Chapter 7

AN OVERVIEW OF SPIDER DIVERSITY IN INDIA

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Introduction

Due to an inherent drive for survival, the life forms have adapted and evolved. These adaptations are aimed at countering environmental challenges. As there can be alternate ways of adapting to a demand, life forms have evolved varied strategies. Various taxa arise due to such diverse approaches. Biodiversity refers to such variations in life forms. A group of individuals that have identical traits and are reproductively compatible constitute a species. Diversity also arises due to the fact that earth has a diverse geography. Based on geography, a classification of biomes has been formulated. The tropical humid rain forests host the most diverse and abundant biodiversity. Such tropical humid rain forests are seen confined to landmasses of the equatorial region. Due to unique geological formations and climate, some of the rain forests are also observed in south Asia in the Western Ghats of India, Northeast India and Myanmar. The climatic conditions here support a rich flora and consequently a diverse fauna.

Myers (1988) classified areas that are rich in endemic species and are threatened by human activity as "biodiversity hotspots". These are high priority terrestrial eco-regions for conservation. Myers *et al* (2000) reclassified the hotspots and identified eight "hottest hotspots". The Western Ghats/Sri Lanka region occupies the seventh place in this list. The recent "Global 200" classification by WWF ranks the Western Ghats at twentieth place among 200 ecologically sensitive regions. As the major threat to any biodiversity hotspot is the human intervention, Cincotta *et al* (2000) analysed the human population dynamics in biodiversity hotspots. The Western Ghats are the most threatened on this count as this region has the highest population density per sq. km (340 km^{-2}) among the hotspots and a positive growth rate.

A quick glance at the biological diversity reveals that arthropods are the most diverse group of organisms. The product of evolution over millions of years has yielded a diversity which is "biased". It has generated a very diverse group of arthropods and in particular, insects. Arthropods constitute 64.5% of the described species as compared to plants (14.3%), fungi (4.2%) and vertebrates (2.3%) (Anonymous 1995). The arachnids constitute the second largest class (7%) of documented arthropods and it is estimated that 8.3% of arthropods are arachnids. Thus arachnids rank second among arthropods. Arthropods comprise more than 900,000 described insect species and about 34,000 described spiders. The order Araneae of class arachnida consists of spiders. The suborders mesothelae and orthognatha consist of primitive spiders, and the suborder labidognatha includes the more recent spiders.

The significance of insects in ecology needs no emphasis. Spiders also have a very significant role to play in the ecology by being exclusively predatory (Wise, 1993) and thereby regulate insect populations. All spiders are venomous but only a few species are venomous enough to harm humans. However, the venom of some spiders is useful in study of neuromuscular and cardiac pharmacology. It is likely that spider

silk will be the material of the future as its silk is the toughest material known. The gene for the silk of *Nephila maculata* has been cloned and the spinning technology needs to be perfected. The coloration of spiders is varied and is paralleled only by insects (Oxford and Gillespie 1998). Spiders may also serve as biocontrol agents (Raghavendra 2001). Inspite of several applied values mentioned above, spiders have received cursory attention. In conservation efforts, often "charismatic" species like birds and mammals draw most attention and ecological significant groups like spiders are often neglected. Only tarantulas are included in Appendix II of CITES.

Review of literature on spiders

Despite the paucity of interest in spider fauna many good accounts on spider fauna are available and information on internet does provide an outline of the spider fauna in various regions. Conventionally, taxonomic accounts have been descriptive with anatomical details and at best provide hand-drawn illustrations. For a group like spiders, there is a need to document the fauna with colored illustrations, which will help easy identification.

International status

The distribution and diversity of spiders has drawn attention of field workers in different parts of the world. These are often restricted by political boundaries and therefore often appear as studies on spider fauna of individual countries. In an effort to popularize spider biology and educate the general public many authors have put in their efforts. Taylor (1999) provides a good and well-illustrated account of the diversity, beauty and intricacies of spiders. Another recent publication by the Discovery books (Anonymous 2000) illustrates spiders and some of the families of spiders. A compendium of the spider fauna of North America is provided in Vincent Roth's Field Guide (2000), (Kaston, 1978). A general description of spiders from all over the world has been provided by Preston-Mafham and Preston-Mafham (1986). The distribution of spiders in Rice lands of South Asia has been well recorded and illustrated by Barrion and Litsinger (1996). Information of diversity of spiders of Australia, Southern United States and Mexico, Europe and Canada (Website #1) is available on internet.

