

Distribution, Diversity and Ecology of Spider Species At Two Different Habitats



Mithali Mahesh Halarnkar and IK Pai*

Department of Zoology, Goa University, India

Submission: January 17, 2018; Published: February 12, 2018

*Corresponding author: IK Pai, Department of Zoology, Goa University, Goa-403206 India; Email: ikpai@unigoa.ac.in

Abstract

The study provides a checklist and the diversity of spiders from two different habitats namely Akhada, St. Estevam, Goa, India, an island (Site-1) and the other Tivrem-Orgao, Marcela, Goa, India, a plantation area (Site-2). The study period was for nine months from June 2016 to Feb 2017. The investigation revealed the presence of 29 spider species belonging to the 8 families and 19 genera at Site-1 and 30 spider species belonging to 7 families, 18 genera at site-2. The study on difference in the distribution and diversity of the spiders was carryout and was found to be influenced by the environmental parameters, habitat type, vegetation structure and anthropogenic activities.

Keywords: Spiders; Habitat; Diversity; Distribution; Ecology

Introduction

Spiders are ubiquitous in distribution, except for a few niches, such as Arctic and Antarctica. Almost every plant has its spider fauna, as do dead leaves, on the forest floor and on the trees during winter. They may be found at varied locations, such as under bark, beneath stones, below the fallen logs, among foliage, house dwellings, grass leaves, underground burrows etc [1]. Their success is reflected in the fact that, on our planet, there are about 45,700 recorded spider species and 114 families [2] and they could achieve this level of diversity due to their higher adaptive value apart from morphological and behavioral uniqueness [2]. They possess a pair of neurotoxin poison glands in their cephalothoraxes, which can be used as medicine and non polluting pesticide. Spiders are also known as wandering spiders, ambushing spiders, web-building spiders, commons all spiders etc., and depending upon the nature. Like most of the biological species deforestation, habitat loss due to intensive agriculture and human settlement are the major threat for spider survival.

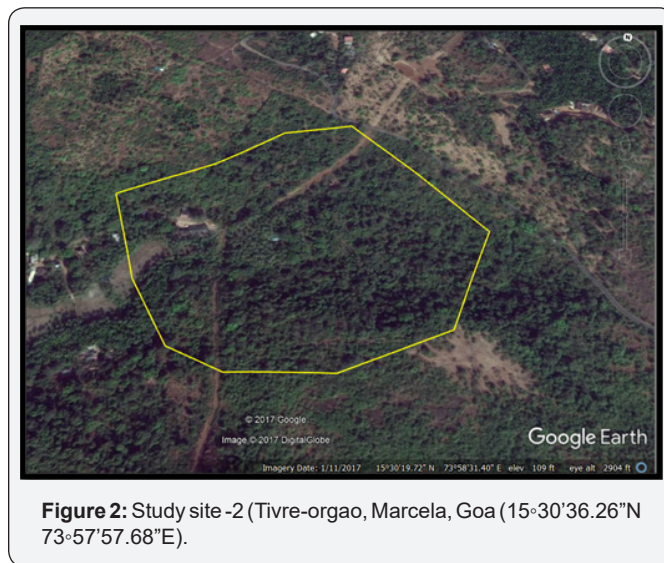
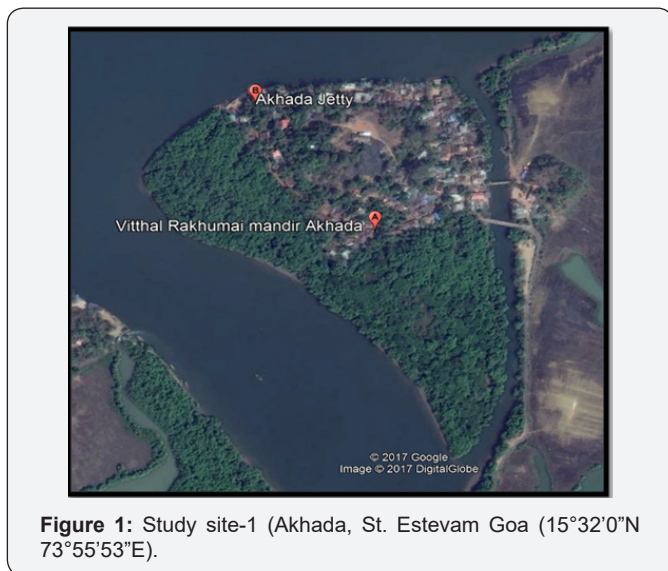
Recordings of spider diversity was done more than a century ago, [3-20] Stoliczka, Thorell, Cambridge, Simon, Pocock and Sherriffs, Bonnet from various parts of the world. In Indian context [21-34] studied 18 families, 34 genera, 56 species from Gujarat, India. While Sudhikumar et al. [35-39] recorded spiders from Kerala, India. Quasin, Uniyal [40] surveyed Milam Valley Nanda Devi Biosphere Reserve, western Himalayas; Archana [41] surveyed Toranmal Sanctuary, Maharashtra, Chetia, Kalita [42] worked on spiders of Assam. Keswani et al. [43] reported that, India has 1685 spider species belonging to 438 genera and 60 families.

