



Diversity and Feeding Habits of Spiders Across Habitats in Coimbatore District

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Abstract: Spiders the generalist predators are considered ecosystem health indicators and are significant predators of insect's pests and play an important role in regulation of ecological balance. The study on the diversity and feeding habits of spiders was undertaken in three different habitats from Coimbatore District viz. the agricultural farms of ICAR- Krishi Vigyan Kendra (KVK), forest ecosystem of Sálim Ali Centre for Ornithology and Natural History (SACON), and a farming village Kondanur. Overall spider diversity from the three study areas comprised of 35 species belonging to 29 genera representing 13 families with a total of 102 individuals. Maximum of 66 individuals representing 16 species and 10 families were noted at KVK followed by Kondanur with 19 individuals representing 14 species and five families, while SACON had 17 individuals representing 13 species and seven families. Shannon diversity index and Evenness index was high at Kondanur followed by SACON and KVK. The spiders fed on 12 different faunal orders occupying habitats as per their prey base niches.

Keywords: Spider fauna, Prey habitat, Ecological balance, Salticidae and Thomisidae

Spiders are generalist predators colonizing almost all habitats and are relatively abundant and diverse in natural systems (Khan and Rather 2012) and are indicators of the health of terrestrial communities and known to play an important role in the regulation of ecological balance (Vijaya et al 2019). Only in recent years, the role of spiders as important components of arthropod communities been recognized, and considerable interest has been displayed in the analysis of spider predation in natural ecosystems (Dharmaraj et al 2020). Spiders are considered important predators as they consume a large number of preys and do not damage plants and can achieve equilibrium in pest control, after which their own numbers are suppressed by their territoriality and cannibalism (Chaubey and Mishra 2017). Many species have become highly specialized to reduce competition with other species some are nocturnal, others are diurnal some build fixed webs (sheets, orbs or tunnels), others throw webs to entangle prey, some hunt prey, other sit and wait in ambush (Anjali and Prakash 2019). Spiders forage using various hunting strategies such as ambushing, chasing after prey and catching trapped prey from their webs and feed on a diverse range of organisms, primarily insects and other arthropods, including other spiders. Victims are usually smaller than or similar in size to the spider, but many spiders can moderate prey several times their own size (Rija et al 2012). Spiders are mostly

carnivorous some feed on pollen and nectar and others have been described as being predominantly herbivorous (Rija et al 2012), one of the most prosperous predatory arthropods in agricultural fields they are more sensitive to insecticides than insects, but some spiders have developed tolerance to the harmful effects of pesticides (Tahir et al 2014). Currently the World spider catalogue (2021) provides a description for 49,564 species of spiders from 4219 genera and 129 families. Keswani et al (2012) reported 1686 species of spiders from India that belongs to 60 families and 438 genera. Recently, Caleb and Karthikeyani (2020), reported 250 species of spiders for the State of Tamil Nadu, however there is no specific information from Coimbatore district. For the present study we selected three different habitats from Coimbatore District.

MATERIAL AND METHODS

Study area: The sampling of spiders was undertaken from the three select habitats in Coimbatore District (Fig. 1). Coimbatore district is in the western part of Tamil Nadu, bordering the state of Kerala. It is surrounded by the Western Ghats mountain range on the west and north, with reserve forests and the Nilgiri Biosphere Reserve on the northern side which is one of the biodiversity hotspots in India (Mownika et al 2021). The Noyyal River runs through Coimbatore and forms the southern boundary of the old city

limits. The District receives both the north east and the south west monsoon with the annual average ranging between 600 to 700 mm. Most of the district is under the rain shadow region with an annual temperature variation between 18 to 38°C.

