The present study was made to enhance the knowledge of diversity and ecology of spiders in and around Kumbakarai Falls area, Theni District, Tamil Nadu. Kumbakarai Falls is located on a subtropical forest in the eastern slope of the Western Ghats which has rich flora and fauna with thorny-bushes, herbs, shrubs, and its foliage bed that harbours a number of spider diversity with varying taxonomical positions. The spiders of this area are unexplored and hence a detailed study on the distribution and ecology of the spiders of Kumbakarai Falls was carried out.

In India 1,685 species of spiders have been reported as per the recent report of Keswani et al., (2012). They belong to two infra-orders, Mygalomorphae and Araneomorphae belonging to 60 families and 438 genera. In India only Southern and Central Indian spiders mainly located in the states of Kerala, Tamil Nadu, Madhya Pradesh and Chattishgarh. Siliwal et al., (2005) in an updated checklist of Indian spider provided taxonomic reevaluation of described species and recorded 1442 species belonging to 59 families from the Indian region.

6.1 Diversity of Spiders

Taxonomy is the way of understanding the countless species diversity of life (Sorensen, 2004; Ghavami et al., 2007). The spider diversity varies in response to biotic and abiotic factors of the environment (Gunnarsson, 1990). It would be expected that the fundamental changes in natural habitats (fragmentation and reduction) would also affect the diversity of this large group (Atauri and Lucio, 2001). A total of 55 species, belonging to 39 genera and 19 families were recorded in Kumbakarai Falls during April 2009 - March 2011. This study was involves the comparison with similar studies carried out in other places like Andaman and Nicobar islands (58 species), Sikkim (65 species), Jabalpur (107 species) and Assam (95 species), (Tikader, 1970, 1977; Gajbe, 2004b; Chetia and Kalita, 2012). Sugumaran et al., (2005) recorded 56 different
species of spiders under 18 families which were observed and recorded in Western Ghats of Tamil Nadu in Nilgiris, Coimbatore, Erode, Viruthunagar and Tirunelveli districts. From Western Ghats of Kerala, 72 spiders belonging to 57 genera of 20 families were reported from Mannavan Shola forest (Sudhikumar et al., 2005).

Scientific reports on spider diversity in Tamil Nadu States are limited (Tikader and Malhotra, 1980; Sugumaran et al., 2010). In 1991 Nirmala et al., reported 18 species under eight families of which 14 species were reported in rice fields of Tamil Nadu. In another report Shunmugavelu (1995) carried out the study of the spider *Crossopriza lyoni* (Blackwall) in the betelvine agroecosystem of Sholavandhan village in Madurai district.

Subsequently Premalatha (2007) recorded 984 specimens representing eight families, nine genera and 12 species of spiders collected from Ayyanar Hills Forest Reserve, in Rajapalayam, Tamil Nadu. The study reports *Stegodypus tibialis* (O.P. Cambridge), *Nephila pilipes* (Fabricius), *Nephila clavata* (L. Koch), *Argiope catenulata* (Doleschall), *Smeringopus elongatus* (Vinson), *Crossopriza lyoni* (Blackwall), *Hersilia savignyi* (Lucas), *Hippasa pantherina* (Pocock), *Peucetia viridana* (Stoliczka), *Heteropoda sexpunctata*, *Heteropoda leprosa* (Simon) and *Heteropoda subtilis* (Karsch) as the most frequently encountered species.

During 2007 Sugumaran et al., observed a total of 265 spider specimens in horticultural crop of Yercaud Hills, near Salem that represented 38 species belonging to 13 families. Later Senthilkumar and Regupathy (2008) reported 10 species of spiders belonging to seven families and eight genera in coffee plantation of Yercaud, Tamil Nadu. Among them, *Telamonia dimidiata* (Simon), *Clubiona* sp. and *Linyphia* sp. dominates throughout the study period.

In India 133 species of spiders representing 19 genera are recorded under family Lycosidae (Keswani et al., 2012). Vinoth Kumar et al., (2010) stated that six species of spiders viz., *Peucetia viridans* (Hentz), *Oxyopes* sp., *Argiope* sp., *Tetragnatha* sp., *Clubiona* sp. and *Thomisus* sp. were found in the cotton field in...
Coimbatore town. Sugumaran et al., (2010) reported 50 species belonging to 17 families in different places of the Shevaroy Hills, near Salem.

