

# Diversity And Distribution Of Spider Fauna In Different Ecosystems Of Chikmagalur Parts Of Western Ghats, Karnataka

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**Abstract:** Spider diversity in coffee agro ecosystem was conducted using active searching, visual observation and leaf litter sampling techniques. Survey and sampling was conducted during January 2015 to June 2015. In hitherto study 465 specimens representing 45 species and 13 families. The Araneidae was the most dominant family having the highest number of species recorded (16), followed by the family Salticidae (9), Oxyopidae (4), Lycosidae and Theridiidae (3), Pholcidae, Tetragnathidae (2) and Agelenidae, Clubinoidae, Scytodidae, Sparasidae, Thomsidae and Uloboridae are one species each respectively. The density was the highest in the Muthodi coffee agroecosystem and lowest in the urban ecosystem.

**Keywords:** Diversity, Western Ghats, Habitats, Spiders, Coffee ecosystem

## I. INTRODUCTION

Spiders are ubiquitous predators that are abundant and diverse in agricultural ecosystems. Spider assemblages have the ability to limit population growth of arthropod pests and other natural enemies (Mansour *et al.*, 1980; Orazé and Grigarić, 1989; Richert and Bishop, 1990; Carter and Rypstra, 1995). Different studies have shown that spiders influence on prey populations depends on spider density. Therefore, relatively high spider abundance has been considered a requirement for pest control in agricultural systems (Greenstone, 1999; Richert, 1999; Sunderland and Samu, 2000), but the role of spider diversity in prey regulation is less understood.

Coffee agroecosystems are particularly useful systems for exploring how vegetation structures affect spider's diversity and density. It has a diversified arthropod fauna (Ibarra, 1990; Ibarra and Garci, 1998) and a range of different management systems (Perfecto *et al.*, 1996; Moguel and Toledo, 1999). Coffee plantations commonly include shade trees normally used to regulate sun intensity on coffee shrub, but the level of the shade used is variable according to land scape availability.

Our knowledge of Indian spider fauna is extremely fragmentary. Indian spiders from all regions have been studied earlier by several European workers and later by Indian Arachnologist by Blackwall (1850). He described some newly discovered species and characters of a new genus of Araneidae. The earliest contribution on Indian spiders was by Stoliczka (1869) and Karsh (1873). Gravely (1921) added considerably to the knowledge of Indian spiders. A major contribution to Indian arachnology was made by Pocock and Tikader, who made other researchers to take interest in research on spider. Pocock described 112 new species of spider from India. His book published in the year 1990 provided the first list of spiders, along with enumeration and new descriptions (Tikader, 1987) also published the first comprehensive list of Indian spiders, which includes 1067 species belonging to 249 genera in 43 families. A number of species from Lahore were described by Dyal (1935). Spiders of many families were practically unknown from Karnataka earlier to Tikader (1980, 1982) who described many species of the families (Lycosidae, Aranidae, Thomisidae, Gnaphosidae, Philodromidae) from all over India. Currently 46,738 species in 4058 genera and 112 families have been described (Platnick, 2017). Updated checklist of Indian spiders includes

1,686 species, 438 genera and 60 families (Keswani *et al.*, 2012). We know little about how many species are threatened and which may already have been extinct, what spider play, what role in ecosystem. The works regarding spider faunal survey were not yet explored in this region. The need is, in fact made more urgent by the spirit of developmental activities; new settlements also affected the natural habitat for spiders. Our work provides list of spiders located in the manmade ecosystems of Chikkamagalur.

## II. MATERIALS AND METHODS

### STUDY AREA

The study was conducted in Muthodi and Chikkolale coffee agro ecosystems and urban ecosystem of Chikkamagalur. It is located in the foothills of Mullayanagiri range, the highest peak between Himalayas and the Nilagiries, in the shadow of the Western Ghats. Chikkamagalur is famous for coffee production and hill stations and is known as Coffee land of Karnataka. It is a place in India where coffee was cultivated for the first time.

### HABITATS DESCRIPTION

In the present study, we were selected two sites in mountain area of coffee agroecosystem and urban ecosystem of Chikkamagalur (Fig1).

- ✓ Muthodi Coffee agroecosystem: It is belonging to Bhadra Wildlife Sanctuary located in 13°22' N and 75°39' E and an elevation of 1204 m. Coffee estate having a lush green vegetation of mostly moist and dry deciduous forests, which is 20 km away from the Chikkamagalur city. The temperature of the region being 22-32°C.
- ✓ Chikkolale Coffee agroecosystem: It is a small village in Chikkamagalur taluk located in 13°20' N and 75°43' E and an elevation 1161m. It is very near to human habitat and having less number of forest plants and 9 km away from the Chikmagalur city.
- ✓ Urban area of Chikkamagalur: It is in 13°20' N and 75°43' E latitude and an elevation 1037 m. The temperature of the city ranges between 11-30°C.

