Entomology

Assemblage of spiders diversity - an agent of biological control of agricultural pests

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Abstract

Arachnids provide an important service by keeping insect populations under control. Spiders are acting as an agent of biological control of insects; without them many insects would have reached high level of pest proportions. This present investigation was aimed to attain the diversity of spider fauna of cultivated croplands of Swamimalai Region of Cauvery Delta, Tamil Nadu. The data on diversity of spiders was investigated by hand picking method. The spotted spider specimens were photographed and left in the same environment without disturbing it. A total of 31 species of spiders under 13 genera were recorded in buildings, wooded areas and cultivated regions. Spiders are normally built nests on their living habits for dwelling as well as catching prey which are trapped in their nests. This is only the baseline study but it needs a long-term inventory which will fulfill the lacunae of spider diversity in the study area.

Keywords: spiders, arachnids, diversity, biological control, cauvery delta

Introduction

Spiders are belonging to the class Arachnida and like all other arachnids, they have two body parts, which are cephalothorax and abdomen. The abdomen is very soft and are unsegmented while the cephalothorax is harder having four pairs of legs which is the special characters of spiders differ from others. As hinted by Oyeniyi Abiola Oyewole (2014) [11] they are lack of wings and antennae. Most of the arachnids are carnivorous in nature and preying on insects and other terrestrial organisms. They provide an important role on keeping agricultural pest insects under control. It is evident that spiders are acting as biological control agent on controlling insect pests. Spiders under the order Araneae are mainly feed on insects. However, they can consume their food in the form of liquids, since they are lacking of chewing type of mouth parts. They normally use Chelicera, the pointed appendages present in front of the cephalothorax which help to grasp the prey and inject venom. Digestive enzymes are breaking the food down into liquid, which will be ingested by the spiders.

Araneae is one of the largest carnivorous group of animals on the planet. Researchers have recorded over 75,000 species of arachnids and many more are unrecorded. Diversity, distribution and feeding habits of insects are suspected of playing an important role in the balance of nature (Oyeniyi Abiola Oyewole., 2014) [11]. Foelix (1996) [5] stated that the loss and degradation of natural habitats results in the loss of biodiversity worldwide. Continuous degradation and alteration of tropical forest habitats become serious issue of modification of landscapes. These kinds of developments make critical consequences to the biodiversity (Tikader, 1987) [22]. It is evident that spiders are friends of farmers as they control different types of pests on cultivated crops (Veeramani *et al.*, 2021) [24].

Since now major contributions of research on arachnology was made by Pocock and Tikader which made the modern researchers to take interest in research on spiders (Veeramani *et al.*, 2021) [24]. According to Ghafoor and Mohamood (2011) [7] biological control through spiders is one of the best strategies to reduce the use of chemical pesticides as well as the population of the insect pests. Similarly taxonomic studies of spider species from various micro habitats were investigated by various researchers (Vungsilabutr, 1988; Sahu *et al*., 1996; Patal, 2003; Mathirajan and Raghubathy, 2003; Vanitha *et al.*, 2009; Bhatkar, 2011; Phalgum Chetia and Dilip Kumar Kalita, 2012 and Mohsin Bukhari *et al.*, 2012) [25, 18, 12, 8, 23, 2, 14, 9]. The present investigation was aimed to carry out survey of spider fauna in the associated cultivated fields of Swamimalai Region of Cauvery Delta, Tamil Nadu. No specific extensive studies on spider faunal diversity in this region were done and published. It is the first approach to study the spider fauna, thus providing base line information for future studies. The objectives of the study include to estimate the assemblage of spiders diversity in the wooded and cultivated fields, study the occurrence of spiders in different habitat types and also to suggest suitable conservation strategies for spiders.

Materials and methods

Collection and identification of spiders

The diversity and density of spiders was investigated throughout the study period by hand picking method. The spotted spider specimens were photographed and left in the same environment without disturbing it. All specimens were identified using the taxonomic keys for Indian spiders given by Tikader (1987) [22], Biswas and Biswas (1992) [3] and Sebastian and Peter (2009) [20]. The diversity of spiders was analyzed by extensively used indices *viz*., The Shannon–Wiener index (H1), which is responsive to changes in the great quantity of rare species in community and the Simpson index (λ), which is sensitive to changes in the most abundant species in a community, and Margalef Richness which were calculated

using biodiversity pro software version 2.
Diversity index was calculated by using following formula.
Diversity index (H`) = -Sum[(pi) * ln(pi)]
Evenness (E) = H/Hmax : Hmax = ln(S)
Where, H` = diversity index; Sum = Summation
Pi = Number of individuals of species i/total number of samples
S = Number of species or species richness
Hmax =Maximum diversity possible: E = Evenness

Results

A total of 31 species of spiders under 13 genera and 13 families (Table 1) were recorded during the survey period in buildings, wooded areas and cultivated regions of Swamimalai region. This area is rich in floral diversity. In this observation salticidae is the most represented family with 14 species followed by Sparassidae with 4 species, Lycosidae and Tetragnathidae had 2 species each. Other species represent each one family (Fig. 1).