Shunmugavelu et al., (2011) reported 20 species of spiders in bhendi field of Chekkanoor near Madurai representing eight families and 15 genera. The most frequently encountered species are Argiope pulchella (Thorell), Argiope lobata (Pallas), Cyrtophora citricola (Forskal), Leucauge decorata (Blackwall), Neoscona crucifera (Lucas), Gasteracantha aciculata (Pocock), Cyclosa conica (Pallas), Hersilia savignyi (Lucas), Latrodectus hasselti (Thorell), Nephila pilipes (Fabricius), Peucetia viridana (Stoliczka), Peucetia graminea (Pocock), Oxyopes ratnae (Tikader), Stegodyphus sarasinorum (Karsch), Heteropoda phasma (Simon), Heteropoda venatoria (Linnaeus), Micrommata virescens (Clerck), Tetragnatha mandibulata (Walckenaer), Tetragnatha anguilla (Thorell) and Leucauge festiva (Blackwall). Ganesan and Shunmugavelu (2012) recorded a faunal survey of 25 species of spiders belonging to 21 genera and 10 families in Perumalmalai forest area, Tamil Nadu.

In recent years globally the diversity of spiders was recorded by Ghaffar et al., (2011) estimating a total of 3817 spiders belonging to 15 families, 36 genera under 81 species in citrus from foliage spider fauna in the Province of Punjab of Pakistan. The spider species distribution in the South African Savanna Biome represented 1,230 species belonging to 62 families and 381 genera was studied by Foord et al., (2011).

The spider fauna of Maldives in tropical Islands were limited. Sunil (2012) carried out 57 species of spiders belonging to 35 genera and 17 families from Maldive Islands in Indian Ocean. Rodrigues et al., (2012) described 14 species and two species of the spider genus Sphecozone as reported in Brazil. Pinzon et al., (2012) determined 9,288 ground dwelling spiders representing 15 families and 164 species in boreal forest in Canada.

During 2012, Batary et al., discussed spider biodiversity to local and landscape scale management intensity in cereal crops and grasslands from Germany. Kerzicnik et al., (2013) have described about 119 species of spider
belonging to 19 families were recorded from Semiarid Eastern Colorado agroecosystem in the United States. Dippenaar-Schoeman et al., (2013) have documented 51 families with 238 genera and 413 species of spiders were recorded from agroecosystem in South Africa. A total of 43 spider families under 60 genera were recorded from Montane grassland management practices in South Africa by Jansen et al., (2013).

In this present study, a total number of 19 families of spiders were recorded namely Araneidae, Oxyopidae, Nephilidae, Philodromidae, Sparassidae, Tetragnathidae, Theridiidae, Salticidae, Lycosidae, Pholcidae, Thomisidae, Clubionidae, Eresidae, Gnaphosidae, Hersiliidae, Miturgidae, Pisauridae, Scytodidae and Uloboridae. This observation is similar to the findings of Ghode et al., (1985) who recorded 21 species spiders belonging to eight families and they are Araneidae, Clubionidae, Lycosidae, Oxyopidae, Salticidae, Sparasiidae, Tetragnathidae and Thomisidae and were recorded from Puri district in Orissa.

Bhatkar (2011) listed 17 different families from Wan Sanctuary of Melghat tiger reserve, Maharashtra. The most frequently abundant families are Araneidae, Lycosidae, Salticidae, Thomisidae, Tetragnathidae, Nephilidae, Uloboridae and Eresidae. Sachin (2012) documented a total of 117 spider species under 58 genera of 20 families which are recorded in Jabalpur district of Madhya Pradesh. These studies were comparable to the present study in which, a total number of 71 spider specimens were documented belonging to Heteropoda venatoria species under the family Sparassidae during April 2010 – December 2010 (Karthikeyani and Kannan, 2012).

