

## Preliminary studies on the spider fauna in Mannavan shola forest, Kerala, India (Araneae)

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**Abstract:** A pioneering study was conducted to reveal the spider diversity in Mannavan shola Forest in Kerala state, India. Mannavan shola, the largest Shola patch in Asia, exists in “Western Ghats”, one of the biodiversity hot spots of the world. A total of 72 species of spiders belonging to 57 genera of 20 families were collected from this area during this five-day study. This represents 5% 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. The most striking feature of the spider fauna of Mannavan shola is the number of new records. About 15 species discovered in Mannavan shola are endemic to Western Ghats of Kerala. The high species diversity of spiders in Mannavan shola can be attributed to the high diversity of plants and insects. Because of the complex interaction of various climatic factors such as high rainfall and humidity, with topographical features, Mannavan shola holds many smaller but diverse environmental niches which make this shola forest an important centre of speciation in Western Ghats. This is the first report of the spider fauna from any shola forest in India.

**Key words:** Mannavan shola, India, spiders, diversity, guild structure

### Introduction

Though spiders form one of the most ubiquitous and diverse groups of organisms existing in Kerala, their study has always remained largely neglected. They have, however, largely been ignored because of the human tendency to favour some organisms over others of equal importance because they lack a universal appeal (HUMPHRIES *et al.* 1995). Due to high species endemism, Western Ghats are listed in the 34 ‘Biodiversity hotspots’ of the world (MITTERMEIER *et al.* 2005). Inaccessibility of these forest areas had considerably facilitated its protection. Due to the scarcity of workers much of the arthropodan diversity in Western Ghats remains unexplored. As a result, the disappearance of many species remains undocumented. With the extinction of such species any prospect for their future utilization ceases. Considering the importance of spiders in the natural suppression of many insect pests and as bioindicators, urgent efforts are needed to understand their diversity. The present knowledge on the spiders of Western Ghats remains confined to the works of POCOCK (1895, 1899, 1900), HIRST (1909), GRAVELY (1915, 1935), SHERRIFF (1919, 1927a,b,c), SINHA (1951), SUBRAMANIAN (1955) and CHARPENTIER (1996). Recently JOSE, SEBASTIAN (2001), SMITH (2004), SUGUMARAN *et al.* (2005), and JOSE *et al.* (2006) tried to document the diversity of spider fauna in and around Western Ghats. However, there are many works on the vertebrate and

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invertebrate diversity in the Mannavan shola forest (NAIR 1991), but there is no work on spider diversity. The aims of this study were to investigate the diversity of spiders in this shola ecosystem and to reveal the species richness, endemism, affinity and similarity with other geographic faunas. Though the study of spiders from Mannavan shola forest is still far from complete, the present study forms a basis for further investigations on this group.

## Materials and Methods

Mannavan Shola forms the largest Shola patch in Asia with an approximate size of 14 km<sup>2</sup>. It is located in Idukki district falling within the Marayur Forest range of Munnar Division. Mannavan shola forest is situated at 10°05' N latitude and 77°05' E longitude and forms a part of Western Ghats. Elevation ranges from 600 m to 1350 m, with average elevation being 1100 m. Annual rainfall is 1720 mm, there is more rain in June - August. The vegetation comprises mostly of southern subtropical hill forests, gradually transforming to the southern montane wet temperate forests. This type of forest is composed of tree species much stunted in habit with spreading canopy, twiggy branchlets and foliage of different colours ranging from dark green to purplish, depending upon the flushing periods of various component species. Wild fauna of this shola forest is also quite diverse and characteristic and the endemic Nilgiri Tahr is one among them, totally restricted to the shola-grassland ecosystem and the associated rocky cliffs. Temperature ranges from a maximum of 17°-25° C with an average of 19° C. This shola was pronounced a reserved forest with a government order in 1901 (NAIR 1991).

