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RESEARCH ARTICLE

DIVERSITY OF SPIDERS FROM SATPUDA MOUNTAIN, INDIA

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ABSTRACT

Diversity, Ecology and systematics of Spiders from Satpuda mountain area was studied during 2015-2016. Study area comprises 20 different collection spots in about 100 sq. km zone of Satpuda Mountains in North Maharashtra, India. A total of 98 individuals belonging to 11 different species were observed and studied from 10 localities. Six families represent 11 species. A maximum of 05 species represented from Araneidae family, 02 from Salticidae and only 01 from Sparassidae, Lycosidae, Scytodidae and Pholcidae family. Changes in species composition and abundance are related to natural forest site variations of low population area (NFS) and in residential area having moderately high population area in satpuda mountains (RFS). They prefer dense vegetation and alkaline soil condition. The Shannon's diversity index shows maximum diversity index with 11 numbers of species is 2.267 in Forest area (NFS) and 2.020 in Residential area (RFS) whereas the Simpsons diversity index shows maximum diversity index with 11 numbers of species is 0.104 in NFS and 0.086 in RFS. The evenness values calculated statistically are 0.93 in RFS and 0.90 in NFS. Need for biodiversity conservation is emphasized.

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INTRODUCTION

Study of diversity of spiders provides crucial information on ecology of the region. In recent times the biotic fauna is greatly threatened by various human activities. Biodiversity conservation necessitates knowledge on the diversity of animals and plants with their distribution and ecological status. Arachnids include about 75000 species till reported and most of the species are yet to describe. Spiders are octopods belongs to the class Arachnida. Major body divisions of spiders are cephalothorax and abdomen. Arachnids are insectivorous and lack wings and antennae (Marshall, 2006) Satpuda mountain ranges of Maharashtra comprises forest zone near the Western Ghats. The Spiders play major role in terrestrial ecosystems. They predate many insects and small organisms in his surrounding environment. They form a web of dry and wet threads in which hunting becomes easy. Spiders keep the control of insects' population in an environment (Australian Museum, 2014) Members of order Araneae are mostly insectivorous. Before ingesting the prey, a spider paralyses them by injecting venoms and digests partially. The ecological conditions and patterns of habitat distribution are random and so the hunting strategies among

spiders is varied which gains the knowledge in integrated pest management studies (Whitcomb, 1974; Young and Edwards, 1990). Spiders can be used as a strong biological control agent in crop pests (Sunderland, 1999; Whitmore *et al.*, 2002) Spiders are an important predators of herbivorous insects in an agro ecosystems (Marc and Canard, 1997; Ferguson *et al.*, 1984). Western Ghats has rich fauna and are listed in the 34 'Biodiversity hotspots' of the world (Mittermeier *et al.* 2005). Wankhede *et al.* (2012) studied on the diversity of Spiders (Class Insecta, phylum Arthropod) in University of Pune and reported total 32 species of spiders belonging to 7 families were observed and also efforts were made to evaluate the status of ecosystems. Nineteen different families of spider are represented in Obafemi Awolowo University, Southwestern Nigeria (Oyewole and Oyelade, 2014). Considering the paucity of information on diversity of spiders in India especially in satpuda mountain ranges, the need of the hour is to make an inventory and to study the distribution pattern of them. These results prompted me to make detailed survey and population dynamic study of spiders to fill up the lacuna of survey of Spider fauna from Forest and Residential area of Satpuda Mountains.

MATERIALS AND METHODS

For present study the survey was made from different vegetation types in and around satpuda mountain area.