Araneidae is the third largest family, a reflection of its great diversity in the tropics (Platnick, 2013). Among species diversity, family Araneidae was the most dominating species that represents 12 species under seven genera. In similar results recorded by Umarani and Shunmugavelu (2010) documented 634 specimens in the Palani hills representing the family Araneidae which includes six genera and seven species of spiders. The most frequently encountered species

### 6.1.1 Seasonal variation of Spiders

In the present study of Kumbakarai Falls, the highest species occurrence was recorded during the Winter seasons, followed by post-Monsoon seasons and Summer. Thus it is clearly evident that abundance of spiders is directly related to seasons. This view can be compared to that of Levold and Finch (2009) who have recorded a maximum number of weaving spiders (Araneidae) at hibernation sites which were collected during the Winter season during 2004 and 2005 in Northwestern Germany. Ghavami (2008) had recorded the highest population of spiders during the Spring and Summer seasons of deserts and pomegranate orchards in Tetran and Semnan Provinces, Pakistan.

Temperature and humidity are the most important factors that influence the microenvironment of the species. The current observation on spider diversity during various seasons show that there are highly significant differences among the seasons. This could be attributed to the prevailing environmental conditions like temperature, rainfall, humidity and prey abundance. Almquist (1973) reported that temperature and humidity were the determining factors for the distribution and diversity of spiders. Spider density fluctuates by the growth occurrence and wide distribution of flora and other fauna.

The spider species richness and abundance are closely related to quality of resource both in terms of physical suitability of the habitat and environmental factors. Senthilkumar and Regupathy (2008) indicated that the location with high plant diversity harbours more spiders than the other locations. Thinning of vegetation influences the composition by creating new gaps or causing changes
in dominant tree species and topographic variations. Such influences will significantly affect the spider fauna because various functional groups of insects were found to be positively correlated with the species richness of the understory vegetation (Huang et al., 2011).

In the present investigation, the spider diversity has been positively correlated with the humidity and negatively correlated with atmospheric temperature. However, the reverse was reported by Hatley and Macmahon (1980) who showed that the number of species were positively correlated with atmospheric temperature and negatively correlated with relative humidity. This variation could be due to the regional differences, while the present study area is located in a tropical region and the other study was carried out at Green Canyon, Cache Country Utah, which has an elevation of 2800 MSL.

Spiders generally have humidity and temperature preference that limit them to areas within the range of their “physiological tolerances” which make them ideal candidates for land conservation studies (Riechert and Gillespie 1986). Therefore, documenting spider diversity patterns in this ecosystem can provide important information to justify the conservation of this ecosystem.

Shannon-Wiener diversity index used in the study shows much difference in spider distribution and their diversity. This index assumes that individuals are randomly sampled from ‘indefinitely large’ population (Peilou, 1975). The index also assumes that all spiders are represented in the sample. The observations show that in the study area the spider diversity and evenness was maximum in the Winter season of 2011 as per Shannon-Wiener diversity index (3.93 and 0.93) and comparatively poorer in the Summer season of 2009 (3.63 and 0.77). Index of dominance was found to be more or less same in all seasons. The data were calculated as per the method of Analysis of Variance. The recorded value is 9.82E-49, whereas comparative P value is (0.05) less than 9.82E-49. The investigated value is highly significant. The reasons for the fluctuations of spider diversity in different seasons may be due to climatic conditions, deforestation, forest fire, disturbance by other animals, and manmade disturbances. The similar
observation was made by Haddad et al., (2009) reported in Maputaland, South Africa.

6.1.2 Sampling of spiders

In the present study, spiders were collected from bushes, flowers, tree trunks, ferns, forest floor, foliage and grasslands by five different standard sampling procedures. Out of these sampling methods, the visual searching and hand picking method was found to be the most effective method with 49% of spiders recorded through this method during the study and 25.6% through sweep net method. Other methods such as beating tray, pit fall traps and leaf litter traps recorded 15%, 5.6% and 4.8% respectively. Tikader (1987) reported similar observations in his studies in India.

6.1.3 Habitation

The spiders are found to be living in different types of habitats. Spiders can adapt to a variety of environmental conditions. They inhabit almost everywhere on or near water bodies, under or on the terrestrial land, from the seashore to the tops of high mountains. Spiders also adopt to live in various climates existing on deserts and snow lands. They are distributed extensively in the fields, thick forest floors as well as in the human habitations and deserted buildings, under stones and logs and on tree trunks and flowering shoots (Tikader, 1987).