Goa is a tiny state on the Western Coast of India, has an area of 3,702 sq. km. enjoys a tropical climate with moderate temperatures ranging from 21°C-31°C, with monsoon during the months of June to September, post monsoon during October and November winter during December to February and summer from March till May, with an annual precipitation of around 3000mm. as Further, as it falls in transition zone between the Northern and Southern western Ghats, has a unique biodiversity pattern. In Goa, the pioneering work in documenting spider diversity in Goa was carried out by Borkar et al., Bastavade and Borkar [44] during which, they recorded 39 species of spiders from the entire state. In 2017, Pandit and Pai reported 74 spiders' species, belonging to 17 families from Taleigao plateau in Goa. As the work on spider diversity seems to be fragmented and incomplete, the present work on survey for spiders at two different habitats namely an Island viz., Akhada, St Estevam Island and plantation habitat at Tivre-Orgao Marcel, Goa, was undertaken.

Materials and Methods

The study included weekly all out survey as well, seasonal studies from spreading over nine months from June 2016 to February 2017. Methods suggested by Warghat et al. [45-50] viz., hand picking, sweep net, inverted umbrella, kerchief method, pitfall trapping, litter sampling were undertaken. The specimen was collected by weekly quadrat and visual search methods from June to February. Temperature and humidity were measured by Byfuss clock, and photographs were taken from Nikon digital camera as well Samsung Galaxy S duos II

mobile phone. The specimens were preserved in 70% alcohol. Further, identified by following “Handbook Indian Spiders” and “Spiders of India” by Sebastian and Peter [37]. The data was subjected for various relevant indices such as Shannon diversity index, Species richness, Species dominance, Species density, Community Similarity (Sorenson’s coefficient) (Figures 1 & 2).



Results

At study site-1, the temperature ranged from 19°C to 27°C. and humidity ranged from 80% - 96%. Study site-2 recorded temperature between 18°C and 27°C. and humidity between 85% and 97% (Tables 1-4).

Table 1: Check List of Spider Species Found at Study Site 1,2.

Family	Species Name	
	Study Site 1	Study Site 2
Araneidae	Cyrtophora citricola (Forsk, 1775)	Cyrtophora citricola (Forsk, 1775)
	Cyrtarachne keralayensis (Jose, 2005)	Cyrtarachne keralayensis (Jose, 2005)
	Cyclosa insulana	Cyclosa insulana (Costa)
	Argiope aemula (Walckenaer, 1842)	Eriovixia laglaizei (Simon, 1877)
	Neoscona sp	Neoscona mukerjei (Tikader, 1980)
	Argiope sp	Neoscona johni sp
	Gea anili (Jose, 2005)	Cyclosa sp
		Neoscona sp
	Araneus sp	
	Argiope sp	
Salticidae	Carrhotus viduus	Carrhotus viduus (Koch, 1846)
	Plexippus paykullii (Savigny and Audouin 1826)	Plexippus paykullii (Savigny and Audouin 1826)
	Plexippus petersi (Karsch, 1878)	Plexippus petersi (Karsch 1878)
	Hasarius adansoni (Audouin, 1826)	Hasarius adansoni (Audouin, 1826)
	Stenaelurillus albus	Stenaelurillus albus (Simon, 1900)
	Asemonea tenuipes (Cambridge, 1896)	Brettus albolimbatus (Simon, 1900)
	Phintella vittata (Koch, 1846)	Tamigalesus sp
	Telamonia dimidiata (Simon, 1899)	Telamonia dimidiata (Simon, 1899)
	Carrhotus sp	Brettus. sp
	Aelurillus sp.	
Brettus. sp.		