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Grasslands, Forests, Rocky Mountains, marshy places, moist soil, agricultural lands, horticultural Zones, gardens, roadside dense vegetation, river-sides, grasslands and paddy fields were the exact locations of occurrence of spiders. The gardens, parks, cultivation area, vermiculture center area and nurseries were always surveyed during different seasons of the year 2014-2015 from the foot of satpuda mountains and allied areas. The preliminary studies carried out at forest area [NFS] of Satpuda Mountain includes, Kothar, Dhadgaon, Molgi, Walamba and Ambabari whereas for residential area [RFS] studies were carried out from Khapar, Akkalkuwa, Taloda, Prakasha and Borad. Collection and observation from each site was made and from a quadrant of 1x1 meter was taken as the unit for population estimation of the spiders. Spiders found in these quadrants were collected by net. The spiders were counted quadrant wise and species wise. The mean was calculated for each species and the number calculated for actual spider population per quadrant area. The moultings of spiders hanging on net was confirmed the existence of that species in that area. The shape, colour and habitat of the spiders' species from these collection sites were recorded for further morphological studies. The identification was made from Zoological Survey of India, Pune. From the survey sites the soil parameters and atmospheric temperature are recorded. The time spent in minutes per area in square Hectometers was recorded in searching the spiders.

RESULTS

Species diversity

A total of 98 individuals belonging to 11 different species of spiders were collected and studied from 20 collection spots in 10 localities distributed along Forest area (NFS) and Residential area (RFS) of Satpuda Mountains in Maharashtra. (Table-1) Six families represent 11 species. A maximum of 05 species represented from Araneidae family, 02 from Salticidae and only 01 from Sparassidae, Lycosidae, Scytodidae and Pholcidae family (Fig-1). Changes in species composition and abundance are related to natural forest site variations area (FA) and in residential area in Satpuda Mountains. The time spent was 872 minutes in searching the spiders from an area of 1975 square Hectometers distributed in 20 collection sites of Satpuda Mountain and allied plane area. (Fig-2) Genera with maximum number of species include *Plexippus paykulli* Audouin, 1826. The species inventory of these spider species was reported from various sites, representing moist land, fallen leaves of plants, and humid, shady and rocky places of forests, agricultural fields and gardens. The majority of spiders were found in Taloda in plane area and in Molgi from mountain area. The greater density and species richness accounted in plane area. Calculations for diversity assay was done using Shannon-Weiner index (H') formula, $H' = -\sum P_i \times \ln(P_i)$, Where P_i = proportion of individual species. The Shannon's index follows the same pattern as that of species richness. The Shannon's diversity index with 11 numbers of species is 0.104 in Forest area (NFS) and 0.086 in Residential area (RFS). The statistically calculated evenness values are 0.93 in RFS and 0.90 in NFS. (Table-2)

Variations in species composition and abundance:

Fauna of spiders and population density of species particularly of the most abundant spiders varied in Mountain as well as in

plane area. *Plexippus paykulli* were tremendous in mountain area whereas *Neoscona punctigera* were more in plane area, even though they are rare. *Plexippus paykulli* are dominant in both area of satpuda studied in present work. Variation in topography and small scale elevation difference and the extent of human impacts (plane area) could contribute to this difference. Area with high organic content had more species like Taloda i.e. Riverside locations with agricultural land having dense vegetation and also in some other locations. Generally spiders preferred moist alkaline soil in dense vegetation. They were very few in acidic soil conditions and rare in an area without organic content.