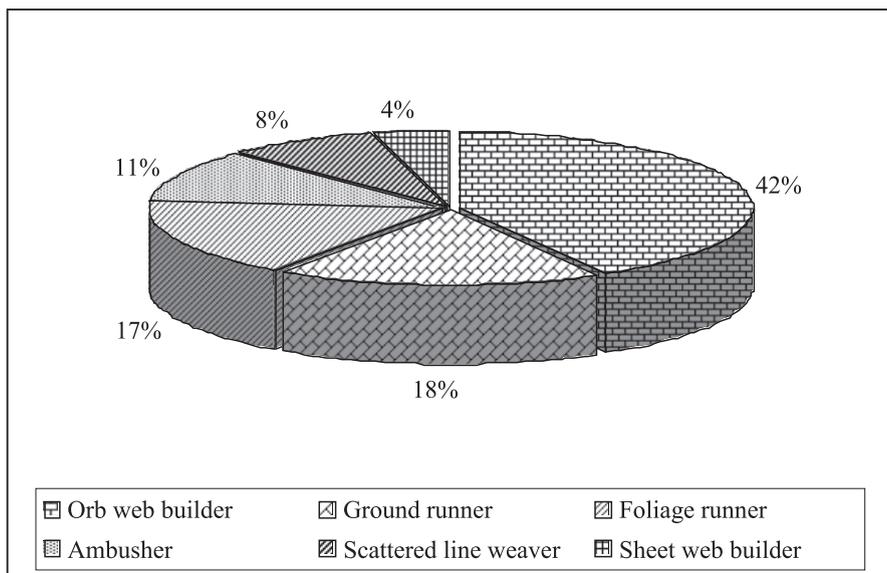
The study was of limited duration extending for five days from December 8, 2003 to December 12, 2003. Bushes, tree trunks, ferns, forest floor, foliage and grass lands were all searched for spiders and collected by hand picking method as suggested by TIKADER (1987). Global Positioning System hand unit (GPS) was used to determine the exact geographical locations. The identification of spiders was done following TIKADER (1970, 1977, 1980, 1982), KOH (1996), MURPHY, MURPHY (2000) and DIPPENAR (2002).

## Results

A total of 72 species of spiders belonging to 57 genera of 20 families were collected during the study (Table 1). Voucher specimens were preserved in 70% ethanol and deposited in a reference collection lodged with the Division of Arachnology, Department of Zoology, Sacred Heart College, Thevara, Cochin, Kerala, India.

**Functional groups:** The collected spiders can be divided into six functional groups (guilds) based on their foraging behaviour in the field (UETZ *et al.* 1999). The dominant guild was of the orb web builders (Fig. 1) and it comprised of 30 species of spiders. Spiders of the families Araneidae, Tetragnathidae and Uloboridae fall under this category. Spiders of the category ground runners formed the next dominant guild in this ecosystem comprising of 13 species of spiders. Foliage runners (12 species), ambushers (8 species), scattered line weavers (6 species) and sheet web builders (3 species) are the other functional groups.

**Family diversity:** Out of the 59 families recorded in the Indian region, 20 families are discovered in Mannavan shola. This represents 36% of the total families recorded in India. Araneidae was the dominant family in this biome, which is composed of 17 species of 10 genera. Tetragnathidae was the next dominant family with 10 species of 6 genera. Salticidae (7 species), Lycosidae (6 species) and Thomisidae (6 species) was the order of dominance of the other major families in this ecosystem. The families consisting of hunting and wandering spiders represent 55% of the spiders found.