ICAR-Krishi Vigyan Kendra: The ICAR Krishi Vigyan Kendra (KVK) is spread over an area of 130 acres at Vivekanandapuram, Karamadai, Coimbatore district, Tamil Nadu. For the present study we selected an area of 10 acres of Krishi Vigyan Kendra. Latitude 11°14'20.88"N and Longitude 76°52'45.95"E, Elevation 440- 450 meters above the mean sea level. The KVK campus is a gated area that has cultivation of coconut and plantation of vetivera (*Chrysopogon zizanioides*), lemon grass (*Cymbopogon citratus*), curry leaf (*Murraya koenigii*) and a hybrid multicut fodder sorghum variety CO FS-29 that serves the local farming community. The study area selected in KVK is dry habitat comprising of shrubs of *Lantana camera*, *Cassia auriculata*, and trees *Tamarindus indica*, *Azhardiracta indica*, *Prosopis juliflora*, *Dichrotachys cinerea* and *Tectona grandis*.

Sálim Ali Centre for Ornithology and Natural History (SACON): Sálim Ali Centre for Ornithology and Natural History (SACON) Campus in the Anaikatty Hills (Latitude 11°05'30.9"N & Longitude 76°47'36.2"E) is 30 km away from Coimbatore city. It's comes under Western Ghats and is part of the Nilgiri Biosphere Reserve of Tamil Nadu. The campus vegetation is predominantly tropical thorn forest and tropical mixed dry deciduous scrub forest (Prakash and Karthik 2021). A small patch of Eucalyptus plantation is also found on the north- eastern part of the campus. The campus touches the Anaikatty Reserve Forest on two sides and on other sides it touches patches of private land. On the western side of SACON is a non-perennial stream called the Perumpallam falls, the water flow is restricted for 5-6 months in a year. The campus terrain is undulating with valleys and hills. Another stream flows through the campus and merges with Perumpallam. The observations of spiders were undertaken in an area of 10 acres in the campus

Kodanur village: Kodanur village located at Latitude 11°06'44.45"N and Longitude 76°45'28.07"E. is a small farming village with approximately 80 households that come under the Periyanaikenpalayam Forest range. The sampling was done from the farm land covering an area of 0.4 ha mostly cultivated vegetables, millets, and banana plantation.

The spiders were observed from the three habitats during April 2019 to September 2020. For observing the different behavior of spiders Visual Search Sampling Method and Hands-on method was employed. The feeding habits of the spiders was documented by observing the prey trapped in the spider webs for each of the species and photographed for

species identification. Spider specimens were not collected but the pictures and videos of spiders were captured by using a Sony 1500D Zoom lens camera as well as mobile phone (Redmi4A) on the field. The specimens photographed were identified using the spider identification taxonomic keys (Sebastian and Peter 2006 and World Spider catalogue 2020). The individuals were counted as per the identified species and Univariate analysis was done to assess Shannon Weaver diversity and Evenness index using the PAST software 4.05. The Kruskal-Wallis test was used to determine the difference between the three sampling habitats (Hammer et al 2001).

RESULTS AND DISCUSSION

The overall spider diversity comprised of 35 species belonging to 29 genera representing 13 families with a total of 102 individuals (Table 1). The species belonging to family Salticidae and Thomisidae were observed in all the three habitats. Ten species belonging to family Salticidae were recorded followed by family Araneidae and Oxyopidae represented by five species each, while Thomisidae had 4 species the remaining families were represented by either one or two species. Statistical comparison using the Kruskal-Wallis test revealed there was no significant difference between the three sampling habitats. The KVK campus had 17 species of spiders representing 12 families with 66 individuals recorded. Maximum species belonged to the Salticidae i.e. five species, Oxyopidae (four species) and one species each of Araneidae, Eresidae, Hersiliidae, Pholcidae, Sparassidae, Tetragnathidae, Thomisidae, Uloboridae. In the SACON campus 17 individuals representing 13 species and seven families were recorded. Maximum species belonged to the Araneidae family (four species) Oxyopidae, Salticidae and Thomisidae family have two species each while Eresidae, Pholcidae, Scytodidae were represented by one species per family. The farming village Kodanur had 19 individuals of spiders representing five families. Maximum species belongs to the Salticidae family with eight species and Theridiidae three species, Thomisidae two species followed by Lycosidae, Sparassidae represented by one species each.