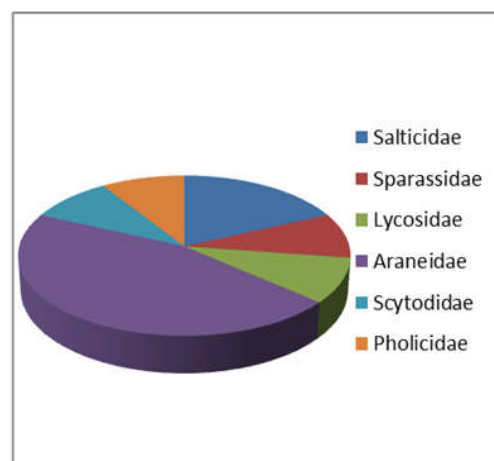


Fig. 1. Family wise composition of percentage of spiders

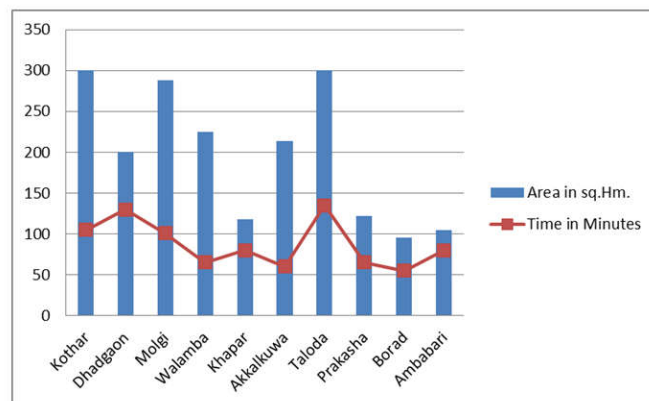


Fig. 2. Area studied from locations and duration spent for collection of spiders

Systematic account

The first largest phylum in animal kingdom is Arthropoda. There are about 35000 named species of spiders occurs. In Arachnida, Araneae is an order includes varieties of spiders. Spiders have poison glands leading through their chelicerae, which are pointed and used to bite and paralyze prey.

Phylum- Arthropoda.

Class- Arachnida

Order- Araneae

Family- Salticidae

Sub family- Plexippinae

Genus- Plexippus

Species- Paykulli.

Genus- Telamonia

Species- dimididata.

Family- Sparassidae.
 Genus-Heteropoda spp.
 Family-Pholicidae
 Genus- Crossopriza.
 Species- lyoni.
 Family- Lycosidae.
 Genus Hippasa spp.
 Family- Araneidae
 Genus- Cyrtophora spp.
 Genus- Neoscona spp.
 Genus-Neoscona.
 Species- punctigera.
 Genus- Argiope.
 Species-anasuja.
 Genus-Araeidae spp.
 Family- Scytodidae.
 Genus- Scytodidae spp.

Soil parameters

To study the ecology of spiders simply an account of soil parameters from study site was made. Most of the spiders prefer low temperature i.e. 25 ° C to 30 ° C and soil rich in organic carbon. In rainy season they occurred from soil surface to the herbs or vegetation's and also in termite mounds. They are more in numbers in moist and humus rich soil. Spiders were few in mountain area up to an elevation of about 1000 meters from sea level and are more in orchards and in plane area. There are dissimilarities in soil parameters of study site preferred by different species of spiders. (Table-3)

DISCUSSION

In North Maharashtra Satpuda mountain is an allied zone of western Ghats, which is an important global hot spot of biodiversity in India. Nowadays overcrowding, overgrazing, overexploitation of natural resources and deforestation causes destruction of various natural habitats, particularly of invertebrates. From the present study it appeared that the

Table 1. Area wise localities of spider collection rom Satpuda Mountain area

S.No	NFS		RFS	
	Name of locality	Collection spots	Name of locality	Collection spots
1.	Kothar	Chandsaily	Khapar	Rethi
2.	Dhadgaon	Kalibel	Akkalkuwa	Hadamba
3.	Molgi	Dab	Taloda	Rozva
4.	Walamba	Walamba river	Prakasha	Vaijali
5.	Ambabari	Khatwani	Borad	Pratapapur

Table 2. Species inventory of Spiders in Forest Area (NFS) and Residential Area (RFS) sites of Satpuda Mountains

