International Journal of Zoology Studies
ISSN: 2455-7269
Impact Factor: RJIF 5.14
www.zoologyjournals.com
Volume 3; Issue 1; January 2018; Page No. 44-47

Biomonitoring of diversity and compostition of spider collection at Sirumalai hills, Dindigul district, Tamil Nadu

[1] K Krishnaveni, [2] C Kandeepan
[1] Research Scholar, Department of Zoology, G.T.N Arts College, Dindigul, Tamil Nadu, India
[2] Research Supervisor, PG and Research, Department of Zoology, APA College, Palani, Tamil Nadu, India

Abstract
An incessant study was conducted to reveal the spider diversity in Sirumalai hills of Dindigul district. The study was conceded out in Sirumalai Hills which is the western offshoot of the Eastern Ghats, lying between 10°07' - 10°18' N latitude and 77°55' - 78°12'. The annual rainfall is around 1200 mm per year, with approximately 75 rainy days in two seasons. The maximum rainfall is recorded from the North-East monsoon (October-November). April- June is noted as the hot summer season. The humidity is maximum in the rainy months (91%) and minimum in the summer months (68%). A total of 112 species of spiders belonging to 52 genera of 18 families were collected from this area during this study period (June 2014- May2015). The maximum and minimum temperatures were recorded in the months of May (29.2°C) and January (18.3°C) respectively. This represents 10% of the total families recorded in India. Guild structure analysis of the collected spiders revealed 6 feeding guilds viz., orb-web builders, foliage hunters, ground hunters, sheet web builders, scattered line weavers and ambushers. The families Araneidae, Tetragnathidae, Salticidae and Thomisidae exhibited maximum species diversity. The dominant family was Araneidae with 17 species. Shannon index, Simpson index, and Margalef Richness index evaluated were 1.06, 0.103 and 8.4 respectively. Spiders belonging to different feeding guild and population were higher during monsoon and winter season. Because of the complex interaction of various climatic factors such as high rainfall and humidity, with topographical features, Sirumalai hills holds many smaller but diverse environmental niches which make this an important centre of speciation in Eastern Ghats.

Keywords: biodiversity, spider, species composition, Sirumalai hills

1. Introduction
Spiders are generalist feeders with immense species richness in each type of earthly habitat and engage in recreation an significant position in the organization of communities and food webs, both as a individual numbers and as energy consumers [8]. Spiders performing as ecological indicator, are cosmopolitan in distribution and in the vicinity plentiful in terms of individuals and taxa. Their small body size allows them to uphold their community in small region. Spiders are insectivorous animal and insect fauna changes with the alter in vegetation. Vegetation structure may vary according to seasonal variation throughout the year. In Sirumalai forest seasonal discrepancy may be an imperative factor for spider diversity.

Spiders play a noteworthy ecological role by being entirely predatory and thereby maintaining ecological balance. Spiders in secluded areas of India are studied by Gajbe in Indravati Tiger Reserve, who recorded 13 species [9]. Rane and Singh recorded five species [19] and Gajbe [10] recorded 14 species from Kanha Tiger Reserve, Madhya Pradesh. Gajbe also prepared a checklist of 186 species of spiders in 69 genera under 24 families distributed in Madhya Pradesh and Chhattisgarh [11]. Patel described 91 species belonging to 53 genera from Parabikulum Wildlife Sanctuary, Kerala [17]. Manju Silwal recorded 116 species from 66 genera and 25 families of spiders from Purna wildlife Sanctuary, Dangs, Gujarat [14]. Bastawade described arachnid fauna of orders Araneae, Scorpionida and Solifugi from Melghat Tiger Reserve, Amravati, Maharashtra State [2]. Hippargi, reported occurrence of spiders from 19, 25, 31families from Lonar, Melghat and Southern Tropical thorn forest, Solapur respectively [13]. Deshmukh and Raut [5] recorded 57 species belonging 35 genera under 14 families during 6 month survey in Salbardi forest (Satpura range). Spiders can be orderly in to different guild based on resemblance in their methods of acquiring food. Availability of prey concentration determines the diversity of spiders. Prey density is essentially based on seasonal deviation and vegetation structure which may maintain changing all through the year in turn affecting spider diversity and abundance. Thus the study was intended with the aim to conclude seasonal variation in spiders community membership as there is absence of any similar work report from this area or even in India.

2. Material and Methods
2.1 Study Area
The present study was conducted from June 2014 to May 2015 at Sirumalai Hills (Eastern Ghats range) with geographical location between East longitudes Coordinates: 10°07' - 10°18' N latitude and 77°55' - 78°12'.

