CHAPTER 5

DISCUSSION

The present study, conducted in the Barpeta District of Assam, has made a significant contribution towards increasing knowledge of spider species distribution in this area. During the extensive survey for a period of two years in the Barpeta District of Assam, 69 species of spiders belonging to 44 genera of 16 families were found in the study area. No previous research on spiders has been carry out in this area, so the study represents new distribution records for all species recorded. The difference in quantity and quality of spider fauna is related to the collection time, sampling method and other geographic features of the area.

Tikader (1987) and Manju Siliwal et al. (2005) recorded 59 families of spider in Indian region, out of which 16 families were recorded in Barpeta District. Families consisting of hunting and wandering spiders like Salticidae (10 spp.), Lycosidae (5 spp.), Oxyopidae (5 spp.), Sparassidae (4 spp.), Pisauridae (3 spp.), Thomisidae (2 spp.), Theraphosidae (1 spp.), Philodromidae (1 spp.) and Hersilidae (1 spp.) represent 46 % of the total spider fauna. Web building families like Araneidae (15 spp.), Theridiidae (6 spp.), Tetragnathidae (5 spp.), Pholcidae (5 spp.), Nephilidae (3 spp.), Linyphiidae (2 spp.) and Uloboridae (1 spp.) contribute 54 % of total spider fauna found of the area.

Families like Salticidae (9), Araneidae (7), Pholcidae (5), Theridiidae (3), Pisauridae (3), Tetragnathidae (2), Nephilidae (2), Lycosidae (2), Sparassidae (2), Thomisidae (2), Linyphiidae (2), Theraphosidae (1), Uloboridae (1), Philodromidae (1) Oxyopidae (1), and Hersilidae (1) exhibit generic diversity. Genera like Araneus, Argiope, Cyclosa, Cyrtophora, Gasteracantha,
Neoscona, Parawixia (Fam: Araneidae); Hersilia (Fam: Hersiliidae); Leptyphantes, Linyphia (Fam: Linyphiidae); Lycosa, Pardosa (Fam: Lycosidae); Herennia, Nephila (Fam: Nephilidae); Oxyopes (Fam: Oxyopidae); Tibellus (Fam: Philodromidae); Artema, Pholcus, Smeringopus, Uthina, Crossopriza (Fam: Pholcidae); Perenethis, Thalassius, Polyboea (Fam: Pisauridae); Asemonea, Carrhotus, Epeus, Hasarius, Hyllus, Menemerus, Phidippus, Plexippus, Telamonia (Fam: Salticidae); Olios, Heteropoda (Fam: Sparassidae); Tetragnatha, Leucauge (Fam: Tetragnathidae); Ischnocolus (Fam: Theraphosidae); Theridion, Argyrodes, Achaearanea (Fam: Theridiidae); Camaricus, Misumena (Fam: Thomisidae); Uloborus (Fam: Uloboridae) are recorded in the area.

Saikia and Baruah (2008) reported 33 species belonging to 9 families and 22 genera from rice ecosystem of Northern Assam. The spiders recorded from the present study are more than the above study. It may be as the present study was conducted in four habitats with large area.

Spider’s surveys were also conducted in some states of North east India. Biswas and Majumder (2000a) reported 27 species from the state Tripura. Biswas and Biswas (2006, 2007) reported 58 species from Arunachal Pradesh and 44 species from Mizoram. But the spider fauna reported from the above mentioned states are less in comparison to the number of spiders recorded in Barpeta district, which shows the spider diversity richness in small geographical area compared to the other states. Biswas and Biswas (2003) reported 91 species from the four districts of state Sikkim, though it represents high species diversity than the present study, but Barpeta District of state Assam alone documented 69 species which show the state Assam’s rich diversity.

The other states of India like Andhra Pradesh (Biswas, 2007) and Chhattisgarh (Gajbe, 2003) with geographical area more than Barpeta district also reported less diversity of spiders,
which reveals the spider diversity richness in the district. It also reveals that the district is
covered widely with vegetation suitable for spider habitat.