**Fig. 1.** Composition (%) of guild structure of spiders collected from Mannavan shola during the study.

**Generic diversity:** Out of the 252 genera recorded from the Indian region (SILIWAL *et al.* 2005), 57 genera are discovered in Mannavan shola. Maximum generic diversity was found in Araneidae (10), Salticidae (7), Tetragnathidae (6) and Thomisidae (6). The number of genera recorded here is higher than that of other major Indian spider studies viz., Andaman and Nicobar islands – 33 genera, Sikkim – 41 genera and Calcutta – 47 genera (TIKADER 1970, 1977, TIKADER, BISWAS 1981). Genera such as *Arachnura* (Araneidae); *Castianeira*, *Oedignatha* (Corinnidae); *Linyphia* (Linyphiidae); *Tibellus* (Philodromidae); *Hyllus*, *Phintella*, *Telamonia* (Salticidae); *Achaearanea*, *Argyrodes*, *Coleosoma*, *Theridula* (Theridiidae); *Camarius*, *Misumenops*, *Ozyptila*, *Pistius*, *Xysticus* (Thomisidae) and *Miagrammopes* (Uloboridae) are first records for Kerala state of India.

**Species richness:** A total of 72 species are discovered from a limited area of 14 km<sup>2</sup>. This number is very high compared with other regions like Andaman and Nicobar islands – 65 species, Sikkim – 55 species and Calcutta – 99 species (TIKADER 1970, 1977 and TIKADER, BISWAS 1981). The above three studies were conducted over a period of one to two years while the present study was limited to five days.

**New records:** The most striking feature of the spider fauna of Mannavan shola is the number of new records. Two species, *Oedignatha carli* (Corinnidae) and *Hyllus diardi* (Salticidae), and 2 genera, *Neriene* (Linyphiidae) and *Coleosoma* (Theridiidae), were recorded for the first time from India. A total of 30 species were recorded for the first time from Kerala (Table 1).

**Endemism:** A total of 252 endemic species of spiders are reported from India so far (SILIWAL *et al.* 2005). Among the collection, 15 species discovered in Mannavan shola are endemic, known so far exclusively from the Western Ghats of Kerala (JOSE *et al.* 2006). Similarly, 44 species are endemic to India. Of the 72 species of spiders found in Mannavan shola, 24 species are found to be endemic to Indo-Srilankan region.

**Affinities:** The present studies conducted in Mannavan shola revealed that the spider fauna of this ecosystem bears affinities with Oriental and Palearctic regions. The presence of species like *Cyclosa bifida*, *Eriovixia excelsa*, *Gasteracantha dalyi* (Araneidae); *Leucauge decorata* and *Nephila pilipes* (Tetragnathidae) bears oriental affinities. A small fraction of species, namely

**Table 1.** List of the spiders collected from Mannavan shola. <sup>1</sup> - First report from India, \* - First report from Kerala.

No.	Family/Species	Guild
	<b>Araneidae</b>	Orb web builder
1.	<i>Arachnura</i> * <i>angura</i> TIKADER, 1970	
2.	<i>Araneus bilunifer</i> POCOCK, 1900	
3.	<i>A. himalayaensis</i> * TIKADER, 1975	
4.	<i>A. nympa</i> * (SIMON, 1889)	
5.	<i>Argiope pulchella</i> THORELL, 1881	
6.	<i>Chorizopes bengalensis</i> TIKADER, 1975	
7.	<i>Cyclosa bifida</i> * (DOLESCHALL, 1859)	
8.	<i>C. hexatuberculata</i> * TIKADER, 1982	
9.	<i>C. insulana</i> (COSTA, 1834)	
10.	<i>Cyrtarachne</i> sp.	
11.	<i>Cyrtophora bidenta</i> * TIKADER, 1970	
12.	<i>Eriovixia excelsa</i> (SIMON, 1889)	
13.	<i>Gasteracantha dalyi</i> POCOCK, 1900	
14.	<i>G. kuhli</i> C. L. KOCH, 1837	
15.	<i>G. remifera</i> BUTLER, 1873	
16.	<i>Neoscona mukerjei</i> TIKADER, 1980	
17.	<i>N. vigilans</i> * (BLACKWALL, 1865)	
	<b>Clubionidae</b>	Foliage runner
18.	<i>Clubiona drassodes</i> CAMBRIDGE, 1874	Ground runner
	<b>Corinnidae</b>	
19.	<i>Castianeira</i> * <i>zetes</i> SIMON, 1897	
20.	<i>Oedignatha</i> * <i>carli</i> <sup>1</sup> REIMOSER, 1934	
	<b>Ctenidae</b>	Ground runner
21.	<i>Ctenus indicus</i> GRAVELY, 1931	
	<b>Gnaphosidae</b>	Ground runner
22.	<i>Poecilochroa</i> sp.	
	<b>Hersiliidae</b>	Foliage runner
23.	<i>Hersilia</i> sp.	
	<b>Linyphiidae</b>	Sheet web builder
24.	<i>Linyphia</i> * <i>urbasae</i> TIKADER, 1970	
25.	<i>Neriene</i> ' sp.	
	<b>Lycosidae</b>	Ground runner
26.	<i>Hippasa agelenoides</i> (SIMON, 1884)	
27.	<i>H. greenalliae</i> (BLACKWALL, 1867)	
28.	<i>H. lycosina</i> * POCOCK, 1900	
29.	<i>H. olivacea</i> * (THORELL, 1887)	
30.	<i>Lycosa carmichaeli</i> GRAVELY, 1924	
31.	<i>Pardosa atropalpis</i> GRAVELY, 1924	
	<b>Miturgidae</b>	Foliage runner
32.	<i>Cheiracanthium</i> sp.	
	<b>Oxyopidae</b>	Foliage runner
33.	<i>Oxyopes birmanicus</i> THORELL, 1887	
34.	<i>O. shweta</i> * TIKADER, 1970	
	<b>Philodromidae</b>	Ambusher
35.	<i>Philodromus</i> sp.	