S. No.	Species	Family	Number of individuals	
			NFS	RFS
1	<i>Plexippus paykulli</i> (Audouin, 1826)	Salticidae	09	04
2	<i>Heteropoda</i> spp.	Sparassidae	02	01
3	<i>Hippasa</i> spp.	Lycosidae.	02	01
4	<i>Neoscona</i> spp.	Araneidae	01	01
5	<i>Neoscona punctigera</i> (Doleschall, 1857)	Araneidae	06	04
6	<i>Scytodidae</i> spp.	Scytodidae	06	04
7	<i>Telamonia dimidiata</i> (Simon, 1899)	Salticidae	02	01
8	<i>Araeidae</i> spp.	Araneidae	02	01
9	<i>Cyrtophora</i> spp.	Araneidae	04	02
10	<i>Argiope anasuja</i> (Thorell, 1887)	Araneidae	06	03
11	<i>Crossopriza lyoni</i> (Blackwall, 1867)	Pholicidae	03	01
	Total		43	23
	Mean		3.9090	2.0909
	SD		2.5081	1.3751
	Shannon's Index		2.267	2.1709
	Simpsons index		0.1046	0.0869
	Eveness		0.93	0.90

Table 3. Soil parameters from study sites

S.No.	Locality	Soil Temp. (°C)	PH	Electrical Conductivity (Ds/m)	Relative humidity	Organic C %	Total N %	Available S (PPM)
1.	Kothar	26.0	7.05	0.66	88.0	1.88	0.43	43.9
2.	Dhadgaon	24.2	7.07	0.79	76.0	2.16	0.39	47.9
3.	Molgi	25.1	7.05	0.66	72.0	4.38	0.08	53.8
4.	Walamba	25.4	7.07	0.68	74.0	4.12	0.48	54.1
5.	Khapar	26.1	6.74	1.14	59.2	5.63	0.47	52.8
6.	Akkalkuwa	25.2	6.51	0.95	61.4	5.91	0.28	36.6
7.	Taloda	24.8	6.71	0.62	92.5	3.74	0.17	23.7
8.	Prakasha	25.1	6.58	0.27	88.0	3.89	0.22	43.4
9.	Borad	25.0	6.73	0.66	84.7	4.32	0.35	18.7
10.	Ambabari	24.3	6.55	0.62	89.2	4.05	0.22	30.4
	Total	251.2	68.06	7.05	785	40.08	3.09	405.3
	Mean	25.12	6.806	0.705	78.5	4.008	0.309	40.53
	SD	0.6196	0.2314	0.2277	11.8466	1.2705	0.1360	12.7478

abundance of spiders species is more from the plane area which was quantified from terrestrial habitats of 10 different localities. There is a much variation observed in forest and plane area sites. The Arachnids fauna of Satpuda Mountain is much but still unexplored therefore a systematic work to describe the members of Arachnids specially spiders from 20 sites of 10 localities was adjourned with 11 species, belonging to Six families of the order Araneae.

Satpuda mountain area is covered with forest, mountains and rivers which is a good habitat for spiders. The availability of food in any ecosystem is a prime factor for growth of spider population. The abundance and distribution of spiders in a community depends on availability of host plants in their habitat where preys attract attention of spiders. According to Turnbull, 1973 the availability of maximum number of spiders in the agricultural cultivated zone is the effect of crop plants on spiders. The spiders have two types of eyes which aid in hunting prey. The pair of main eyes is located in frontal cephalothorax in first row and remaining are in second row. They have well developed eye sight. Some spiders give nasty bite whereas some are venomous and may cause wound and even cell death.

To study the ecology of spiders simply with an account of soil parameters and temperature range from study site was made. Most of the spiders prefer low temperature i.e. 25 °C to 30 °C and soil rich in organic carbon. During monsoon they occurred from soil surface mostly and also on their webs in vegetation's and rarely in and around termite mounds. Spiders are more in numbers in moist and humus rich soil which attract flies and insects. These results correlates with the study of Marshall (2006), showed that insect population can be controlled in diverse plant environment. Maximum diversity of spiders in satpuda mountain area is reported in agricultural and cultivated area and also where vegetation is rich. This helps the fauna of spiders to survive, grow and complete their life cycle. The result correlates with the finding of Whitmore *et al.* (2002). About 1442 species of spiders are reported from India of which 252 species are endemic to India (Siliwal *et al.*, 2005). The complex of varieties of shrubs shows great diversity of spider's community (Uetz, 1991).