Oxyopidae	Oxyopes birmanicus (Thorell, 1887)	Oxyopes birmanicus (Thorell, 1887)
	Oxyopes javanus (Thorell, 1887)	Oxyopes javanus (Thorell, 1887)
	Oxyopes superbus	
Tetragnathidae	Tetragnatha mandibulata (Walckenaer 1842)	Tetragnatha mandibulata (Walckenaer, 1842)
	Leucauge pondae (Tikader, 1970)	Tetragnatha javana (Thorell, 1890)
		Leucauge pondae (Tikader, 1970)
Nephilidae	Nephila pilipes (Fabricius, 1793)	Nephila pilipes (Fabricius, 1793)
		Nephila kuhli (Doleschall, 1859)
Thomisidae	Misumena vatis (Clerck)	
Sparassidae	Heteropoda nilgirina (Pocock, 1901)	Heteropoda nilgirina (Pocock, 1901)
Pisauridae	Heteropoda venatoria (Linnaeus, 1767)	
	Pisaura gitae (Tikader, 1970)	
Lycosidae		Hippasa agelenoides (Simon, 1884)
		Lycosa tista (Tikader, 1970)
		Pardosa sumatrana (Thorell, 1890)

Table 2: Sorenson's Coefficient of Site 1 and 2.

Seasons	Sorenson's Coefficient	
	Site-1	Site-2
Monsoon – Post monsoon	0.723	0.473
Post monsoon – winter	0.66	0.571
Monsoon - winter	0.25	0.214

Table 3: Sorenson's Coefficient between of both site 1, 2.

Season	Sorenson's Coefficient
Monsoon	0.68
Post monsoon	0.34
Winter	0.26

Table 4: Diversity Indices of Both Site 1,2.

Site	Akhada			Orgao		
	Mon	Post-Mon	Winter	Mon	Post-Mon	Winter
No of species	22	22	14	19	19	9
Total no spiders	559	150	349	548	341	477
Shannons index	2.236	2.744	1.582	2.111	2.426	1.379
H max	3.091	3.091	2.639	2.944	2.944	2.197
Equitability	0.723	0.88	0.599	0.717	0.824	0.62
Species richness	3.3195	4.1910	2.220	2.8542	3.1307	1.29
Species Density	380.272	87.20	202.96	336.19	209.20	292.63

At study site-1, a total of 1058 spiders, belonging to 8 families, 19 genera and 29 species, were recorded during the study period of nine months. Maximum numbers of spiders were observed during monsoon, while minimum numbers of spiders were observed during winter. But, spider diversity was maximum in post monsoon season (Shannon-Wiener diversity index 2.774) and minimum in winter (1.582). Among families observed, seven species were recorded from family Araneidae; ten species were recorded from family Salticidae, three from Oxyopidae and two each from Tetragnathidae and Sparassidae, one each from Nephidae, Thomisidae and Pisauridae. Overall Salticidae is dominant family by having ten species.

During monsoon and post monsoon season *Cyrtophora citricola* of family Araneidae was dominant having constituting

37.03% and 13.33 % of overall spider population respectively. During winter season *Pisaura gitae* was dominant constituting 47.85% of the population. The overall result indicates that, the density of the spider's decreases in post monsoon and increases in monsoon season. Whereas the diversity increases in post monsoon and is least during winter.