Table 1. Continued.

No.	Family/Species	Guild
36.	<i>Tibellus</i> * sp.	
	<b>Pholcidae</b>	Scattered line weaver
37.	<i>Artema atlanta</i> WALCKENAER, 1837	
	<b>Psechridae</b>	Sheet web builder
38.	<i>Psechrus torvus</i> (CAMBRIDGE, 1869)	
	<b>Salticidae</b>	Foliage runner
39.	<i>Bavia</i> sp.	
40.	<i>Hasarius</i> sp.	
41.	<i>Hyllus</i> * <i>diardi</i> ' (WALCKENAER, 1837)	
42.	<i>Myrmarachne plataleoides</i> (CAMBRIDGE, 1869)	
43.	<i>Phintella</i> * <i>vittata</i> (C.L. KOCH, 1846)	
44.	<i>Telamonia</i> * <i>dimidiata</i> (SIMON, 1899)	
45.	<i>Thiania</i> sp.	
	<b>Scytodidae</b>	Ground runner
46.	<i>Scytodes fusca</i> WALCKENAER, 1837	
	<b>Sparassidae</b>	Ground runner
47.	<i>Heteropoda phasma</i> SIMON, 1897	
48.	<i>Olios</i> sp.	
	<b>Tetragnathidae</b>	Orb web builder
49.	<i>Herennia ornatissima</i> (DOLESCHALL, 1859)	
50.	<i>Leucauge decorata</i> (BLACKWALL, 1864)	
51.	<i>L. dorsotuberculata</i> * TIKADER, 1982	
52.	<i>L. tessellata</i> (THORELL, 1887)	
53.	<i>Nephila kuhli</i> * DOLESCHALL, 1859	
54.	<i>Nephila pilipes</i> (FABRICIUS, 1793)	
55.	<i>Opadometa fastigata</i> (SIMON, 1877)	
56.	<i>Tetragnatha sutherlandi</i> GRAVELY, 1921	
57.	<i>Tylorida culta</i> * (CAMBRIDGE, 1869)	
58.	<i>T. ventralis</i> (THORELL, 1877)	
	<b>Theridiidae</b>	Scattered line weaver
59.	<i>Achaearanea</i> * <i>mundula</i> (L. KOCH, 1872)	
60.	<i>Argyrodes</i> * <i>gazedes</i> TIKADER, 1970	
61.	<i>Coleosoma</i> * sp.	
62.	<i>Theridula</i> * <i>angula</i> TIKADER, 1970	
63.	<i>Steatoda</i> sp.	
	<b>Thomisidae</b>	Ambusher
64.	<i>Camaricus</i> * <i>khandalaensis</i> TIKADER, 1980	
65.	<i>Misumena decorata</i> * TIKADER, 1980	
66.	<i>Misumenops</i> * <i>andamanensis</i> TIKADER, 1980	
67.	<i>Ozyptila</i> * sp.	
68.	<i>Pistius</i> * sp.	
69.	<i>Xysticus</i> * <i>himalayaensis</i> TIKADER, BISWAS, 1974	
	<b>Uloboridae</b>	Orb web builder
70.	<i>Miagrammopes</i> * sp.	
71.	<i>Uloborus krishnae</i> TIKADER, 1970	
72.	<i>Zosis geniculata</i> (OLIVIER, 1789)	