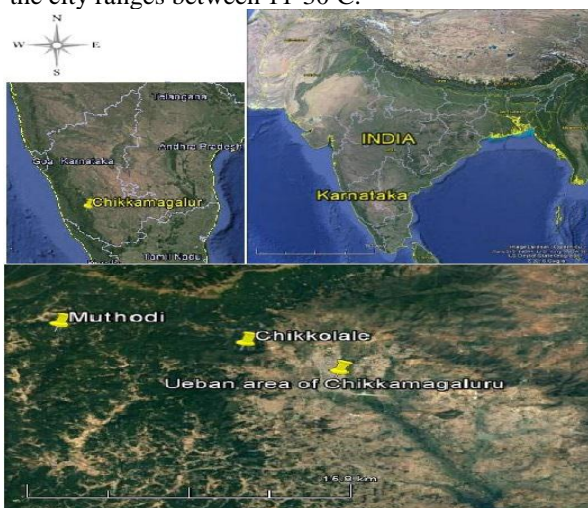


Figure 1

### SAMPLING

The field observation and collection of spiders was made twice in the month from January 2015 to June 2015. The spiders are collected from Bushes, tree trunks, ferns, forest floor, foliage and grass lands by visual searching and hand pecking method (Tikader, 1987) and (Sudhikumar *et al.*, 2005). The collected spiders were preserved in 70% alcohol and species identification done by the help of World spider catalogue (Platnick, 2017). The collected data was subjected to the statistical analysis namely Dominance, Shannon Index, Evenness and Species Richness by using past3 software.

## III. RESULT AND DISCUSSION

Chikkamagalur taluk provides diverse habitat to various spider species. A total of 456 individuals were collected during the study period in the area of Muthodi and Chikkolale coffee agroecosystem and urban ecosystem. Among these 45 species under 34 genera and 13 families were recorded. This represents 21.66% of total families and 2.66% of total species reported from India (Keswani *et al.*, 2012). Among them 16 species belonged to family Araneidae, followed by Salticidae (9), Oxyopidae (4), Lycocidae and Theridiidae (3), Tetragnathidae, Pholcidae (2) and Agelenidae, Clubionidae, Scytodidae, Sparassidae, Thomsidae and Uloboridae (1) respectively (Table-1). The distribution of spiders in Muthodi coffee agroecosystem with 35 species followed by Chikkolale 24 species and urban ecosystem 13 species was recorded. The Araneidae family is the most dominant it includes 37% of the total species, followed by the Salticidae 23%, Oxyopidae 7%, Tetragnathidae and Theridiidae 6% each, Pholcidae 3% and Agelenidae, Clubionidae, Scytodidae, Sparassidae, Thomisidae and Uloboridae are 1% each of the total species collected (Fig 2). Spider diversity is high in Muthodi it is due to low disturbance and rich diversity of plants and insects. It can be assumed that rich floral diversity provides diverse microhabitat for the faunal diversity. In terrestrial habitats, spiders are dominant group of predators that in the role as generalist feeders (Nentwing, 1986); (Wolf, 1990). The spider diversity was very less in the urban ecosystem and it may be due to lack of food sources and habitat loss.