This hill is located 6.5 km south of Dindigul town and 22.5 km north of Madurai City. Sirumalai Hills is about 19.3 km long and 12.8 km broad with an area of 247 km2. Starting from Nadukandamalai in the northeast, one ridge slopes down

in the northwest to Reddiapatti. The only motorable Ghats road is on this slope. Another ridge runs northwest for 4.8 km, and abruptly descends to Ambathurai. Two ridges diverge from Pudur village (1100 m), on the southern slope of Nadukandamalai, one running west, the other south. The latter, after some 1.6 km, slopes down north of Kodaikanal Road Railway station; the inner one, after reaching Ayyanar Hills (1040 m) continues south, and forms the western ridge. The southern ridge of Sirumalai Hills slopes down to Sattiar valley at the eastern end. The eastern side has a continuous ridge for 20 km, starting at Annanagar of Sirumalai Palayaur and sloping down to Sattiar valley via Kadamankulam, Madhagamalai and Waverkadu. From the eastern slope, two ridges slope down to Thavasinnadai and Anjukulipatti. The main peaks are Mullupanrimalai (1380 m) in the north-east, Vellimalai (1350 m) in the north, Kaluguparai (1350 m) in the south and Madhagamalai (1250 m) in the north. The temperature in the area varied from 18°C to 40°C. The region receives an annual rainfall of 900 mm during the southwest monsoon between June and September. The relative humidity varied from 30 to 80 %. The study area was divided in to a total five different habitats to study the diversity of spiders.

2.2 Sample Collection

Sampling was conceded out at each habitat at a period of 7 days. In order to have sufficient samples of spiders from various habitats, a extensive variety of collection and trapping methods were used, i.e. walk through the habitat and visual search for spiders, their webs or retreats (curled leaves, silken leaves), sweeping, beating, pitfall trapping etc. The collected spiders were photographed, sorted and preserved in labelled insect collecting bottles containing 70% alcohol. Collected spiders were identified using standard identification keys of Barrion and Litsinger [1], Biswas and Biswas [3], Davies and Zabka [4], Gajbe [11], Plantnick [18], and Tikader [24, 25, 26, 27].

2.3 Data Analysis

The diversity of spiders was analyzed by extensively used indices viz., The Shannon –Wiener index (H1), which is responsive to changes in the great quantity of rare species in community and the Simpson index (λ), which is sensitive to changes in the most abundant species in a community, and Margalef Richness which were calculated using biodiversity pro software version 2.

3. Results

A total of 324 individuals belonging to112 species, 52 genera and 18 families were collected during the study (Table no. 1). Amongst the families the Salticidae was the most abundant (19.23%) followed by Aranidae (18.26%), Thomisidae (12.05%), Oxyopidae (8.65%), Lycosidae (7.69%), Gnaphosidae (6.73%), Philodromidae (4.76%), Eresidae (3.84%), Tetragnathidae (3.84%), Pholcidae (2.88%), Theridiidae (2.88%), Clubionidae (1.92%) and Uloboridae (1.92%) (Table. 2). The smallest amount species diversity was found in the families in Hersilidae, Miturgidae, Nephilidae, Scytodidae and Sparacidae with (0.96%) in each family, abundantly found for restricted period. Out of the 112 species classified, 41 species were 'very common', 29 species common', 22 species 'rare' and 12 species 'very rare' (Fig.1). Spiders exhibited seasonal variation in their rate. A total of 30 species were recorded during Monsoon season (June, July, August, September); 60 species during winter (October, November, December, January); 14 species during summer (February, March, April, May). However 10 species were recorded throughout the year. (Table 2). %. Shannon index, Simpson index, and Margalef Richness index evaluated were 1.06, 0.103 and 8.4 respectively. (Table 3).

4. Discussion

Previous researchers revealed that spiders remain active during winter, often have exact types of life cycles and convinced overwintering stages [7, 15, 22, 23]. To confirm this in part, the study was framed to decide the family composition and species abundance of spiders in different seasons in Sirumalai forest throughout the year. Family composition of the spiders community shows substantial variability from month to month. Salticidae represent the leading family for most of the months because it feeds on nymphs, larvae and insects whatever available throughout the year. It is fascinating to note that, the highest numbers of spiders were collected in winter and maximum numbers of species were also reported as compared to monsoon and summer, whereas least number was recorded in summer.

After the beginning of rainy season various seasonal plants starts to thrive and attracts large number of insect fauna. During this time maximum families of spiders were pragmatic, mainly with abundance of *Leucage decorata*, *Hippasa pisaurina* and *Hippasa holmerae* etc. This matches with the inspection of other researchers on grasslands who verified that spiders counter numerically to the diversity and intricacy of the vegetation [12, 21].

Monthly variation in their activity is mainly prejudiced by the activity of males, when mature male becomes active in the attempt to find mates. Therefore, the increased number in collection is indicative of the time of reproduction [6, 16, 28] similar observations were recorded in our study, mature male of genus *Oxyopus* were abundant during last week of August and egg sacs of the same were observed during September.