The species density decreases to almost 3.7 times from monsoon to post monsoon. This is presumably due to the destruction of the habitat by stubble burning as well burning of grasses which generally occur during November- December. This is the time when there were a very few spiders were observed at the burnt site. At study site-2, during the entire study period, as many as 1339 number of spiders, belonging to 7 families, 18 genera and 30 species were recorded. Maximum numbers

of spider specimen were observed during monsoon season, whereas the minimum number of spider was recorded during post monsoon.

Among families encountered during the study period, ten species were recorded from family Araneidae, eight species were from family Salticidae, three species each from Tetragnathidae and Lycosidae and two from each Oxyopidae and Nephilidae. Overall Araneidae was dominant family having ten species. During monsoon season *Cyrtophora citricola* of family Araneidae was dominant constituting 38.53%. During post monsoon and winter season *Eriovixia laglaizei* dominates the population by 26.11% and 47.85% respectively. Spider diversity was highest post monsoon season (Shannon-Wiener diversity index 2.426) and lowest in winter (1.379).

The overall results indicate that, the density of the spider's decreases in post monsoon and are increases in monsoon season. Whereas the diversity increases in post monsoon and is decreases in winter. While comparing two habitats, it was revealed that, Site-1 had more number of spider species compared to site-2, but the species density was more in site-2, than in site-1. Among the species of spiders that were recorded at site-1, out of 29 species 7 species viz., *Argiope amemula*, *Asemonea tenuipes*, *Phintella vittata*, *Carrhotus sp*, *Aelurillus sp*, *Misumena vatis*, *Pisaura gita*, *P. gitae* were exclusive to the area. Out of 30 species observed at site-2, eight of these species viz., *Eriovixia laglaizei*, *Neoscona mukerjei*, *Cyclosa sp*, *Nephila kuhli*, *Tetragnatha javana*, *Hippasa agelenoides*, *Lycosa tista*, *Pardosa sumatrana* were found to be limited to the site

Discussion

The study was intended to provide a checklist of two habitats and to compare its distribution and ecology of spiders. The nine months weekly surveys showed that, the habitat structure and vegetation complexity determines the presence of spider species, their richness and composition as reported by Valverde and Lobo [51-52]. The habitat heterogeneity hypothesis by Tews et al. [53], states that, the more complex habitat, more niches are available; therefore the higher the species richness. This was confirmed by the present studies too. Further, Uetz, Greenstone, Green [54-56] reported that, the diversity of web constructing spider is correlated significantly with the height of vegetation, while ground dwelling spiders are correlated with the amount of litter. In the similar lines, in present studies too members of Araneidae, which are known to construct web were in larger number during monsoon as the vegetation was higher during monsoon. Similarly ground dwelling spider's species belonging to Salticidae, and Lycosidae were in higher number in winter, wherein leaf litter was more.

Preference of the habitat of spider species is known to be influenced by the physical organization of environmental parameters as they are very sensitive to changes in the habitat arrangement and microclimate [57-60]. The presence and abundance of individuals belonging to specific families will also

depend on the physical characteristics of the vegetation [61], which is proved by the members of the Family Nephilidae in the present studies.

Distribution and occurrence of spiders are influenced by habitat structure and vegetation parameters, alteration of the habitat by anthropogenic activities can cause degradation of habitat and even cause local extinction of the species [62], which results in the suppression of the number of spiders [63]. Species richness is used to assess the quality of the habitat, abundance and species richness of spiders are higher in not heavily manipulated systems [64], which is supported by the present findings, where in reduction in spider diversity was observed as and when there are anthropogenic activities such as burning of stubble/ grass.

Bultman and Uetz [65] in 1982 revealed that the spider abundance is also influenced by the environmental parameters which in turn results in change in spider species diversity and seasonal abundance. In the present context, where the studies were carried out at in two different ecosystems, the results provide additional evidence for the findings of Bultman and Uetz. Generally, temperature and humidity are important limiting factors for microclimatic preferences by spiders as they have varying ranges of physiological tolerances. Therefore, the variation in diversity of spider species among three seasons is expected to be due to difference in temperature, rainfall, humidity and other physical factors of the environment. Different pattern of activities of individual spider and morphology of spider community also influences the variation in seasonal abundance of spider [66-68]. In conclusion it can be said that as the spiders are integral part in the pest management, knowledge on their diversity, distribution pattern, seasonal variation will not only influences the pest population but also of great importance in monitoring the changes of vegetation parameters quality and disturbances of habitat.