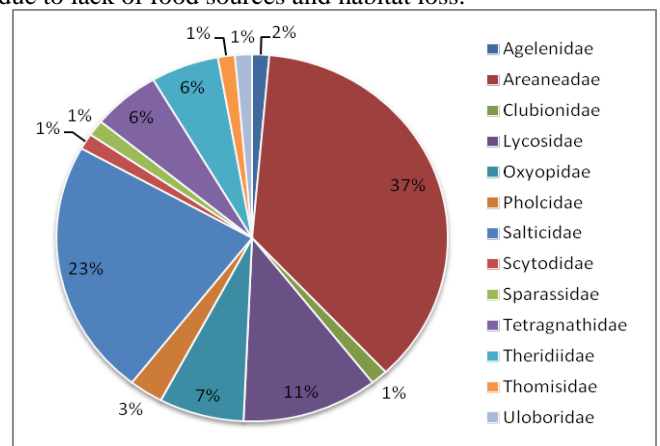


Figure 2

Sl.No.	Species name	Muthodi	Chikkolale	Urban area
	<b>Agelenidae</b>			
1	<i>Tegenaria sp.</i>	-	-	+
	<b>Araneidae</b>			
2	<i>Arachnura sp.</i>	+	-	-
3	<i>Araneus sp.</i>	+	-	-
4	<i>Argiope anasuja</i> (Thorell, 1887)	+	+	-
5	<i>Argiope pulchella</i> (Thorell, 1881)	+	-	+
6	<i>Cyclosa bifida</i> (Doleschall, 1859)	+	-	-
7	<i>Cyclosa conica</i> (Pallas, 1772)	+	+	-
8	<i>Cyrtophora bidenta</i> (Tikader, 1970)	-	+	-
9	<i>Cyrtophora citricola</i> (Forsskal, 1775)	-	+	+
10	<i>Gasteracantha geminate</i> (Fabricius, 1798)	+	+	-
11	<i>Gasteracantha kuhli</i> (C. L. Koch, 1837)	+	-	-
12	<i>Neoscona mukerjei</i> (Tikader, 1980)	+	-	-
13	<i>Neoscona nautica</i> (L. Koch, 1875)	+	+	+
14	<i>Parawixia dehaani</i> (Doleschall, 1859)	+	+	-
15	<i>Nephila pilipes</i> (Fabricius, 1793)	+	+	-
16	<i>Herennia multipuncta</i> (Doleschall, 1859)	+	+	-
17	<i>Nephilengys malabarensis</i> (Walckenaer, 1841)	+	-	-
	<b>Clubionidae</b>			
18	<i>Clubiona sp.</i>	+	-	-
	<b>Lycosidae</b>			
19	<i>Hippasa agelenoides</i> (Simon, 1884)	+	+	-
20	<i>Lycosa sp.</i>	+	+	+
21	<i>Paradosa sp.</i>	+	-	+
	<b>Oxyophidae</b>			
22	<i>Hamataliwa sp.</i>	+	-	-
23	<i>Oxyopes javanus</i> (Thorell, 1887)	+	-	-
24	<i>Oxyopes lineatus</i> (Latreille, 1806)	-	+	-
25	<i>Oxyopes sp.</i>	+	+	-
	<b>Pholcidae</b>			
26	<i>Crossopriza lyoni</i> (Blackwall, 1867)	-	-	+
27	<i>Pholcus sp.</i>	-	-	+
	<b>Salticidae</b>			
28	<i>Evarcha sp.</i>	+	+	-
29	<i>Hasarius adansoni</i> (Audouin, 1826)	+	-	+
30	<i>Hyllus sp.</i>	+	+	-
31	<i>Plexippus paykulli</i> (Audouin, 1826)	+	-	-
32	<i>Plexippus setipes</i> (Karsch, 1879)	-	+	-
33	<i>Plexippus petersi</i> (Karsch, 1878)	+	+	+
34	<i>Plexippus sp.</i>	-	+	+
35	<i>Rhena sp.</i>	+	-	-
36	<i>Telamonia dimidiata</i> (Simon,	+	+	-

	1899)			
	<b>Scytodidae</b>			
37	<i>Scytodes sp.</i>	+	-	-
	<b>Sparassidae</b>			
38	<i>Heteropoda venatoria</i> (Linnaeus, 1767)	-	-	+
	<b>Tetragnathidae</b>			
39	<i>Leucauge sp.</i>	+	+	-
40	<i>Tetragnatha sp.</i>	+	+	-
	<b>Theridiidae</b>			
41	<i>Theridion sp.</i>	+	+	+
42	<i>Argyrodes flavescens</i> (O. Pickard-Cambridge, 1880)	-	+	-
43	<i>Theridion manjithar</i> (Tikader, 1970)	+	-	-
	<b>Thomisidae</b>			
44	<i>Thomisus sp.</i>	+	-	-
	<b>Uloboridae</b>			
45	<i>Uloborus sp.</i>	+	-	-