During winter large numbers of species were recorded in the study area. *Cyclosa simon*, *Cyclosa moonduensis* and *Cyclosa hexatuberculata* were most abundantly found. They were living together on the patches of vegetation of *Annona squamosa*. Thomisidae, Therediidae, Uloboridae were also plentifully recorded in winter. Thomisus commonly known as flowering spiders, they feed on the insect visiting flowers, Male and female of this family were also recorded during winter and egg sacs were observed during late winter. The kleptoparasite, *Argyrodes* species do not put up their own webs but steal prey from the host's web like orb webs of some Araneids, crenellate orb webs of *Uloborus* and even on the webs of *Nephila Philip* in October and November respectively. *Argyrodes* species feeds on insects which are trapped in the host's web. Hersilidae species were abundant in the limited period of year during the month of October on the bark of tree. Mature male and females of family *Eresidae* genus *Stegodyphus* were observed during October, mating was recorded in November and egg sacs in December to January. Spiderlings hatches in February but with rising temperature they hide up and recurrence was recorded after sufficient rain

fall. As rainy season starts certain species like e.g. *Neoscona*, *Cyclosa*, *Thomisus* etc. start to come into view. According to Duffey it is well known that denser the vegetation superior is the density of young spiders and greater the diversity of vegetation the greater is the spiders species diversity [6]. Most orb web spiders rest at the hub of the orb during the day and are sensitive to heating and aridness. Larger orb weavers, such as *N. clavipes*, exhibit behavioral thermoregulation when uncovered to direct sunlight [20]. Same observations were recorded in the Sirumalai forest, it has been also observed that orb weaving spiders start to construct their webs in the evening and self-destruct them by morning.

Table 1: Diversity of spider species abundance in Sirumalai Hills, Dindigul District

S. No	Family	Genera	Species	No. of Individuals	Season
1	Araneidae	8	20	51	MWS
2	Clubionidae	1	3	12	W
3	Eresidae	1	5	20	WS
4	Gnaphosidae	5	8	21	MWS
5	Hersiliidae	1	2	05	W
6	Lycosidae	3	9	26	MWS
7	Miturgidae	1	1	06	W
8	Nephilidae	1	1	06	MW
9	Oxyopidae	2	10	39	MW
10	Philodromidae	4	6	20	MW
11	Pholcidae	1	3	11	MWS
12	Salticidae	11	20	51	MWS
13	Scytodidae	1	1	07	W
14	Sparacidae	1	1	05	W
15	Tetragnathidae	2	4	8	MW
16	Thomisidae	6	13	32	MWS
17	Theridiidae	2	3	09	W
18	Uloboridae	1	2	07	W
	Total	52	112	328	

M- Monsoon (June, July, August, September)
W- Winter (October, November, December, January)
S- Summer (February, March, April, May)

Table 2: Seasonal occurrence of spiders from Salbardi forest

S. No	Season	No. of Spider species
1	Monsoon (June, July, August, September)	20
2	Winter (October, November, December, January)	62
3	Summer (February, March, April, May)	16
4	Throughout the year	14

Table 3: Diversity indices of spiders in Sirumalai hills.