*Araneus nympha* (Araneidae) and *Nephila kuhlii* (Tetragnathidae) show Palearctic affinities. Affinities with the island fauna of Sri Lanka are also pronounced. *Argiope pulchella*, *Cyclosa insulana*, *Gasteracantha remifera* (Araneidae) *Tylorida culta*, *Tylorida ventralis* (Tetragnathidae) are some of the species having Srilankan affinities discovered from Mannavan shola. A total of 16 species recorded in Mannavan shola are widely distributed in South Asia; 6 of these are found only in the Indo-Srilankan region.

**Faunal similarity:** Faunal similarity of spiders found in Mannavan shola with other regions of India is also striking. *Artema atlanta* (Pholcidae); *Myrmarachne plataleoides* (Salticidae) and *Nephila pilipes* (Tetragnathidae) are species commonly found in the spider fauna of Andaman and Nicobar islands (TIKADER 1977). Species like *Cyrtophora bidenta*, *Cyclosa insulana* (Araneidae); *Oxyopes shweta* (Oxyopidae); *Leucauge decorata*, *Leucauge tessellata*, *Nephila pilipes* (Tetragnathidae); *Argyrodes gazedes* and *Theridula angula* (Theridiidae) are commonly found in the spider fauna of Sikkim (TIKADER 1970). *Argiope pulchella* (Araneidae); *Nephila kuhlii*, *Tylorida ventralis*, *Leucauge decorata* (Tetragnathidae); *Phintella vittata* and *Telamonia dimidiata* (Salticidae) are also found in Calcutta (TIKADER 1981).

## Discussion

Of about 1442 species reported from India (SILIWAL *et al.* 2005), 72 species have been recorded from Mannavan shola. The high species diversity of spiders in Mannavan shola can be attributed to the high diversity of plants (850 spp.) and insects (7500 spp., 65 spp. of butterflies) (SWARUPANANDAN *et al.* 2000). It can be assumed that a high floral diversity sustains a high faunal diversity by providing diverse microhabitat especially for invertebrates. Unlike other ecologically important zones, there is no previous work to compare the spider diversity. This indicates the need for further sampling in this area. Because of the complex interaction of various climatic factors like high rainfall and humidity, with topographical features Mannavan shola holds many smaller but diverse environmental niches. The presence of diverse habitats like forests, bushes and grasslands in this ecosystem is further evidence to this. This makes Mannavan shola an important centre of speciation in Western Ghats.

There are many environmental factors that affect species diversity (ROSENZWEIG 1995). However, when spiders were divided according to their functional group there was a significant effect of habitat on the diversity of these groups. The web building and foliage running spiders rely on vegetation for some part of their lives, either for finding food, building retreats or for web building. The structure of the vegetation is therefore expected to influence the diversity of spiders found in the habitat. Studies have demonstrated that a correlation exists between the structural complexity of habitats and species diversity (HAWKSWORTH, KALIN-ARROYO 1995). Diversity generally increases when a greater variety of habitat types are present (RIED, MILLER 1989). UETZ (1991) suggests that structurally more complex shrubs can support a more diverse spider community. DOWNIE *et al.* (1999) and NEW (1999) have demonstrated that spiders are extremely sensitive to small changes in the habitat structure, including habitat complexity, litter depth and microclimate characteristics. Spiders generally have humidity and temperature preferences that limit them to areas within the range of their "physiological tolerances" which make them ideal candidates for land conservation studies (RIECHERT, GILLESPIE 1986). Therefore, documenting spider diversity patterns in this ecosystem can provide important information to justify the conservation of this ecosystem.