The spider species, *Argiope pulchella* Thorell, 1881 are significantly abundant covering
11.96% of the total spider population in the area. The same type of result was not reported by
Saikia and Baruah (2008). It may be because their abundance is more in residential as well as
jungle areas and possibly for their adaptation to any environment even in laboratory condition
(Zschokke and Herberstein, 2005). The other spider species like *CROSSOPRIZA LYONI*
Blackwall, 1867; *Plexippus Petersi* Karsch, 1878; *Plexippus Paykulli* Audouin 1826; *OXYOPES
birmanicus* Thorell, 1887; *Neoscona mukerjei* Tikader, 1980; *Araneus inustus* L Koch, 1871;
*Pardosa birmanica* Simon, 1884; *Hasarius adansonii* Audouin, 1826; *Lycosa mackenziei* Gravely
, 1924; *Leucauge decorata* Blackwall, 1864; *Telamonia dimidiate* Simon, 1899; *Artema atlanta*
Walckenaer, 1837; *Pardosa sumatranana* Thorell 1890 are less in population, whereas *Misumena
chrysanthemi; Argyrodes gazedes* Tikader, 1970; *Argyrodes argentatus* OP Cambridge 1880;
*Olios milleti* Pocock, 1901; and *Asemonea tenuipes* O P Cambridge, 1869 are found to be
negligent in the district just covering 0.09% of the spider population. It can also be concluded
that the low number of individuals recorded for some of the species might be for the relatively
small populations and are facing the problem of habitat destruction and fragmentation.

About 69 species recorded in Barpeta district are widely distributed in India and South
Asia. 17 species out of 69 species are endemic to India. Species like *CROSSOPRIZA LYONI*, *PHOLCUS
phalangioides*, *Smeringopus pallidus* are cosmopolitan. Few species are found in Indo-China and
Indo- Myanmar region only (Siliwal et al., 2005).

The study holds importance as it is the pioneer work which gives out the distributional
status of the spiders in our state. In order to get good representation of all areas, study was
conducted in diverse areas of the district like in agricultural fields, jungles, marshy areas and residential areas. Though spiders are cosmopolitan but their species diversity proves to be important because they bear a close relationship with the habitat’s diversity. During the study, distribution of spider is found more in jungle area followed by residential area, moderate in agricultural area and lower in marshy area. This is possibly due to nearly 28% undisturbed forest covering the district. Species diversity would possibly be reported more in the agricultural area, if there is judicious use of pesticides and fertilizers in agricultural fields.

It was observed during the research period the 100% abundance of spider species in summer season, followed by post monsoon season (82.61%), winter season (33.33%) and monsoon season (7.23%). This result reveals that spiders are inactive during winter season and monsoon season but very active in summer season and post-monsoon, as discussed by Kato et al. (1995) that climatic changes through seasons would influence the abundance of spiders. It may be due to the different seasonal preferences of different spider species.

As explained by Coddington et al., 1991; Toti et al., 2000, the present study of spider fauna three collection methods were adopted and show that the number of individual and spider species collected were more by aerial than by ground or beating method.

Uetz (1977); Canard (1990) and Uetz et al. (1999) differentiated spiders with respect to their hunting behavior into web builders and wanderers. While based on web type (Canard 1990; Uetz et al., 1999), spiders were distinguished into different functional group. The study of the families of spider included in the different functional groups depending on the webs in Barpeta District shows that abundance of different functional groups of spiders varies in different habitats and sites. The same was observed by Cardoso et al., (2011). The present study reveals that out of
16 families, 09 families are web-less spiders, 04 orb web spiders, 02 irregular web and 01 sheet web spiders.

Diversity of families proves to be important because they bears close relationship with that of habitat’s diversity. The percentage distribution of spider family reveals that the spider family Hersilidae is almost rare in the district and the Araneidae family is found abundantly in Barpeta district contributing 28.14% of the total spider family found in the district which is also most diverse family among the other families. Similar observation was reported by Uniyal (2006) who reasoned it for habitat types, which gives more opportunity to the web builders, which in turn provides the spiders with more niches and communities to live in.

It was revealed from the Alpha diversity estimate that Ruposhi Block of the district was rich in spider species whereas Bhawanipur shows the least diversity. As the distribution of spider is higher in jungle area followed by residential area, moderate in agricultural area and lower in marshy area, which is clear from the Alpha diversity estimate in different habitats. So, the Ruposhi block of Barpeta district with higher percentage of area covered with jungle land accounts for higher distribution of spiders among the other blocks of the district. Also the spider distribution in some blocks of Barpeta District is possibly less due to habitat destruction for urbanization, construction of roads and highway, habitats of spiders near residential areas are damaged, rigorous use of pesticides and fertilizers in agricultural fields, more marshy areas, polluting the water bodies by dumping the wastes and domestic sewage, etc. The same type of observation was reported by Hsie et al. (2003) that lower spider abundance and species diversity are characteristics of areas subjected to high levels of disturbance, such as grazing, agricultural practices, forestry, and burning. So, there is uneven distribution of spiders in different blocks of Barpeta district. The Beta diversity is more when compared between residential and agricultural
area, which shows that the habitats have lots of unique spider species. But the marshy and residential records least beta diversity.