Conclusion

From 20 different collection sites, a total of 98 individuals belonging to 11 different species of spiders were observed. Six families represent 11 species. A maximum of 05 species represented from Araneidae family. Changes in species composition and abundance of low population area (NFS) and in residential area (RFS) is studied. The Shannon's diversity index with 11 numbers of species is 2.267 in (NFS) and 2.020 in (RFS) whereas the Simpsons diversity index is 0.104 in (NFS) and 0.086 in (RFS). The evenness values calculated statistically are 0.93 in RFS and 0.90 in NFS. The habitat preference of spiders is dense vegetation, low temperature range and alkaline soil conditions.

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REFERENCES

- Australian Museum 2014. Online Fact sheet. <http://australianmuseum.net.au/Spiders>.
- Ferguson, H.J., Mcpherson, R.M. and Allen, W.A. 1984. Ground and Foliage-Dwelling Spiders in Four Soybean Cropping Systems. *Environmental Entomology*, 13,975-980.
- Marc, P. and Canard, A. 1997. Maintaining Spider Biodiversity in groecosystems as a Tool in Pest Control. *Agri-culture, Ecosystems & Environment*, 62, 229-235.
- Marshall, M.A. 2006. Insect: Their Natural History and Diversity.
- Mittermeier RA, RG Patricio, M Hoffman, J Pilgrim, T Brooks, CG Mittermeier, J Lamoreux, GAB Fonseca 2005. Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. *Coservation International, USA*, p.432
- Oyewole, O.A. and Oyelade, O.J. 2014. Diversity and Distribution of spiders in southwestern Nigeria. *Natural Resources*, 5, 926-935. <http://dx.doi.org/10.4236/nr.2014.515079>.
- Siliwal Manju, Sanjay Molur and Biswas B>K. 2005. Indian spiders (Arachnida: Araneae) : Updated checklist 2005. *Zoos print Journal*, 20(10): 1999-1049.
- Sunderland, K.D. 1999. Mechanisms Underlying the Effects of Spiders on Pest Populations. *Journal of Arachnology*, 27, 308-316.
- Uetz, G.W. 1991. Habitat Structure and Spider Foraging. In: McCoy, E.D., Bell, S.S and Mushinsky, H.R., Eds., *Habitat Structure: The Physical Arrangement of Objects in Space* Chapman and Hall, London, 325-348. http://dx.doi.org/10.1007/987-94-011-3076-9_16
- Wankhade V. W., N. A. Manwar1, A. A. Rupwate1 and N. M. Raut, 2012. Diversity and abundance of spider fauna at different habitats of University of Pune, M. S. (India) *Global Advanced Research Journal of Environmental Science and Toxicology* (ISSN: 2315-5140) Vol. 1(8) pp. 203-210, November, 2012 Available online <http://garj.org/garjest/index.htm>.
- Whitcomb, W.H. 1974. Natural Populations of Entomophagous Arthropods and Their Effect on the Agroecosystem.
- Whitmore, C., Slotow, R., Crouch, T.E. and Dippenaar-Schoeman, A.S. 2002. Diversity of spiders (Araneae) in a Savanna Reserve, Northern Province, South Africa. *Journal of Arachnology*, 30,344-356.[http://dx.doi.org/10.1636/0161-8202\(2002\)030\[0344:DOSAIA\]2.0.Co;2](http://dx.doi.org/10.1636/0161-8202(2002)030[0344:DOSAIA]2.0.Co;2).
- Young, O.P. and Edwards, G.B. 1990. Spiders in United States field crops and their potential effect on crop pests. *Journal of Arachnology*, 18,1-27.