The univariate statistics showed highest Shannon diversity index and Evenness at Kodanur followed by SACON and KVK (Table 2). The spiders from Western Ghats can be classified into the following seven ecological guilds based on their foraging mode i.e. stalkers, orb weavers, ground runners, space web builders, ambushers, foliage runners and sheet web builders. Seven feeding guilds were recorded during our study with the spiders belonging to family Salticidae common in all the three habitats and more

dominant at KVK and Kondanur (Table 3). This can be attributed to the spider's adaptation to the changed landscape and their stalking behavior. At SACON the spiders belonging to Araneidae i.e. orb-weavers dominated this is due to the presence of undisturbed vegetation and very little human interference. This was coupled by the presence of

Table 2. Univariate analysis for the three sampling stations

Statistical tests	KVK	SACON	Kondanur
Shannon weaver diversity	2.332	2.558	2.625
Evenness Index	0.572	0.922	0.920

Table 1. Spiders recorded from KVK, SACON and Kondanur village

Family	Species	KVK	SACON	Kondanur village	Total
Araneidae	<i>Argiope anasuja</i>	0	3	0	3
	<i>Cryptophora citricola</i>	0	1	0	1
	<i>Gasterocantha germinata</i>	1	1	0	2
	<i>Neoscona sp</i>	0	1	0	1
	<i>Nephilengys malabarensis</i>	0	1	0	1
Eresidae	<i>Stegodyphuss arasinorum</i>	2	2	0	4
Hersiliidae	<i>Hersilla sp</i>	1	0	0	1
Lycosidae	<i>Hippasa sp</i>	0	0	1	1
Oxyopidae	<i>Oxopes shweta</i>	1	0	0	1
	<i>O. birmanicus</i>	1	0	0	1
	<i>O. javanus</i>	9	0	0	9
	<i>Oxyopes sp</i>	0	1	0	1
	<i>Peuctia viridana</i>	4	1	0	5
Pholcidae	<i>Crossopriza lyoni</i>	3	1	0	4
Salticidae	<i>Carhotus viduus</i>	1	0	2	3
	<i>Hyllus semicupreus</i>	6	0	0	6
	<i>Myrmarachne sp</i>	0	0	1	1
	<i>Myrmarachne melanocephala</i>	0	0	1	1
	<i>M. plataleoides</i>	1	0	1	2
	<i>Plexippus paykulli</i>	22	0	3	25
	<i>P. petersi</i>	4	0	1	5
	<i>Rhene sp</i>	0	1	1	2
	<i>Stenaelurillus jagannathae</i>	0	1	0	1
	<i>Telamonia dimidiata</i>	0	0	1	1
Scytodidae	<i>Scytodes sp</i>	0	1	0	1
Sparassidae	<i>Olios milleti</i>	2	0	0	2
	<i>Sparassid sp</i>	0	0	1	1
Tetragnathidae	<i>Leucauge decorata</i>	2	0	0	2
Theridiidae	<i>Achaearanea sp</i>	0	0	1	1
	<i>Argyodes sp</i>	0	0	1	1
	<i>Chrysso sp</i>	0	0	2	2
Thomisidae	<i>Thomisus sp</i>	0	0	1	1
	<i>T. lobobus</i>	4	0	1	5
	<i>Tmarus sp</i>	0	1	0	1
	<i>Xyitics sp</i>	1	1	0	2
Uloboridae	<i>Ulobrius sp</i>	1	0	0	1
	Total	66	17	19	102

Oxyopidae (Stalkers) and Thomisidae (Ambushers) spiders that prefer undisturbed trees and flowers. Spiders possess diverse prey capturing techniques that play a key role in the regulation of pest population in agricultural areas. The populations observed in agro-ecosystems as well as modified plant structure, may be designated as environmental stressors, especially in agricultural areas. Spiders have amazing adaptations which facilitate better survival. The study of feeding habits in the present study