The non-parametric estimators Chao and Jackknife generate an estimate 72-78 actual spider species in the Barpeta District. It can be concluded that Chao estimator is more reliable and cost-effective than the Jackknife estimator in spider species richness with only 2.39 S.E than that of Jackknife with S.E. 4.38, which also established the studies of Henderson (1989) and Magurran (1988) on present–absent data. This study also reveals the fact that out of 69 species, 6 are singletons, 7 are doubletons and 9 are unique to the each sample unit. Sebastian. et al. (2005) described that the number of species estimated to be present by the estimators showed wide deviations from the observed number of species because these quantitative estimators are abundance based estimator, so the number of times a species is present in a sample set has a significant effect on the number of species estimated to be present. The difference in estimated and observed numbers of species reveals that the sampling efforts used were inadequate to reveal the true species diversity at the sites and indicates the necessity to conduct more intensive studies with modification of sampling techniques, viz. including extended sampling time, sampling during different time periods of the day, etc. (Sebastian. et al., 2005).

Out of six principal types of webs described by Tikader (1987), the three types of webs were encountered during the survey-Sheet web, Orb web and Irregular webs. Out of these three web weavers found in the Barpeta District, Orb web weaver spider species are more, followed by Irregular web weaver and the sheet web weaver are the least.

The spider species *A. puchella* selected for web silk threads study, builds orb web readily in the laboratory condition i.e. a cardboard box and the same has been reported by Zschokke and Herberstein (2005).
The spider silk threads is with high strength and elasticity, so to know their structural properties, Scanning Electron Microscopy of Dragline and Viscid threads of *Argiope pulchella* were done. SEM was done for the advantage of its large depth of focus which yields almost three dimensional views of surface structures as described by Foelix (1974).

Dragline shows an average diameter of 5.7 µm with circular cross-section whereas Viscid Silk Shows an average diameter of 5.5µm. Rengasamy (2005) also studied the SEM of *Nephila*’s web threads and reveals that the average diameter of *Nephila* spider dragline silk varies from 9 to 12µm with circular cross-section and other spider silk have an average diameter of 7-8 µm. The micrograph shows that dragline has multiple cylindrical filaments with slightly rough surface which is possibly the negligible amount of glue like substance on it. Such type of observation was reported by Vollrath (2000). The substructure of the Viscid Silk reveals the two axial threads that are stuck together and aligned parallel. Similar observation was reported by Foelix (1974).

The sticky spiral (viscid spiral) of an orb web is typically a continuous double-stranded thread of elastic silk that is covered with glue secretions. Similar type of observation was described by Blackledge *et al.* (2011). So, it can be concluded from the SEM study of dragline and viscid threads that dragline thread is thicker than viscid silk and glue is found more on the viscid silk substance whereas negligible amount of it is found on dragline silk. It may be possibly due to these properties that make the spider silk the strongest and elastic material to gradually decelerate intercepted insects, thereby preventing prey from ricocheting out of webs.

Ironically, the spider diversity in Assam is still not fully explored or understood. The study had to begin with very little information as it is a pioneering work on the spiders of Assam and nothing was known about the spiders of this area before the study. These difficulties were felt from literature collection to specimen collection and identification of spiders. In the name of
literature on Indian spider, there are only the three volumes of Fauna of India (Araneae) and some literature are mostly outdated or not accessible in libraries. Apart from, no other authoritative books exist on Indian spiders. It is intended that diversity of the spiders of Barpeta district, Assam will fill the existing emptiness of literature on Arachnology for the state and apprise investigators of the spider fauna of Assam.

The present thesis brings out only a portion of the diversity of the spider that remain hidden in the landscape of Assam (Barpeta district). The further prospective study will indeed raise the number of spider species exponentially. There is a need to realize the importance of our biological wealth and continue the research and document them. Governments and our Forest Departments must take constructive steps to protect and conserve the smaller animals like spiders along with larger animals. As an inhabitant of the Barpeta district, the study is done in the area of Barpeta district, but it is the representation of the state Assam and further research is needed to be planned in the other district of Assam.