Table 1: Spider species recorded in the study area

Sl. No.	Family	Species Name	Common Name	Habit
1	Araneidae Clerck, 1757	*Neoscona nautica* (L. Koch, 1875)	Grey sphere spider	Orb Web builders
2	Ctenidae Keyserling, 1877	*Ctenus* sp.	Tropical wolf spider	Bark Spider (Ground runners)
3	Hersiliidae	*Hersilia clypealis* Baehr & Baehr, 1993	Long-spinnered bark spiders and two-tailed spiders	Tree trunk spider
4	Lycosidae Sundevall, 1833	*Draposa* sp. Kronestedt 2010	Wolf spider	Bark Spider (Ground runners)
5		*Arctosa littoralis* (Hentz, 1844)	Beach Wolf Spider	Stalkers
6	Salticidae Blackwall, 1841	*Evarcha flavocincta* (C. L. Koch, 1846)	Jumping spiders	Stalkers
7		*Hyllus semicupreus* (Simon, 1885)	heavy-bodied jumper (or) semi-coppered heavy jumper,	Stalkers
8		*Hyllus* sp.	Jumping spiders	Stalkers
9		*Plexippus paykulli* (Audouin,1826)	Jumping spiders	Stalkers
10		*Plexippus petersi* (Karsch 1878)	Small Zebra Jumper	Stalkers
11		*Telamonia dimidiate* (Simon, 1899)	Two striped Jumping spider	Stalkers
12		*Telamonia c.f. festiva var.* Thorell,1887	Jumping spiders	Stalkers
13		*Brettus cingulatus* Thorell, 1895	Jumping spiders	Stalkers
14		*Telamonia dimidiata* (Simon 1899)	Two-striped jumper	Stalkers
15		*Lyssomanes viridis* (Walckenaer, 1837)	Magnolia green jumper	Stalkers
16		*Carrhotus viduus* (C. L. Koch, 1846)	Jumping spiders	Stalkers
17		*Chalcotropis pennata* (Simon, 1902)	Jumping spiders	Stalkers
18		*Phintella. vittata* (C. L. Koch, 1846)	Jumping spiders	Stalkers
19		*Hindumanes karnatakaensis (Tikader & Biswas 1978).*	Jumping spiders	Stalkers
20	Philodromidae	*Psellonus planus* (Simon, 1897)	Philodromid crab spiders	Stalkers
21	Pholcidae	*Crossopriza lyoni* (Blackwall, 1867)	Tailed cellar spiders, tailed daddy longlegs spiders	Cellar spider
22	Oxyopidae	*Oxyopes javanus* Thorell, 1887	lynx spiders	Stalkers
23	Sparassidae Bertkau, 1872	*Hetetopoda venatoria* (Linn. 1767)	Huntsman Spider	Wandering (Foliage runners)
24		*Heteropoda maxima* Jäger, 2001	giant huntsman spider	Wandering (Foliage runners)
25		*Micrommata virescens* (Clerck, 1757)	Green Huntsman Spider	Wandering (Foliage runners)
26		*Palystes castaneus* (Latreille, 1819)	Rain spiders, or lizard-eating spiders	Wandering (Foliage runners)
27	Tetragnathidae Menge, 1866	*Tylorida striata* (Thorell, 1877)	Huntsman spiders (or) cane spider	Orb web Builders
28		*Tetragnatha montana* Simon, 1874	silver stretch spider,	Long-jawed orb weaver
29	Theridiidae Sundevall, 1833	*Steatoda grossa* (C.L. Koch, 1838)	Cobweb spiders	Scattered line weavers
30	Thomisidae Sundevall, 1833	*Thomisus onustus* Walckenaer, 1805	Flower crab spiders	Foliage dweller (Ambushers)
31	Zodariidae Thorell, 1881	*Zodarion sp.*	Ant spider	Burrowers