The most striking result is the surprisingly high diversity in this biome compared with other biomes that have been surveyed in India. The number of species found here is a lot higher than in other studies conducted in Western Ghats (SUGUMARAN *et al.* 2005). However, that study was

conducted for a period of more than one year and sampling for the present study was done in a limited number of days only. CULIN, YEARGAN (1983) noted that the species richness of spiders is significantly higher in systems that have not been heavily manipulated. Species richness is only one way of assessing habitat quality. The uniqueness of species compositions, as indicated by levels of endemism and habitat specialization, is more important in establishing regional conservation priorities (PLATNICK 1991). This shola habitat has a diverse spider community and further research should be encouraged in this biome. However, to maintain and manage this high diversity biome, factors other than habitat type need to be identified. Factors at the microhabitat scale, which may be important in influencing the diversity, need to be investigated. This conclusion is also supported by existence of 45 endemic and numerous widely distributed species in Western Ghats (SUGUMARAN *et al.* 2005). In a zoogeographic respect the widely distributed spiders are more dominant. However the characteristic faunal element is the endemic species. Their number is high and their faunistic composition reflects the local character of the fauna. Many of the species found in Mannavan shola are not reported from any other region in India. This phenomenon can be explained by the relative isolation of Western Ghats provided by mountains in the east and Arabian Sea in the west (NAGENDRA, GADGIL 1998). Thus the existing data suggest that Western Ghats represents one of the main centres of speciation in Asia. HOLLOWAY (2003) observed that conversion of forest to plantation and other man-induced disturbances lead to reduction in the diversity of invertebrates, both in species richness and in the taxonomic and biogeographic quality. Being an area of varied habitat, top priority must be given to the conservation of its rich diversity. This study is the first survey of shola forest spiders in Western Ghats. It also emphasizes the need for conservation of this ecosystem by characterizing species diversity and highlighting rare and endemic species in the sholas. This study serves as a baseline for future study of spiders in shola ecosystems. Such studies can build upon this one by using additional collecting methods and/or collecting in different seasons. Future studies can build upon this checklist and continue to catalogue the poorly documented spider fauna and perhaps discover new species along the way.

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## References

- CHARPENTIER P. 1996. The illustrated redescription of *Poecilotheria rufilata* Pocock, 1899. - *Exothermae Magazine, Exothermae Publishing*, Belgium. No. 0 (special edition), 34 p.
- CULIN D., K. V. YEARGAN 1983. Spider fauna of alfalfa and soybean in Central Kentucky. - *Transactions of the Kentucky Academy of Science*, 44: 40-45.
- DIPPENAAR-SCHOEMAN A. S. 2002. The spider guide of Southern Africa. ARC-Plant Protection Research Institute. South Africa.
- DOWNIE I. S., W. L. WILSON, V. J. ABERNETHY, D. I. MCCRACKEN, G. N. FOSTER, I. RIBERA, K. J. MURPHY, A. WATERHOUSE 1999. The impact of different agricultural land-use on epigeal spider diversity in Scotland. - *Journal of Insect Conservation*, 3: 273-286.
- GRAVELY F. H. 1915. Notes on Indian mygalomorph Spiders. I. - *Records of Indian Museum*, 11: 257-287.
- GRAVELY F. H. 1935. Notes on Indian mygalomorph spiders. II. - *Records of Indian Museum*, 37: 69-84.
- HAWKSWORTH D. L., M. T. KALIN-ARROYO 1995. Magnitude and distribution of biodiversity. - In: HEYWOOD V. H. (ed.): *Global Biodiversity Assessment*. United Nations Environment Programme. London, Cambridge University Press, 107-191.
- HIRST A. S. 1909. On some new or little-known mygalomorph spiders from the Oriental Region and Australasia. - *Records of Indian Museum*, 3: 383-390.