Habitat structure is a significant factor that influences spider diversity, abundance and distribution (Ghaffar et al., 2011). Among the spiders found in Kumbakarai Falls, Argiope aemula was also found to construct a large orb-web with an X-shaped stabilimentum. However, these juveniles construct X-shaped stabilimentum, with stripes not crossing at the centre. The species, Nephila pilipes was found to construct the largest orb-web with a diameter of about 1m to 2m. Hence they have a good dispersal ability, which facilitates colonization and diversification. These species web appears as golden colour in sunlight. So this species is commonly known as golden orb-web spider.
Spiders in general have very good defensive mechanism particularly though camouflage. Some of them are mimics. The features of mimics among these species, include an ant-like spider *Myrmarachne plataleoides*. Nelson (2012) described morphological and behavioural characteristics of ant mimicry in spiders from New Zealand. Similarly, Tikader (1973) had recorded some ant-like jumping spiders belonging to the genus *Myrmarachne* from India. The spider mimics extends not only to the body form but also in its behaviour, such as the spiders moving with anterior legs elevated like a pair of antennae. Narayan (1915) had investigated six ant-like spiders namely *Myrmarachne himalayensis*, *M. ramunni*, *M. uniseriatus*, *M. paivae*, *M. satarens* and *Harmochirus lloydii* from India.

The Brown flower spider, *Camaricus formosus*, has a typical crab-like appearance and it is found inside the flowers. Similarly another spider, *Thomisus lobosus* is also found in flowers and generally hides behind sepalas and petals, which resemble as bird-dropping. Two-tailed spider, *Hersilia savignyi*, resembles the bark of a tree, often spotted on trunks of coconut palms in a head down position and feeds on moths, ants and other smaller spiders. Brown crab spider, *Hystius minutes* are found on the ends of leaves, branches of various plants and often amongst dead leaves or dead flowers where they appear to be well camouflaged. In similar findings Chetia and Kalita (2012) documented bionomics of spiders in semi evergreen forest from Gibbon Wildlife Sanctuary, Assam.

In the present study at Kumbakarai Falls, Wolf spider *Pardosa amkhasensis* vigorously attacks its prey sensing vibrations such as the buzzing wings of insects, as well as visual signals. These spiders are generally found in freshwater-forest ecotones where their distribution is determined by their ability to respond to environmental moisture and prey availability. The uniqueness of the species are carried on the spiderlings dorsal of the abdomen. This report coincides with that of Gajbe, (2004a) who has described some Wolf spiders of the family Lycosidae observed in Madhya Pradesh. Most Gnaphosids are ground
dwellers and construct a silk retreat under stones or surface debris within which they remain during the inactive period. Their eyesight is poor and prey is perceived by tactile or chemotactic stimuli. This observation coincides with the study of Pinzon et al., (2011) who has observed the habitat of ground dwelling spiders found in boreal forest in Canada.

Pocock (1900) had recorded social spider, *Stegodyphus sarasinorum* from Ceylon which is also a widely distributed species found in Karnataka, Tamil Nadu and Kerala of South India, and Punjab of North India. Sociality among spiders is rare, as they are exclusively carnivorous as well as cannibalistic in nature. However, a social spider, *Stegodyphus sarasinorum* was recorded in large number of species in Kumbakarai Falls. They construct very large webs in which hundreds of individual spiders live together (Tikader and Biswas 1981).

The harmful spiders, *Loxosceles reclusa, L. deserta, L. arizonica* and *L. laeta* are found in North and South America. They are highly poisonous and have not been reported in India so far (Gajbe, 2004a). Similary, no exceptionally poisonous spider was found among the species recorded from Kumbakarai Falls.

### 6.2 Taxonomy of spiders

Taxonomy of spiders is an ambiguous one and consolidated information is yet to be collected in India (Kapoor, 2008). Pocock (1901) had described morphological characteristics of 39 new species of spider belonging to six families from British India. Tikader (1980) reviewed the general taxonomic characters of spiders of India with special reference to Thomisidae which comprised two sub-families belonging to 115 species of these, 23 species were new to science. Patel (2003) identified 91 species of spiders under 22 families as found in four sites of Parambikulam wildlife Sanctuary, Kerala.

In Kumbakarai Falls, the taxonomy of spiders has been studied and it includes the morphometric characters and distribution of 55 species of which three species are new to science. Gajbe (2007) observed taxonomic characters and distribution of spiders belonging to 125 species from Madhya Pradesh, India.
The taxonomy of spider *Thelyphonus sepiaris* (Butler) is reported for the first time from Madhya Pradesh by Talmale *et al.*, (2012).

