individuals were recorded, comprising 88 species, 78 genera, and 17 families (Table 2). Specifically, in Chikkalingadalli, there were 262 individuals of 63 species, in Sher Camp there were 334 individuals of 78 species, in Chandrampalli Dam there were 261 individuals of 63 species. In Shangreela, there were 278 individuals of 77 species. In Burugadoddi there were 288 individuals of 70 species (Table 6). The Shannon Index H'=4.3, the Evenness EH=0.98, and the Simpson Index 1-D=0.986 represent the diversity of the recorded species. When comparing the diversity between habitats during the monsoon season, it is observed that the Shannon diversity index is higher in Sher camp (H'=4.26) and lower in Chandrampalli Dam (H'=4.00) (Table 2). Additionally, the evenness of species is higher in Chikkalingadalli (EH=0.93) and lower in Chandrampalli Dam (EH=0.86). Species dominance is higher in Chandrampalli Dam (D=0.022) and lower in Sher camp (0.0153) (Table 6). Among the recorded species, Cyrba ocellata (2.70%) is the most abundant, followed by Plexippus paykulli (2.08%), Oxyopes sertatoides (2.08%), Wadicosa prasantae (2.01%), Hersilia savignyi (2.35%), and Crossopriza lyoni (2.57%). On the other hand, Phintella sp. (0.20%), Indothele dumicola (0.20%), Zelotes tenuis (0.20%), and Theridion indicum (0.28%) are less abundant (Table 7).

Figure 1

Seasonal Variation of spider diversity

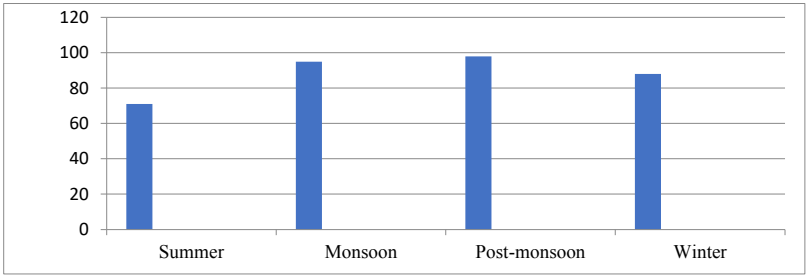
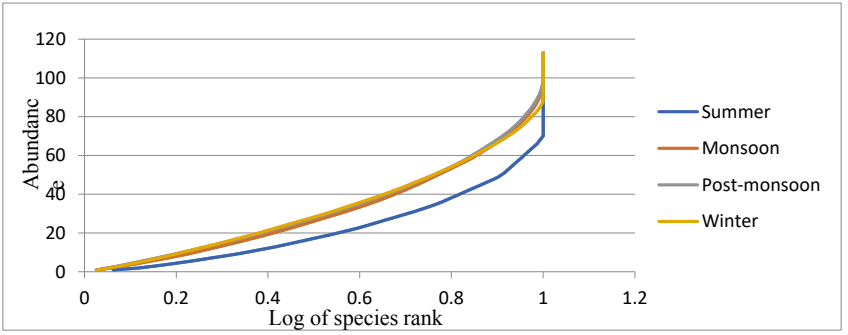


Figure 2

Depicting spider diversity in different habitats of Chincholli Wildlife Sanctuary



Over two years. from February 2016 to February 2018, an extensive survey was conducted in the forest and aquatic habitats near the Chincholli Wildlife Sanctuary. The study revealed a total of 113 species of spiders from 85 Genera across 32 families, representing 54% of the families, 20.33% of Genera, and 6.41% of species reported in the country (World Spider Catalog, V 19.0 dated 16 July 2018). This research marks the first of its kind in the area, providing new distribution records for all species identified. The findings indicate that certain spider species are present during specific seasons. The abundance of spider fauna is influenced by seasonal weather changes, a notion supported by Kato et al. (1995). Rainfall also plays a crucial role in the regional spider diversity. Temperature and humidity are key factors affecting the microclimatic preferences of spiders due to their varying physiological tolerances. Therefore, the diversity of spider species

across the four seasons is expected to vary based on differences in temperature, rainfall, humidity, and other environmental factors. Lubin (1978) proposed that changes in prey availability and humidity contribute to the observed variations in spider abundance. Additionally, Corey et al. (1998) suggested that seasonal fluctuations in spider abundance may be linked to differences in individual spider activities and the morphology of the spider community. Hence, seasonal variation is a significant factor influencing spider diversity.