References

1. Tikader BK (1977) Studies on spider fauna of Andaman & Nicobar Islands, Indian Ocean. Rev Zool Surv India 72: 153-212.
2. Ahmed M (2015) Diversity of spider fauna in agro-ecosystem of Sonipur district. PhD thesis, Guwahati University, India.
3. Blackwall J (1864) A history of the spiders of Great Britain and Ireland, London. The Ray Society Part-ii: 75-384.
4. Blackwall J (1867) Description of several species of East Indian Spiders, apparently to be new or little known to Arachnologists. The Annals and magazine of natural history; zoology, botany, and geology 3(19): 387-394.
5. Stoliczka F (1869) Contribution towards the knowledge of Indian Arachnoidae. J Asiat Soc Beng 38: 201-299.
6. Thorell T (1877) Descriptions of the Araneae collected in Colorado in 1875 by AS Packard. Bulletin of the United States Geological Survey 3: 477-529.
7. Cambridge (1897) On the cteniform spiders of Ceylon, Burma and the Indian archipelago west and north of Wallace's line; with bibliography and list of those from Australia south and east of Wallace's line. The Annals and magazine of natural history; zoology, botany, and geology 20(6): 329-356.

8. Simon E (1897a) *Histoire Naturelle des Araigness*. Paris, UK 1: 891.
9. Simon E (1897b) *Arachnides recueillies par MM Maindron a kurrachee et a Matheran press Bombay en 1896*. Bull. Mus. Paris, UK pp. 289-297.
10. Pocock RI (1899) Diagnoses of some new Indian Arachnida. *J Bombay nat Hist Soc* 12: 744-753.
11. Pocock RI (1900a) *Fauna of Brit. India Archnnida*, Taylor and Francis, London,UK pp. 244-254.
12. Pocock, RI (1900b) *The Fauna of British India including Ceylon and Burma: Arachnida*, London, UK.
13. Pocock RI (1901) Description of some new species of spiders from British India. *J Bombay Nat Hist Soc* 13: 478-492.
14. Sherriffs WR (1919) A contribution to the study of south Indian arachnology. *The Annals and magazine of natural history; zoology, botany, and geology* 9(4): 220-253.
15. Sherriffs WR (1927) *South Indian Arachnology, Part II*. The Annals and magazine of natural history; zoology, botany, and geology 9: 533-542.
16. Sherriffs WR (1928) *South Indian Arachnology, Part III*. The Annals and magazine of natural history; zoology, botany, and geology 2(10): 177-192.
17. Sherriffs WR (1929) *South Indian Arachnology, Part IV*. The Annals and magazine of natural history; zoology, botany, and geology 4(10): 233-246.
18. Bonnet P (1945) *Bibliographia Araneorum*, Toulouse 1: 1-832.
19. Bonnet P (1955) *Bibliographia Araneorum*, Toulouse 2: 1-5058.
20. Bonnet P (1961) *Bibliographia Araneorum*, Toulouse 3: 1-59.
21. Tikader BK (1963) Studies on some spider fauna of Maharashtra and Mysore state, Part I. *J Univ Poona Sci & Tech* 24: 29-54.
22. Tikader BK (1970) Spider fauna of Sikkim. *Rev Zoological Survey of India* 63(1-4): 1-83.
23. Tikader BK (1976) Studies on some Mygalomorph spiders of Family Ctenizida and Theraphosidae from India. *The journal of the Bombay Natural History Society* 74: 306-319.
24. Tikader BK (1980) The fauna of India: Areanea: Thomisidae. *Zoological Survey of India* 1: 1-247.
25. Tikader BK (1982a) The Fauna of India: Areanae: Araneidae. *Zoological Survey of India* 2: 1-293.
26. Tikader BK (1982b) *Fauna of India, Spiders: Araneae II*. *Zoological Survey of India* (1-2): 1-536.
27. Tikader BK (1987) *Handbook of Indian Spiders*. *Zoological Survey of India* pp. 1-251.
28. Murthy VA, Ananthakrishnan TN (1977) *Indian Chelonethi*. *Oriental insects monograph* 4: 1-210.
29. Gajbe UA (1979) Studies on some spiders of the genus *Sosticus* from India (Araneae: Gnaphosidae). *Bull Zoological Survey of India* 2(1): 69-74.
30. Sharma RM, Bastawade DB (2001) Occurrence of gall midges (Diptera : Cecidomyiidae) on webs of Spiders (Aranae : Pholcidae) *Bionotes* 3(4): 84.