### 6.2.1 New species

The most striking feature of the spider fauna of Kumbakarai Falls is the three new species of spiders namely, *Neoscona kumbakariensis* sp. nov., *Peucetia kumbakariensis* sp. nov. and *Plexippus gajbei* sp. nov. They are new to science and 10 species are new records for Tamil Nadu. In a similar study by Sanap and Mizra (2011), two new trapdoor spider species, *Scalidognathus nigriaraneus* sp. nov. and *Scalidognathus tigerinus* sp. nov. recorded from South Western Ghats of Tamil Nadu were reported. The first occurrence of the genus *Tigidia* is reported with the description of two new species from the Western Ghats in Tamil Nadu. They are *T. nilgiriensis* sp. nov., in Kotagiri, Nilgiri District and *T. rutilofronis* sp. nov., in Maruthamalai, Coimbatore District, and described by Siliwal *et al.*, (2011).

Jose and Sebastian (2007) observed new species of the genus, *Thelcticopis* (Araneae: Sparassidae) in India. They are *Thomisus meenae* sp. nov., *T. dhananjayi* sp. nov., *T. pritiae* sp. nov., *T. manjuae* sp. nov., *T. manishae* sp. nov., *T. ashishi* sp. nov., *Xysticus viveki* sp. nov., and *X. yogeshi* sp. nov. Two new species of the spiders, *Oxyopes kobaenis* sp. nov., *Oxyopes boriensis* sp. nov. from Oxyopidae family were described in central India from Koha and Bori meadows, Goa after two years of resettlement of forest villages as reported by Bodkhe and Vankhede (2012).


A new record of Theraphosinae spider genus *Catanduba* (Araneae: Theraphosidae) comprising five new spider species viz., *C. tuskae* sp. nov., *C. araguaia* sp. nov., *C. piauiensis* sp. nov., *C. canabrava* sp. nov., and
C. peruacu sp. nov., were recorded from Central Brazil in Cerrado areas by Yamamoto et al., (2012). Platnick and Duperre (2011) documented 17 new species representing Andean goblin spiders from Peru. Similarly, Eichenberger et al., (2012) discovered 14 new species of the spider genera Gamasomorpha and Xestaspis (Araneae: Oonopidae) from Indonesia. The discovered species are G. asterobothros sp. nov., G. keri sp. nov., G. petoteca sp. nov., G. insominia sp. nov., G. ophiria sp. nov., G. squalens sp. nov., G. coniacris sp. nov., G. raya sp. nov., G. fricki sp. nov., G. Schmilingi sp. nov., X. kandy sp. nov., X. paulina sp. nov., X. semengoh sp. nov. and X. bifloccin sp. nov. They are very diverse and differ only by the shape of the booklung covers. Dankittipakul and Deeleman-Reinhold (2013) have documented five new spider species from South East Asia. The recorded species are Sesieutes minuatus and Sesieutes aberrans from Thailand, Sesieutes abruptus and Sesieutes befidus from Malaysia and Sesieutes apiculatus from Indonesia.

The main taxonomical identifications of the spiders are based on their cephalothorax, abdomen, epigyne and internal genitalia that vary from species to species (Sen et al., 2013). The Araneidae is a large cosmopolitan family commonly known as orb weavers. They are relatively large in size and colourful (Rodrigues and Mendonca, 2011). In the present study, the orb weavers Neoscona kumbakariensis sp. nov. (Araneae: Araneidae) resemble Neoscona mukerjei Tikader and can be distinguished from characteristic cephalothorax which is brownish-black in colour without patch, but N. mukerjei cephalothorax is brown in colour provided with V shaped patch. The dorsum of abdomen is uniformly brownish-black in colour without any patch, but in N. mukerjei with club shaped greyish white patch. Epigyne and internal genitalia are also structurally different from N. mukerjei. This record is compared with Gajbe’s (2004a) report which has described two new orb weavers, N. dyali sp. nov., and N. sanjivani sp. nov., from Jabalpur, Madhya Pradesh.