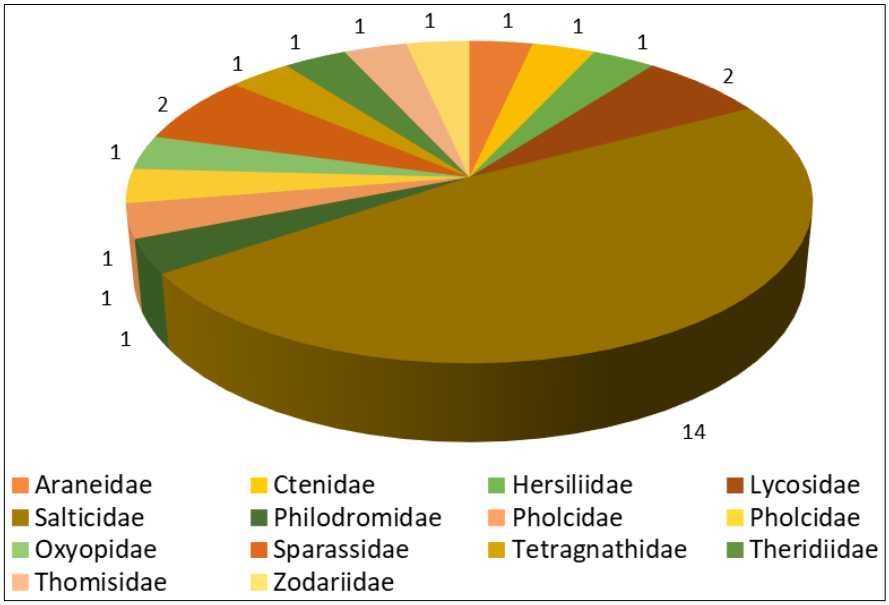


Fig 1: Familywise spider species recorded

Spiders are normally built nests for their living habits for dwelling as well as catching prey which traps in their nests. The habits of different spider species such as Stalkers with 55%, Foliage runner 13%, Orb web builders 10%, Ground runner 6% and others are 3% each (Fig. 2).

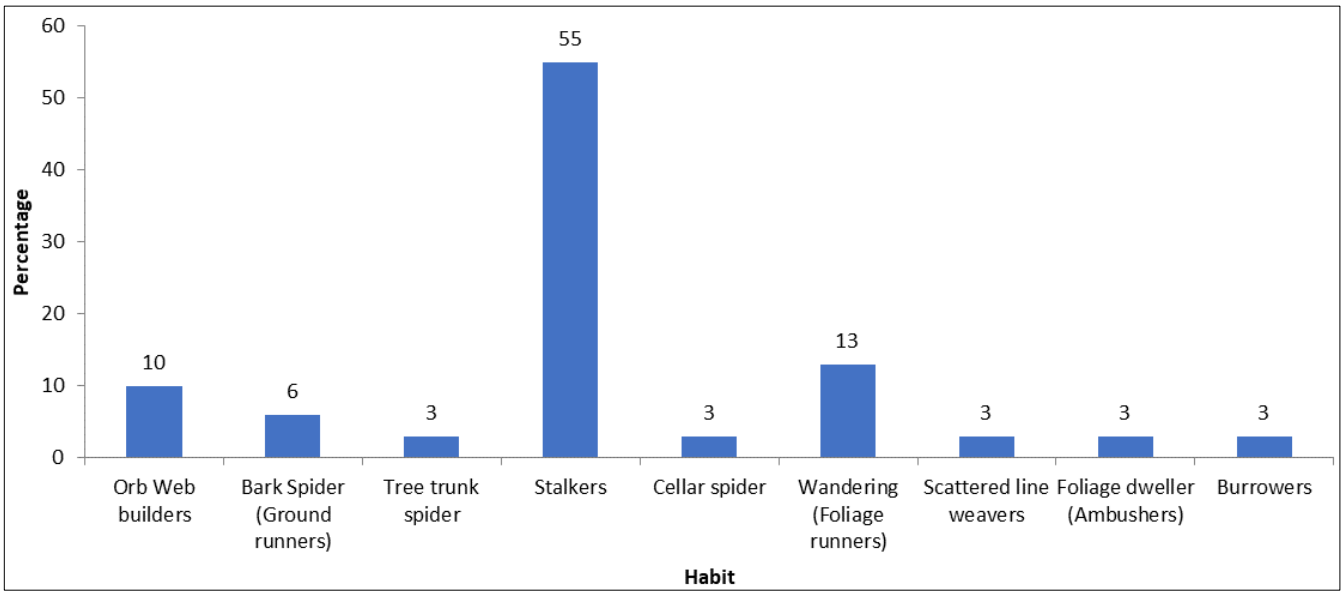


Fig 2: Habits of spiders in the study area

Ecological parameters *viz*., species richness (R) was 1.786, 1.645, 1.568 and 1.752, Shannon diversity index (H) were 2.535, 1.879, 2.347 and 2.142, Evenness index (E) were 0.8831,0.8432,0.9745 and 0.9637, in the month of Feb. 2022 to May 2022 respectively in the association of spiders in the study area (Table 2).