Indian literature

The knowledge on diversity and distribution of spiders in India is sparse as compared to other regions of the world listed above. The most comprehensive description yet on Indian spiders is by Tikader (1987). This Handbook does not provide the region in which the spider species listed is found. A brief account of spiders is also provided by Vijayalakshmi and Ahimaz (1993). The first detailed account of Indian spiders was provided by Pocock (1900) which lists 216 spider species under 17 families. Among the other early accounts is that of Gravely (1922). Tikader (1987) has listed 1066 under 43 families. Table 1 lists the number of spider species among major families found in India. Five of them namely, Lycosidae, Salticidae, Gnaphosidae, Thomisidae and Araneidae are the predominant ones. Each of these families constitutes

about ten percent or more of the spider fauna recorded by Tikader (1987). Currently there are very few workers actively involved in surveying and recording Indian spiders (Ganeshkumar and Mohanasundram, 1998). Thus a pressing need exists to explore spider diversity in the country. The following example illustrates the shortcoming. The Canadian Biodiversity Survey has recorded about 1400 species of spiders in Canada (Website # 1). Canada is known for its cold climate and a relatively limited biodiversity. Added to that, it is a vast country and many times larger than India, which renders a survey at the national level, daunting. Under these circumstances 1400 species have been documented. In comparison India has a very rich diversity, smaller area to be surveyed, has a tropical climate with a biodiversity hotspot, has manpower to conduct biodiversity surveys, but the best account so far (Tikader, 1987) lists 1066 spider species.

Table 1. Families of spiders with ten or more species occurring in India (Tikader 1987).

Family	Number of species	Family	Number of Species
Barychelidae	10	Tetragnathidae	22
Oonopidae	10	Oxyopidae	32
Hersilidae	12	Theridiidae	49
Scytodidae	12	Theraphosidae	50
Linyphidae	12	Heteropodidae	65
Ctenide	13	Clubionidae	69
Agelenidae	13	Lycosidae	97
Pisauridae	13	Salticidae	100
Ctenizidae	14	Gnaphosidae	108
Zodaridae	14	Thomisidae	117
Uloboridae	15	Araneidae	142
Dictynidae	16		

Spiders in Western Ghats

For reasons mentioned above, we have set about to survey and record the distribution, diversity and biology of spiders. Western Ghats is one of the regions rich in biodiversity and endemic species and an account of spider fauna in this region is not available. Our expectation of finding a rich diversity of spiders in the Western Ghats was an educated guess. Taxonomy of spiders is an ambiguous area and consolidated information is lacking. Our observations therefore arrive only at the level of family or at best genus level. One of the impediments in preservation of spiders is the fact that unlike insects, spiders cannot be dry-mounted. The cuticle being soft, spiders tend to shrink and disfigure on drying. Such specimens loose their coloration and hence impede taxonomic studies. We therefore, photograph specimens either in the field or

as soon as they are brought to the laboratory. Among other authors, keys for identification of spiders is provided by Tikader (1987), Barrion and Litsinger (1995), Roth (1993). We have in our wet collection a total of 200 species of spiders. Identification of these is in progress. Based on our observations we have collated the eye patterns of spiders (Fig. 1) which can also be used as a key for identification.

The occurrence of major spider families and their relative abundance in the central Western Ghats as revealed by our observations is listed below. Our surveys at present are confined to arboreal spiders and does not include epigeal and litter spiders. The major representation is from the families Oxyopidae, Thomisidae, Araneidae and Salticidae. The Western Ghats regions are characterized by heavy rains averaging 3000 mm between June – August. We have also observed seasonal fluctuations in relative abundance.

Table 2. Relative abundance of major arboreal spider families in the central Western Ghats.

Family	Percentage
Hersilidae	2.9
Linyphidae	4.2
Oxyopidae	5.4
Thomisidae	11.9
Salticidae	26.2
Araneidae	38.0

We took this as baseline data and extended our studies to observe whether the agricultural activities, which are an important factor in influencing the fauna do influence the spider fauna. Western Ghats are fragmented in many places due to agriculture including horticulture. As compared to the diversity of spiders shown above the garden crops arboreal spiders showed lesser diversity. The relative abundance of spiders among garden crops (Poornima, 2001) is as shown in Table 3.

Table 3.

Plant species	Araneidae	Salticidae	Thomisidae	Uloboridae	Linyphidae
Psidium gujava	15	11	1	1	1
Areca catechu	25	1	2		
Thevea indica	8	4	1		
Hevea brasilensis	7	5			
Caesalpenia pulcherima	9	24	3		

Seasonal variation of spiders

The density of spider was high during the pre-monsoon season and gradually decreased during monsoon. On some plants like *Areca* and *Ceasalpinia* they were abundant in the month of December and their number decreased by end of January. There was considerable variation in the members of *Araneidae* during rainy season and winter. In *Areca* plant *Gasteracantha* species are abundant, which suggests that species prefer specfic habitats. Flowering plants such as *Nyctanthus* have high density of spider belonging to Thomisdae.