'+'=Present, '-'=Absent

Table 1: Distribution of Spider species in different locations

Totally 456 individuals representing the 45 species belongs to 13 families were recorded in three habitats of Chikkamagalur. Their distribution includes 10 from Muthodi agroecosystem and 6 from Chikkolale and 7 from urban ecosystem respectively. Araneidae, Lycosidae, Salticidae and Theridiidae are the most diversified families, the members of these families are recorded in all three ecosystems. Araneidae was the dominant family in Mannavan Shola Forest which is composed of 17 species and 10 genera (Sudhikumar *et al.*, 2005). The families like Oxyopidae and Tetragnathidae were recorded only in Coffee agroecosystems. Agelenida, Pholcidae and Sparassidae were recorded only in urban ecosystem, Clubionidae, Scytodidae, Thomisidae and Uloboridae were recorded only in Muthodi Coffee agroecosystem (Table 1). Among them Araneidae was the dominant family having 26 species reported in all the three study areas and those includes 14 species from Muthodi, 9 from Chikkolale and 3 from urban ecosystem, followed by Salticidae 16, out of these 7 from Muthodi, 6 from Chikkolale and 3 from Urban ecosystem, Lycosidae 3 from Muthodi, 3 from Chikkolale and 2 from urban ecosystem, Oxyophidae 3 from Muthodi, 2 from Chikkolale, Tetragnathidae 2 from both the Coffee agroecosystem and these three are absent in urban ecosystem, Clubionidae, Scytodidae, Thomisidae and Uloboridae 1 species each recorded in Muthodi coffee agroecosystem, Agelenidae 1 and Pholcidae 2 species are recorded only in urban ecosystem (Table 1). This result showed that spider diversity was more abundant in coffee agroecosystem than to the urban ecosystem. Human activities like habitat destruction, increased pollution level and urbanization have lead to decline in spider diversity as well as the wild fauna

A total of 45 species were documented in all three locations in Chikamagalur. Among these *Neoscona nautica*, *Lycosa sp.*, *Plexippus petersi* and *Theridion sp.* are common in all three locations. The species like *Arachnura sp.*, *Araneus sp.*, *Cyclosa bifida*, *Gasteracantha kuhli*, *Neoscona mukerjei*, *Clubiona sp.*, *Nephilengys malabarensis*, *Hamataliwa sp.*, *Oxyopes javanus*, *Plexippus paykulli*, *Rhena sp.*, *Scytodes sp.*, *Theridion manjithar*, *Thomisus sp.* and *Uloborus sp.* are found in Muthodi coffee agroecosystem, and *Cyrtophora bidenta*,

*Oxyopes lineatus*, *Plexippus setipes*, *Argyrodes flavescens* are found in Chikkolale coffee agroecosystem. The species which are common in both the coffee agroecosystems include *Argiope anasuja*, *Cyclosa conica*, *Neoscona nautica*, *Parawixia dehaani*, *Hippasa agelenoides*, *Nephila pilipes*, *Herennia multipuncta*, *Oxyopes sp.*, *Evarcha sp.*, *Hyllus sp.*, *Telamonia dimidiata*, *Leucauge sp.*, *Tetragnatha sp.* The species like *Tegenaria sp.*, *Heteropoda venatoria*, *Crossopriza lyoni* and *Pholcus sp.* are found only in urban ecosystem (Table 1). The data revealed that spider species are more abundant in the coffee agroecosystem compared to the urban ecosystem. This indicates that, the spiders may prefer more undisturbed and unpolluted habitats.

Different diversity indices were calculated to understand the community structures of spiders at three different ecosystems (Table 2). Shannon diversity index varied 3.47: 2.987: 2.44 respectively in Muthodi, Chikkolale and Urban ecosystems and Evenness (E) was varied 0.86 to 0.91 between ecosystems (Table 2). It clearly indicated the distribution of spider species between the ecosystems is almost similar. Further, species richness was highest (6.16) at Muthodi and 4.52 in Chikkolale ecosystem, but it was very low (2.75) at urban ecosystem (Table 2) and Sorenson's diversity ( $\beta$ ) also showed similar result between different ecosystems (Table 3). Thus species richness is significantly high in the ecosystems with lesser manipulation (Culin *et al.*, 1983).

Diversity indices	Study sites		
	Muthodi	Chikkolale	Urban area
Taxa_S	35	23	13
Individuals	249	129	78
Dominance_D	0.03327	0.05739	0.09533
Shannon_H	3.47	2.987	2.443
Evenness_E	0.9185	0.862	0.8854
Margalef Species Richness	6.162	4.527	2.754

Table 2: Results of Alpha ( $\alpha$ ) diversity indices

Sites	Muthodi	Chikkolale	Urban area
Muthodi	-	0.638	0.292
Chikkolale	0.638	-	0.375
Urban area	0.292	0.375	-

Table 3: Beta diversity ( $\beta$ ) (Sorenson's index)

#### IV. SUMMARY

The spider sampling was done in different habitats of Chikkamagalur from January 2015 to June 2015. A total of 456 individuals representing 13 families and 45 species were recorded. The family Araneidae was the most dominant contributing 37% of the total species recorded. The Muthodi Coffee agroecosystem was the rich in diversity of spiders compared to urban ecosystem due to its rich floral diversity. Alpha and beta diversity indices were calculated to understand the community structures of spiders at three different ecosystems. The study serves as the baseline for further study on spiders in Chikkamagalur area.

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