31. Bastawade DB (2002) Three new species from spider families Amaurobiidae, Thomisidae and Salticidae (Araneae: Arachnida) from India. *The journal of the Bombay Natural History Society* 99(2): 274-281.
32. Bastawade DB, Borkar M (2008) Arachnida (Orders scorpions, Uropygi, Amblypygi, Araneae and phalangida), *Survey of India Fauna of Goa*. *State Fauna Series* 16: 211-242.
33. Patel BH (2003a) Fauna of protected area in India-1: Spiders of Vansda National Park, Gujarat. *Zoos Print J* 18(4): 1079-1083.
34. Patel BH (2003b) Fauna of protected areas in India-2: a Preliminary list of spiders with description of three new species from Parambikulam Wildlife Sanctuary. Kerala, India
35. Patel BH, Vyas R (2001) Spiders of Hingolghadh Nature Education Sanctuary, Gujarat, India. *Zoos' Print Journal* 16(9): 589-590.
36. Jose KS (2005) A faunistic survey of spiders (Araneae: Arachnida) in Kerala. Sacred Heart College Ph D theses submitted to Mahatma Gandhi University, Kottayam, India.
37. Sebastian PA, Mathew MJ, Beevi SP, Joseph J, Biju CR (2005) The spider fauna of the irrigated rice ecosystem in Central Kerala, India across different elevational ranges. *The Journal of Arachnology* 33(2): 247-255.
38. Sebastian PA, Peters KV (2009) *Spiders of India*. University Press Publication, India.
39. Siliwal M, Molur S, Biswas BK (2005) Indian Spiders (Arachnida: Araneae) Updated Check list 2005. *Zoos' print Journal* 20(10): 1999-2049.
40. Sudhikumar AV, Mathew MJ, Sunish E, Sebastian PA (2005) Seasonal variation in spider abundance in Kuttanad rice agro ecosystem, Kerala, India (Araneae). *European Aracnology Acta Zoologica Bulgarica, supp(1)* pp. 181-190.
41. Quasin S, Uniyal VP (2011) Spider diversity along altitudinal gradient in Milam Valley Nanda Devi Biosphere Reserve, Western Himalaya. *Wildlife Institute of India* pp. 1207-1211.
42. Archana M (2011) Spiders (Arachnida: Aranea) from Toranmal Sanctuary, Maharashtra, India.
1. *E-International Scientific Research Journal* 3(4): 326-334.
43. Chetia P, Kalita DK (2012) Diversity and distribution of spiders from Gibbon Wildlife Sanctuary, Assam, India. *Indian Journal of Arachnology* 1(1): 130-142.
44. Keswani S, Hadole P, Rajoria A (2013) Checklist of spiders (Arachnida: Araneae) from India. *Indian Journal of Arachnology* 1: 1-129.
45. Manoj RB, Neelam K, Bastawade DB (2006) First report of whip spider *Phrynicus phipsoni* Pocock from the human habitations and protected areas of Goa state, India; with notes on its habits and habitat. *Rec Zool Surv India*: 106 (part 4): 33-38.
46. Barrion AT, Litsinger A (1995) *Riceland Spiders of South and Southeast Asia*. CAB International, Wallingford, UK pp. 700.
47. Koh J (1989) A guide to common Singapore spiders. *Malaysian Nature Society, Singapore* pp. 160.
48. Greenstone MH (2001) Spiders in wheat: First quantitative data for North America. *Biocontrol* 46(4): 439-454.
49. Rindali IMP, Mendes BP, Cady AB (2002) Distribution and importance of spiders inhabiting a Brazilian sugarcane plantation. *Revista Brasileira de Zoologia* 19(suppl 1): 271-279.
50. Ghavami S, Amin GA, Taghizadeh M, Karimian Z (2008) Investigation of abundance and determination of dominant species of spider species in Iranian cotton fields. *Pak J Biol Sci* 11(2): 181-187.
51. Warghat NE, Sarma NR, Chirde SG, Chandrasekar MR (2010) Distribution of spiders from foot hill agricultural fields of Satpura mountain range of Amravati district, Maharashtra, India. *BioSci Biotech Res Comm* 3(2): 150-153.
52. Lubin YD (1978) Seasonal abundance and diversity of web building spiders in relation to habitat structure on Barro Colorado I Panama. *Journal of Arachnology* 6(1): 31-51.