The unique diagnostic characteristics of family Oxyopidae species are hexagonal eye arrangement, much tapered abdomen and heavy spination on the
legs (Gajbe, 2008b). In the present study, *Peucetia kumbakariensis* sp. nov. (Araneae: Oxyopidae) has similar appearance to *Peucetia rajani* Gajbe but differs in cephalothorax with black marking on lateral sides, but in *P. rajani* with black spots are found all around cephalothorax. Sternum is provided with yellowish-green in colour without spots, but *P. rajani* with black roundish spots. Whereas the lateral side of the abdomen is provided with a longitudinal white line with red marks and mid-dorsally provided with three pairs of yellowish spots and one pair of whitish spot, but *P. rajani* with two lateral and one transverse white stripe and mid-dorsally provided without spots. Posterior end of the abdomen is found with three transverse black bands marking, but *P. rajani* is without black bands marking. In a similar study, Gajbe (2008b) documented six new *Peucetia* species of spiders from Sundarban forest in West Bengal, India. The recorded species are *P. biharensis, P. ketani, P. pawani, P. ranjani, P. viveki* and *P. yogeshi*.

Salticids are the largest and most diverse family in India. Keswani et al., (2012) listed about 207 described species belonging to Salticidae. Even though their number is larger, they are one of the least studied families among Indian spiders (Sunil, 2013). The jumping spiders of Salticids are renowned for their often fantastic colouration and wild and interesting range of behaviours (Biswas, 1984). In the present study, the Zebra jumper *Plexippus gajbei* sp. nov. (Araneae: Salticidae) resembles *Plexippus mandali* Tikader, but with a difference in cephalothorax and abdomen with white patch on lateral sides found in *P. gajbei* but absent in *P. mandali*. Epigyne and internal genitalia are also structurally different from *P. mandali*.

The uniqueness of species compositions, as indicated by levels of endemism and habit specialization are more important in establishing regional conservation priorities (Platnick, 1991). However, the species level taxonomy remains poor for many groups of spiders. There are sparse distributional information and a variety of techniques are needed for a reasonable complete inventory study.
6.3 Guild composition of spiders

Habitat complexity consists of the arrangement of the physical elements in the environment in a way that provides support for organisms (Cunha et al., 2012). The distribution and occurrence of spiders are strongly influenced by habitat structure and vegetation parameters (Souza and Martins, 2004).

The organisms in guilds describe part of the communities’ structure and can be valuable in comparative descriptions of different communities. Uetz et al., (1999) stated that spider guilds could be established using the family level determination. Several studies have been made using this approach to describe the community structure of spider assemblages. Cardosa et al., (2011) determined a global pattern of guild composition and functional diversity of spiders. They have described eight guilds such as sheet, space, orb web weavers, specialists, ambush, ground and other hunters. In this present study area, the guild structure analysis has revealed six functional groups belonging to 19 families such as Foliage runners, Orb web builders, Ground runners, Ambushers, Scattered line weavers and Sheet web builders.

Spider families serve as ecological surrogates for species. The different families present similar roles in the ecosystems, with replacement of some taxa by other within the same guild. As per the available literatures of guild structure and composition of spiders in different crops viz., peanut, alfalfa, soybeans, rice, corn, cotton, sugar and sorghum fields in the USA and guild concept has been used to compare spider communities in agro ecosystems (Uetz et al., 1999). Kerzicnik et al., (2013) have reported that the hunting spider guild represented 89% of the spider fauna found in eastern Colorado agroecosystems, United States.

The abundance of the foliage spiders depends upon the branch variables such as diameter, length and number of branching angles (Ghaffar et al., 2011). For instance, the dominant guild was the foliage runners, in contrast to the results of Sebastian et al., (2005b) and Sudhikumar et al., (2005) which reported that orb web weavers constituted the dominant feeding guild. The dominant
guild of foliage runners is dependent on vegetation for some part of their lives, either for finding food or for building retreats. Hore and Uniyal (2008) described guild structures of spiders that vary considerably in relation to the structural quality of five vegetation types in Terai conservation area, India. The structure of the vegetation is therefore expected to influence the diversity of spiders found in the habitats. Spiders in tropical regions seem to have higher redundancy of functional roles and fine resource partitioning than in temperate regions. Although species and family diversity were higher in tropics, functional diversity seems to be influenced by habitat structure (Cardosa et al., 2011).