The foothills of Western Ghats are often converted to monoculture gardens like Cashew. In an study concentrating on diversity of spiders on cashew, we collected 156 specimens and the major families of spiders observed were: Araneidae, Salticidae, Thomisidae, Oxyopidae (Raghavendra, 2001). Except Araneidae the others are non web-building hunters. There was also a seasonal fluctuation in their density with maximum diversity in spring. This corresponds to the seasonal occurrence of pests on the cashew crop (Devasahayam and Sunderaraju, 1987). Comparatively the diversity of spiders is less in the garden crops. A reason for this decline is use of pesticides. Crab-spiders (Thomosidae) are more in the garden crops and they are lesser in pristine forest areas. Members of Hersilidae, Heteropodidae, Clubionidae, Palpimonidae, Lycosidae, Tetragnathidae, are absent in the garden. Thus by comparison it is evident that conversion of pristine forests to agricultural land reduces diversity of spiders.

Recommendations

1. Faunal diversity surveys and conservation efforts are often concerned with charismatic species like higher vertebrates. We need to pay attention to other faunal components also, like spiders because of the significant ecological role the play.

2. In order to formulate conservation measures a baseline data about a particular group is needed. For many of the arthropods such information is lacking and therefore needs to be generated.

3. Deforestation selectively reduces diversity and density of fauna like that of spiders. Additionally, use of pesticides may dramatically influence their diversity. It would be worthwhile designing insecticides such that they are less toxic to spiders.

4. Spiders appear to be promising candidates and can be used in biological control of pests.

Spiders exhibit stunning morphological diversity and coloration. An ant-mimicking spider of the genus *Myrmarachne* belongs to salticidae. The salticid on top right panel shows brilliant coloration. The coloration of spiders comes both from colored hairs or pigments incorporated into the cuticle or placed below it. Orb-weaving Araneidae members have large abdomen and Oxyopidae are characterized by spiny hairs on the body. Oxyopidae (Lynx spiders) and Salticidae (Jumping spiders) members are hunters and do not spin webs.

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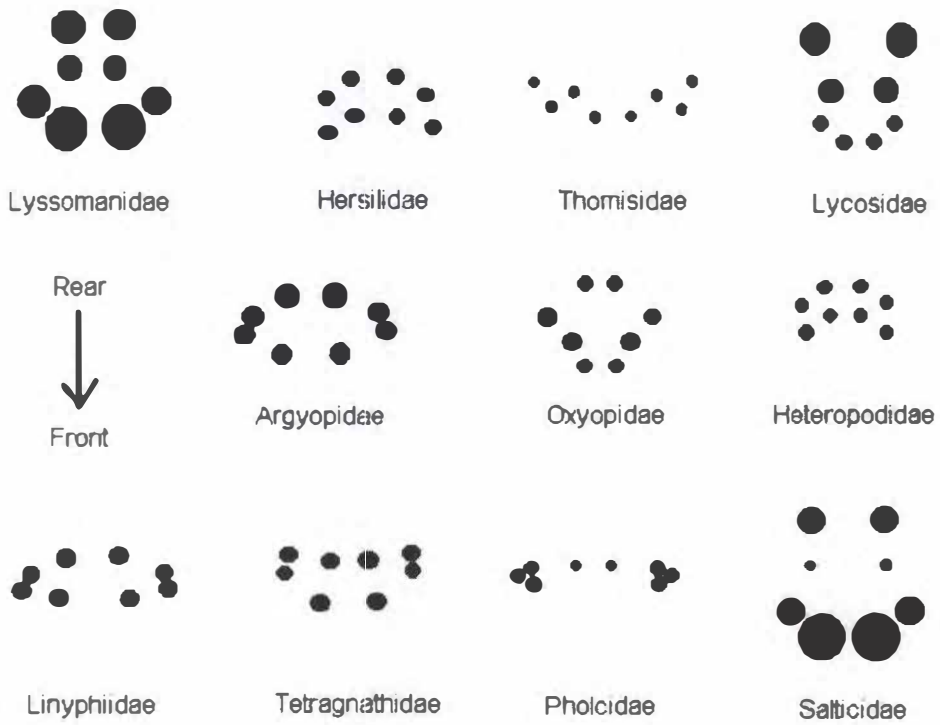

Fig. 1. Variations in eye patterns cahracteristlc to spiders belonging to different families