Table 3. Number of individuals based on Guild

Guild	Family	No. of species
Ambushers	Thomisidae	4
Foliage runner	Lycosidae	1
	Sparassidae	2
Ground runners	Hersiliidae	1
	Scytodidae	1
Orb-weavers	Araneidae	5
	Tetragnathidae	1
	Uloboridae	1
Sheet-web builders	Eresidae	1
Space web builders	Pholcidae	1
	Theridiidae	3
Stalkers	Oxyopidae	5
	Salticidae	10

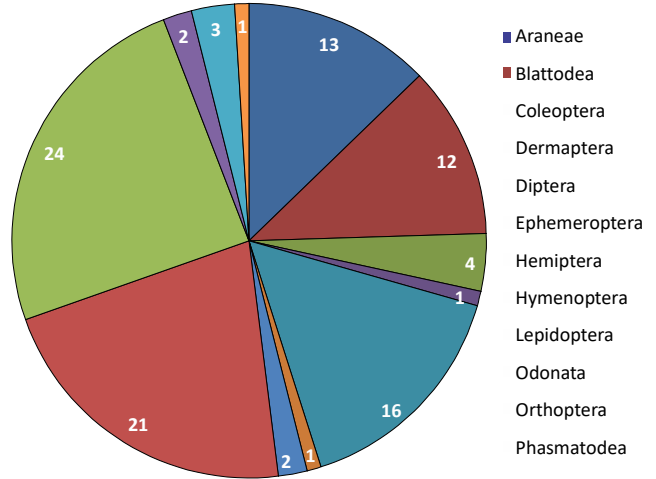


Fig. 2. Different fauna fed by the spiders

showed that the spiders fed on 12 different faunal orders (Fig. 2) dominated by 29 spider species that fed on Diptera, followed by 25 that fed on Lepidoptera, 22 fed on Hymenoptera, 13 fed on Araneae, 12 fed on Blattodea followed by other groups like Coleoptera, Orthoptera, Odonata, Dermaptera, Ephemeroptera, Hemiptera and Phasmatodea. The diversity within the different species, within the family, between the families, between the genera and between the guilds, in predation, prey capturing, adaptation and habitat selection are factors which render spiders, as potential dominant predators in agro ecosystem (Joseph and Premila 2016).

CONCLUSION

The study revealed that the species belonging to family Salticidae and Thomisidae were observed in all the three habitats. The maximum species diversity was observed in the farming village followed by the forest and agro forest habitat. The higher diversity in the village farm is attributed to the environmental stressors providing habitat for different spider species.

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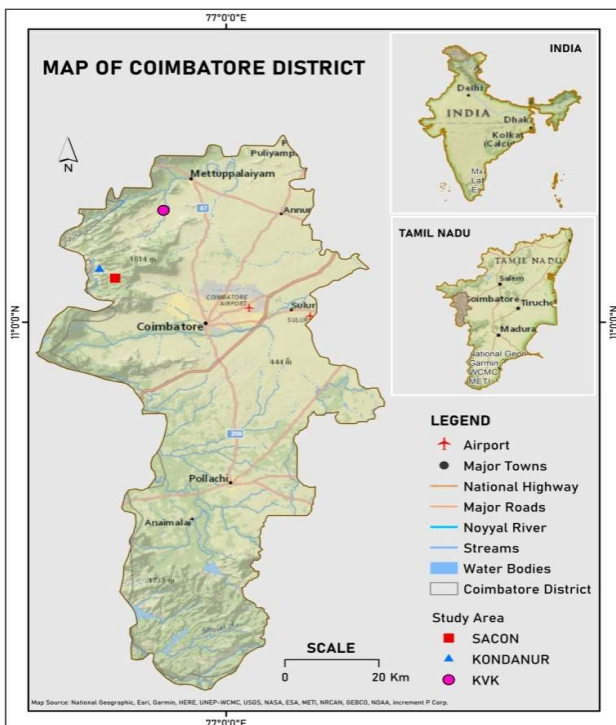


Fig. 1. Map showing the study area

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