53. Valverde AJ, Lobo JM (2007) Determinants of local spider (Araneidae and Thomisidae) species richness on a regional scale: climate and altitude vs. habitat structure. *Ecological entomology* 32(1): 113-122.
54. Tews J, Brose U, Grimm V, Tielborger K, Wichmann MC, et al. (2004) Animal species diversity driven by habitat heterogeneity/diversity: the importance of keystone structures. *Journal of Biogeography* 31(1): 79-92.
55. Uetz GW (1975) Temporal and spatial variation in species diversity of wandering spiders (Araneae) in deciduous forest litter. *Environmental Entomology* 4(5): 719-724.
56. Greenstone MH (1984) Determinants of web spider species diversity. Vegetation structural diversity is prey availability. *Oecologia* 62(3): 299-304.
57. Green J (1999) Sampling method and time determines composition of spider collections. *Journal of Arachnology* 27(1): 176-182.
58. Bishop AL (1981) The spatial dispersion of spiders in cotton ecosystem. *Australian Journal of Zoology* 29: 15-24.
59. Hurd LE, Fagan WF (1992) Cursorial spiders and succession: Age or habitat structure? *Oecologia* 92(2): 215-221.
60. Downie IS, Wilson WS, Abernethy VJ, Mc Craken DL (1999) The impact of different agricultural land use on epigeal spider diversity in Scotland. *Journal of Insect Conservation* 3(4): 273-286.
61. New TR (1999) Untangling the web: spiders and the challenges of invertebrate conservation. *Journal of Insect Conservation* 3(4): 251-256.
62. Malumbres-Olarte J, Vink CJ, Ross JG, Cruickshank RH, Paterson AM (2013) The role of habitat complexity on spider communities in native alpine grasslands of New Zealand. *Insect Conservation and Diversity* 6(2): 124-134.
63. Karthikeyani R (2003) Biodiversity of spiders (Araneae) in Kumbakarai falls, Periyakulam Taluk, Theni District, Tamil Nadu, South India Ph D thesis. Madurai Kamaraj University, India.
64. Culin JD, Yeargan KV (1983) Comparative study of spider communities in alfalfa and soybean ecosystems: ground surface spiders. *Annals of the Entomological Society of America* 76(5): 832-838.
65. Bultman TL, Uetz GW (1982) Abundance of spider community structure of forest floor spiders following litter manipulation. *Oecologia* 55(1): 34-41.
66. Corey DT, Stout IJ, Edwards GB (1998) Ground surface spider fauna in Florida sandhill communities. *Journal of Arachnology* 26(3): 303-316.
67. Pandit R, Pai IK (2017) Spiders of Taleigao Plateau, Goa, India. *Journal of Environmental Science and Public Health USA* 1(4): 240-252.
68. Subrahmanyam TV (1968) An Introduction to the study of Indian spiders. *Bombay Nat Hist Soc* 65(2): 453-461.



This work is licensed under Creative Commons Attribution 4.0 License
DOI: [10.19080/IJESNR.2018.08.555747](https://doi.org/10.19080/IJESNR.2018.08.555747)

**Your next submission with Juniper Publishers
will reach you the below assets**

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats
(Pdf, E-pub, Full Text, Audio)
- Unceasing customer service

Track the below URL for one-step submission
<https://juniperpublishers.com/online-submission.php>