6.4 Predatory potential of spiders

The capability of spiders on prey-capture strategies are diverse. Spiders are the only class of arthropods that are entirely predatory in nature and occupy an important part of the overall predatory authorized fauna in different terrestrial ecosystems. The population of the spiders are directly proportional to the population of the pest. Most of the spiders feed on a variety of insects and other prey species for their survival and reproduction. Hence, spiders are interacting with other organisms found on the same habitat and in many cases they act as regulatory forces influencing the pest populations (Karthikeyani and Kannan, 2012).

The huntsman spider, *Heteropoda venatoria* is ground runners and uses native vegetation and leaf litter for shelter, breeding, feeding and protection against desiccation like in other spiders (Romero and Vasconcello-Neto, 2004). During this study, *Heteropoda venatoria* was proved to be more effective than *Musca domestica* and 21 adults of *Nilaparvata lugens*. This view has been supported by the findings of Shukla and Lele (2008). Due to the huntsman spiders, *Heteropoda venatoria* feed on pests in crop, other domestic harmful insects and cockroaches in tropical countries.

Mostly jumping spiders hunt by pouncing on their prey and gauging distances to their unsuspecting meals in a way that appears to be unique vision and such traits have been discussed by Castro (2012). The jumping spider of
Plexippus paykuli consumed a maximum number of preys, Musca domestica (38) and Moth of Corcyra sp. (34). This finding is in accordance with that of Rossi and Godoy (2006) who demonstrated that the predation impact of spider on prey Dermestes ater was less when compared to the prey Musca domestica.

The predator classifies prey and its ability to discriminate between prey types. It is conceptually different from simply determining a predator’s natural diet or determining whether a natural diet deviates from a random sample of prey available in the environment (Huseynov et al., 2008). Among the three preys tested, moths of Corcyra sp. were consumed more by all the five species of spiders.

According to Kamal et al., (1990) and Sugumaran (2010) many of the spiders feed on the preys which were greater than their body size. They observed predatory potential of six spider species, and found H. venatoria and P. paykuli were efficient predator which consumed a maximum number of preys. Palanichamy (1983) had reported the predatory habits of jumping spider Marpissa sp. which feeds on more number of preys when compared to other spiders.

Spiders possess the characteristics of predators that can contribute to density-independent limitation of prey, including self-damping, high levels of polyphagy, and life cycles that are asynchronous to those of prey species (Skerl, 2011). Usage of herbicide in agriculture reduces the predatory potential of spiders, as the pests become distasteful. This circumstance increases the chance of escape for the prey from predator (Tahir et al., 2012).

The webbing sites of web builders are easily affected by environmental factors in addition to the web spaces overlapping; there is competition among the species and between species of web builders. Therefore, hunters probably are more effective predators than web builders. In particular, the interaction of prey and predator showed a constant numerical interaction about this relationship which is fundamental to biological control. Thus spiders are considered as agents
of biological control against pests in agro-ecosystems and forests (Nyffeler, 1999). Their role in biological control is a community phenomenon in which a high diversity of spiders is very important (Prieto-Benitez and Mendez, 2011).

A large number of spiders feed on insects like houseflies and mosquitoes, which are carriers of pathogens causing serious diseases in human beings. Assemblages of spider species reduce populations of many insect pests of cultivated crops, including leafhoppers in rice (*Oryza*) (Oraze and Grigarick, 1989), aphids in spring barley (*Hordeum*) (Chiverton, 1986), caterpillars in taro (*Colocasia*) (Nakasuji *et al.*, 1973) and cotton (*Gossypium*) (Mansour, 1987), and scale insects in orchards (Mansour and Whitcomb, 1986).

Spiders are active biological control organisms in rice fields of China, Philippines, Taiwan, Japan, and Thailand (Okuma, 1968). The study records reveal that spiders act as potential biocontrol agents as reported by Clarke and Grant (1968). The role of spiders in regulation of insect pests has been studied in the rice agriculture fields of Aduthurai, Tamil Nadu as described by Jayakumar and Sankari (2010). Pekar *et al.*, (2012). They reported a prey race drives differentiation of biotypes in ant-eating spiders of the genus *Zodarian* as a biocontrol agent in Iberian Peninsula. The *Zodarian cesari* species (Araneae: Zodariidae) is specialised ant eating predators in four citrus groves (Monzo *et al.*, 2013). Dippenaar-Schoeman *et al.*, (2013) discussed agrobiont spider species playing an important role as natural control agents of pests on crops in South Africa.