- HOLLOWAY J. D. 2003. The Moths of Borneo: part 18; Family Nolidae. Kuala Lumpur, Malaysia, Southdene Sdn. Bhd., 455 p.
- HUMPHRIES C. J., P. H. WILSON, R. I. VANE-WRIGHT 1995. Measuring biodiversity value for conservation. - *Annual Review of Ecology and Systematics*, **26**: 93-111.
- JOSE S. K., P. A. SEBASTIAN 2001. Occurrence of *Psechrus alticeps* Pocock (Araneae: Psechridae) in western Ghats, Kerala with a redescription and notes on its habit and habitat. - *Journal of the Bombay Natural History Society*, **98**: 304-306.
- JOSE S. K., A. V. SUDHIKUMAR, S. DAVIS, P. A. SEBASTIAN 2006 (In press). Preliminary studies on the spider fauna (Arachnida: Araneae) in Parambikulam wildlife sanctuary in Western Ghats, Kerala, India. - *Journal of the Bombay Natural History Society*, **102** (3).
- KOH J. K. H. 1996. A guide to common Singapore spiders. Singapore, Singapore Science Centre, Second edition.
- MITTERMEIER R. A., R. G. PATRICIO, M. HOFFMAN, J. PILGRIM, T. BROOKS, C. G. MITTERMEIER, J. LAMOREUX, G. A. B. FONSECA 2005. Hotspots Revisited: Earth's Biologically Richest and Most Endangered Terrestrial Ecoregions. Coservation International, USA, 432 p.
- MURPHY F., J. MURPHY 2000. An Introduction to the Spiders of South East Asia. Malaysian Nature Society, Malaysia, vii+624 p.
- NAGENDRA H., M. GADGIL 1998. Linking regional and landscape scales for assessing biodiversity. A case study from Western Ghats. - *Current Science*, **75** (3): 264-271.
- NAIR S. C. 1991. The Southern Western Ghats - a biodiversity conservation plan. New Delhi, INTACH, 92 p.
- NEW T. R. 1999. Untangling the web: spiders and the challenges of invertebrate conservation. - *Journal of Insect Conservation*, **3**: 251-256.
- PLATNICK N. I. 1991. Patterns of biodiversity. - In: ELDRIDGE N. (ed.): Systematics, ecology and the biodiversity crisis. New York, Colombia University Press, 15-24.
- POCOCK R. I. 1895. Notes on the identity of some of the types of Mygalomorphae in the collection of the British Museum. - *Annals and Magazine of Natural History*, Sixth Series, **16**: 223-230.
- POCOCK R. I. 1899. Diagnoses of some new Indian Arachnida. - *Journal of the Bombay Natural History Society*, **12**: 744-753.
- POCOCK R. I. 1900. Great Indian spiders - The genus *Poecilotheria*: its habits, history and species. - *Journal of the Bombay Natural History Society*, **13**: 121-133.
- RIECHERT S. E., R.G. GILLESPIE 1986. Habitat choice and utilization in web-building spiders. - In: SHEAR W. B. (ed.): Spiders: Webs, Behavior and Evolution. Stanford, Stanford University Press, 23-48.
- RIED W. V., K. R. MILLER 1989. Keeping options alive: A scientific basis for conserving biodiversity. Washington D.C., World Resources Institute.
- ROSENZWEIG M. L. 1995. Species diversity in space and time. New York, Cambridge University Press.
- SHERIFF W. R. 1919. A contribution to the study of South Indian Arachnology I. - *Annals and Magazine of Natural History*, **9**: 220-253.
- SHERIFF W. R. 1927a. A contribution to the study of South Indian Arachnology II. - *Annals and Magazine of Natural History*, **9**: 533-542.
- SHERIFF W. R. 1927b. A contribution to the study of South Indian Arachnology III. - *Annals and Magazine of Natural History*, **10** (2): 177-181.
- SHERIFF W. R. 1927c. A contribution to the study of South Indian Arachnology IV. - *Annals and Magazine of Natural History*, **10** (2): 233-249.
- SILIWAL M., S. MOLUR, B. K. BISWAS 2005. Indian Spiders (Arachnida: Araneae): Updated checklist 2005. - *Zoos' Print Journal*, **20** (10): 1999-2049.
- SINHA T. B. 1951. On the collection of lycosid spiders in the Zoological Survey of India. - *Records of Indian Museum*, **48**: 9-52.
- SMITH A. M. 2004. A new species of the arboreal theraphosid, genus *Poecilotheria*, from southern India (Araneae, Mygalomorphae, Theraphosidae) with notes on its conservation status. - *Journal of British Tarantula Society*, **19**: 48-61.