S. No	Diversity indices	Sirumalai hills
1	Shannon index H	1.06
2	Simpson index λ	0.10
3	Margalef Richness Index R	8.42

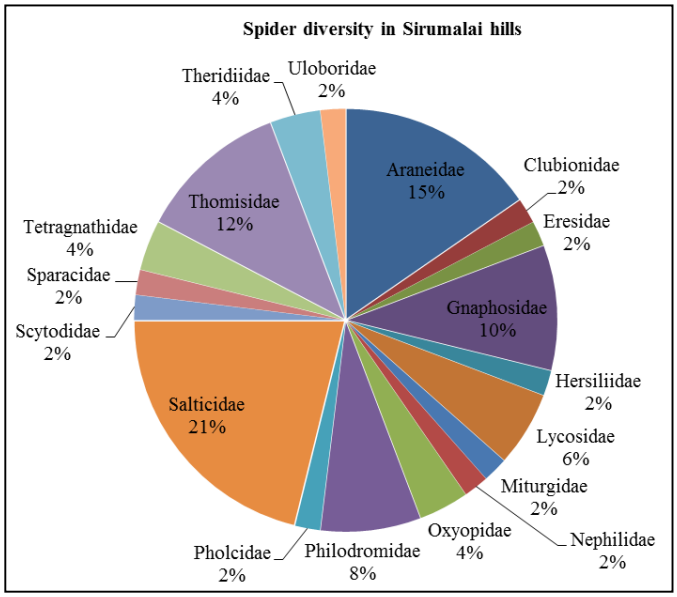

Fig 1: Dominant spider families on an annual scale

5. References

1. Barrion AT, Listinger JA. Riceland spiders of south and Southeast Asia. CAB international, Wallingford, England. 1995, 736.
2. Bastawade DB. Arachnid fauna of orders araneae, Scorpionida and Solifugi from Melghat Tiger Reserve, Distt. Amravati, Maharashtra. In the Proceeding of Symposium on Three Decades of Project Tiger in Melghats. 2004, 70-71.
3. Biswas B, Biswas K. Araneae: Spiders. In: Fauna of Manipur. State Fauna Zoological Survey of India. 2004, 10:25-46.
4. Davies V, Todd, Zabka M. II 13: Illustrated keys to the genera of jumping spiders (Araneae: Salticidae) in Australia. Mem Qd Mus. 1989; 27(2):189-266.
5. Deshmukh US, Raut NM. Distribution of spider fauna at the border of Madhya Pradesh and Maharashtra in the Salbardi-Satpuda forest range. Bioscience Biotechnology Research Communications. 2012; 5(2):210-213.
6. Duffey E. A population study of spiders in limestone grassland. J Anim Ecol. 1962; 31:571-599.
7. Foelix RF. Biology of spiders, Edn 1, Cambridge, MA & London: Harward university press, 1982.
8. Gajbe UA. Spiders Fauna of Conservation Areas: Fauna of Kanha Tiger Reserve, Madhya Pradesh. Zoological Survey of India. 1995a, 27-30.
9. Gajbe UA. Spiders, Fauna of Conservation Areas: Fauna of Indravati Tiger Reserve, Madhya Pradesh. Zoological Survey of India. 1995b, 53-56.
10. Gajbe P. Checklists of Spiders (Arachnid; Araneae) of Madhya Pradesh and Chhattisgarh. Zoos Print Journal. 2003; 18(10):1223-1226.

11. Halaj J, Ross DW, Moldenke AR. Habitat structure and prey availability as predictors of the abundance and community organization of spiders in western Oregon forest canopies. Journal of Arachnology. 1998; 26:201-220.
12. Hippargi RV, Bodkhe AK, Chikhale MP, Santape GB, Behere RM, Bolde PM, *et al.* Spider (Arachnida: Araneae) Families of Three Ecosystems of Maharashtra, India. EInternational Scientific Research Journal. 2011; 3(1):23-33.
13. Silwal M, Suresh B, Bonny Pilo. Spiders of Purna wildlife Sanctuary, Dangs, Gujarat. Zoos Print Journal. 2003; 18(11):1259-1263.
14. Merrette P. The phenology of Linyphiid spiders on heath land in Dorset. J Zool London. 1969; 156:239-256.
15. Milner JE. Oxleas wood: Observation on the spiders, their phenology and ecological strategies. Lond Nat. 1988; 67:97-118.
16. Patel BH. Fauna of Protected Areas - A Preliminary list of Spiders with the descriptions of three new species from Parambikulum Wildlife sanctuary, Kerala. Zoos Print Journal. 2003; 18(10):1207-1212.
17. Platnick NI. Advances in Spider Taxonomy 1981-1987: A Supplement to Brignoli's A Catalog of the Araneae Described Between 1940 and 1981 (edited by P. Merrett). Manchester University Press. 1989, 673.
18. Rane PD, Singh RK. Spiders (Arachnida: Araneae) from Kanha National park, Madhya Pradesh, India. Newsletter Zoological survey of India. 1977; 3(2):84.
19. Robinson MH, Robinson B. Adaptive complexity: the themoregulatory posture of the golden web spiders, Nephila claviceps, at low latitudes. American Midl Nat. 1974b; 92:386-396.
20. Rypstra AL. The importance of food and space in limiting web- spider densities: a test using field enclosures. Oecologia. 1983; 59:312-316.
21. Schaefer M. Experimentelle undersuchungen zum Jahreszyklus and zur uberwintering von spinnen (Araneidae). Zool Jb Syst. 1976; 103:127-289.
22. Thaler K, Steiner HM. Winter active spinnen auf einem Ackre bei grossendorf, anz. Schadlingskde pflanzenschutz Unweltschutz. 1975; 48:184-187.
23. Tikader BK. Gazetteer of India, Maharashtra state, General Series: Fauna, Chapter 4–Spiders. 1974, 295-306.
24. Tikader BK. Handbook of Indian Spiders, Zoological Survey of India. Calcutta, India. 1987, 251.
25. Tikader BK. Family Araneidae (Argiopidae), typical orb weavers. Fauna India (Araneae). 1982a; 2:1-293.
26. Tikader BK. Family Gnaphosidae. Fauna India (Araneae). 1982b; 2:295-536.
27. Tretzel E. Reifeund fortpflanzungszeit bei spinnen. ZMorph Okol Tiere. 1954; 42:634-691.