The importance of diversity in families is evident as it is closely linked to the diversity of habitats. The distribution of spider families in the study area shows that the Araneidae family contributes 12.61% of the total spider families, making it the most diverse family. This is followed by Lycosidae (11.71%), Theridiidae (10.81%), and Salticidae (9.91%). A similar observation was made by Uniyal (2006), who attributed it to the different habitat types that provide more opportunities for web builders, thus creating more niches and communities for spiders to inhabit. On the other hand, families such as Amaurobiidae, Clubionidae, Dictynidae, Dipluridae, Filistatidae, Mimetidae, Pisauridae, Prodidomidae, Scytodidae, Segestriidae, Sicariidae, Titanoecidae, Oonopidae, and Palpimanidae are rare and less abundant, contributing only 0.90% of the total spider families in the study area. The quality and quantity of spider fauna sampling depend on the sampling method and the time of collection (Sudhikumar et al., 2005). In this study, visual methods and night surveys were used for sampling. The present study also employed visual census, hand capture, pitfall traps, and foliage beating methods to sample spider species. The diversity of spider species can be influenced by environmental factors such as habitat type, seasonality, competition, spatial heterogeneity, predation, productivity, and environmental stability (Riechert & Bishop, 1990). Lycosidae is the most abundant family in the Chandrampalli Dam. During night surveys, web builders are more abundant, constructing webs along the entire dam fencing due to the availability of suitable microclimate.

The presence of structurally complex vegetation has been linked to higher diversity and abundance of spiders, as noted by various researchers (Hatley & Mac Mahon, 1980; Green, 1999). Orb weaver spiders tend to be more prevalent in the upper canopy while ground-dwelling spiders are commonly found in litter-covered areas like the periphery of forests such as Chikklingadalli. Various diversity indices were utilized in this study, including the Shannon-Wiener Index, Simpson Index, and Richness Index. The Shannon-Wiener Index is particularly sensitive to changes in the abundance of rare species within a community. The investigation into diversity aimed to assess differences in community structures across different seasons and habitats based on species distribution abundance (Solow, 1993). The

highest value of the Shannon Index was observed in Shangreela, which features a mixed dense forest and the Chandrampalli Dam. This suggests the presence of rare species within the mixed dense forest of Shangreela. The results indicate that the Araneidae and Lycosidae spider families are dominant across all habitats, representing approximately 24.32% of the total spider abundance. The study also examined the species richness index to determine the number of species present in a habitat. This index provides valuable insights into ecological changes over time and variations among ecological communities (Bisby, 1995). Generally, the species richness index is the most commonly used diversity measure (Sudhikumar et al., 2005). The richness index was highest in Chandrampalli Dam and Shangreela (EH=0.88) and lower in Chikkalingadalli (EH=0.85). Chandrampalli Dam and Shangreela benefit from good humidity and moisture levels, experiencing fewer climatic fluctuations compared to other study areas, while Chikkalingadalli forest faces human interference and litter burning during dry seasons, failing to provide suitable microhabitats for web-building spiders.

Web-weavers are strictly insectivorous, whereas wandering and stalker spiders shows a varied approach of insectivorous and araneophagic foraging patterns (Nyffeler, 1999). Salticidae family spiders exhibit as the successful biocontrol agent of different crops due to having type II functional response (Upadhyay & Das, 2020; Caleb, 2023). Abundance of spiders might be pest density-dependent Moreover, they exhibit a huge range of predating strategies (Marc et al., 1999).

CONCLUSIONS

The systematic examination of spider species in two distinct habitats, namely forests and near aquatic habitats, is of great significance in this particular context. Although the study only identified a few species up to the genus level, they could not be classified as new due to the lack of necessary literature. These specimens have been deposited in Government College, Kalaburagi, 144 Karnataka, India. However, a considerable number of specimens still need to be examined in the laboratory. The current study holds immense value in achieving the objectives of biocontrol aspects, ecological indication, and molecular taxonomy of spider fauna. Despite previous taxonomic work on spiders in India, there is still much to be done in terms of accurate identification. Many species have been incorrectly placed in the wrong genus, and several species described as new are actually synonyms of already known species. Conducting DNA fingerprinting on these challenging genera may uncover numerous synonyms and differences among these species. Furthermore, it will aid in understanding the evolutionary relationships

between species and genera. This thesis only presents a fraction of the overall spider diversity that remains hidden in the vast forest landscape of the district. A future investigation is expected to significantly increase the number of species by two to three times. It is crucial to know about our own biological resources. It is reasonable to consider that spiders could play a key role in integrated pest management practices. The variation in species abundance can be valuable in monitoring changes in vegetation parameters and habitat disturbances.

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