- SUBRAMANIAN T. V. 1955. Habits and habitat of some common spiders found in Western Ghats. - *Journal of the Bombay Natural History Society*, **52** (4): 876-881.
- SUGUMARAN M. P., M. GANESHKUMAR, K. RAMASAMY 2005. Biodiversity of spiders in Western Ghats of Tamil Nadu. - *Entomon*, **30** (2): 157-163.
- SWARUPANANDAN K., N. SASIDHARAN, K. C. CHACKO, S. C. BASHA 2000. Studies on the Shola Forests of Kerala. - *Kerala Forests Research Institute research report*, **158**.
- TIKADER B. K. 1970. Spider fauna of Sikkim. - *Records of the Zoological Survey of India*, **64**: 1-83.
- TIKADER B. K. 1977. Studies on spider fauna of Andaman and Nicobar islands, Indian Ocean. - *Records of Zoological Survey of India*, **72**: 153-212.
- TIKADER B. K. 1980. Thomisidae (Crab-spiders). - *Fauna of India (Araneae)*, **1**: 1-247.
- TIKADER B. K., B. BISWAS 1981. Spider fauna of Calcutta and vicinity: Part I. - *Records of Zoological Survey of India*, Occasional Papers, **30**: 1-149.
- TIKADER B. K. 1982. Family Araneidae (Argiopidae), typical orb weavers. - *Fauna of India (Araneae)*, **2**: 1-293.
- TIKADER B. K. 1987. Handbook of Indian Spiders. Calcutta, Zoological Survey of India, 251 p.
- UETZ G. W. 1991. Habitat structure and spider foraging. - In: BELL S.S., E. D. MC COY, H. R. MUSHINSKY (eds): *Habitat structure: the physical arrangement of objects in space*. London, Chapman & Hall.
- UETZ G. W., J. HALAJ, A. B. CADY 1999. Guild structure of spiders in major crops. - *Journal of Arachnology*, **27**: 270-280.

## Предварителни проучвания върху аранеофауната (Araneae) на Манаван Шола (Керала, Индия)

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### (Резюме)

Проведено е пионерно изследване върху паяците, обитаващи гората Манаван Шола в индийския щат Керала. По отношение на биоразнообразието, Манаван Шола се нарежда сред световно значимите места на планетата. В рамките на пет дена са събрани общо 72 вида паяци от 57 рода и 20 семейства. Това представлява 5% от общия брой на всички семейства в Индия. Най-добре са представени семействата Araneidae, Tetragnathidae, Salticidae и Thomisidae, като в проучения район доминира Araneidae със 17 вида. Около 15 вида се приемат за ендемити на Кералски Западен Гатс. Високото видово разнообразие при паяците се свързва с високото видово разнообразие на растенията и насекомите. Анализирани са структурата на различните екологични типове паяци, като са установени шест групи – строители на кълбовидни мрежи, ловци в подстилката, наземни ловци, строители на пеленовидни мрежи, строители на неправилни мрежи и ловци от засада.