Table 2: Species diversity indices for monthly sample collection of spiders

Indices	Feb. 2022	Mar.2022	Apr. 2022	May 2022
Diversity (H^1 Log)	2.535	1.879	2.347	2.142
Richness (D)	1.786	1.645	1.568	1.752
Evenness (J^1)	0.8831	0.8432	0.9745	0.9637

Discussion

The dominant families observed in the present study was almost similar to the studies conducted in different parts of the country. An extensive study on the spider fauna in rice field of Philippines demonstrate their influence in the control of insect pests (Barrion and Litsinger, 1995) [1]. Tetragnathidae are commonly called stretch spiders, referring to their elongated body form. When disturbed, they will stretch their front legs forward and the others in the other direction, thus being able to hide on blades of grass or similar elongated substrates. The body and leg shapes and the silver, black and yellow markings of Leakage make identification of the genus relatively easy. In most cases the web is slanted rather than vertical and the spider rests in the middle of the web with its underside facing upwards (Rod and Ken, 1984) [17]. The web is usually horizontally inclined over streams or bodies of water in sunlit areas. It is taken down and reconstructed daily and the spider is often found on an incomplete (Tikader, 1982) [21]. Salticidae, are active hunting spiders capable of jumping over a distance. They are diurnal in activities. They move by walking, running, jumping or leaping and use all these movements in prey capture. They hunt the prey by stalking, chasing and leaping over it. Prey includes mainly insects. Some also prefer other spiders or ants. A few salticids also exhibit aggressive mimicry. They usually do not use web for capturing the prey (Everton and Milton, 2009) [4]. A great work has been conducted in Indravati Tiger Reserve, recorded 13 species (Gajbe, 1995) [6]. Another study in Kanha Tiger Reserve, Madhya Pradesh recorded 5 species (Rane and Singh, 1977) [16]. An ecosystem wise study of spiders was initiated in India by Patel. He conducted an extensive study on the predatory spiders from different crops of Sayurashtra and North Gujarat and described 56 species of spiders belonging to 34 genera distributed in 18 families (Patel and Vyas, 2001) [13]. Araneidae is a large cosmopolitan family commonly known as orb weavers. The family exhibits a wide variation in size, color, shape and behavior. They construct perfect webs with sticky spiral or a modified orb web as in Cyrtophora. Another study on the spider fauna conducted in Kuttanad rice field, Kerala identified 1632 individuals from 69 species, 49 genera and 17 families. Most species rich family was salticidae followed by tetragnathidae and araheidae (Sebastian *et al*., 2006) [19].

The spider fauna of India is represented by 1520 spider species belonging to 377 genera and 60 families (Oxford and Gillespie, 1998) [10]. The study represents 18 families, 56 genera and 95 species arranged on their field. The distribution of some families was found to be continuous (Araenidae, Salticidae, Tetragnathidae etc), while some had very discontinuous distribution. Coloration in spiders varies extensively among the species due to different environmental effects which also is due to different behavioral pattern observed on them (Pocock, 1900) [15].

Neoscona nautica (L. Koch, 1875)

Ctenus sp.

Draposa sp. Kronestedt 2010

Evarcha flavocincta (C. L. Koch, 1846)

Hyllus sp.

Plexippus paykulli (Audouin,1826)

Telamonia dimidiate (Simon, 1899)

Telamonia c.f. festiva var. Thorell,1887

Hetetopoda venatoria (Linn. 1767)

Micrommata virescens (Clerck, 1757)

Tylorida striata (Thorell, 1877)

Steatoda grossa (C.L. Koch, 1838)

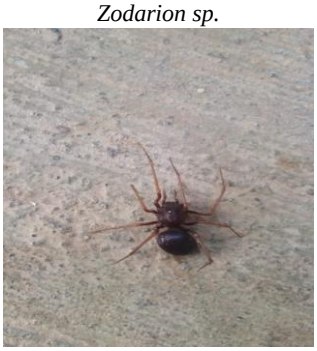
Thomisus onustus Walckenaer, 1805

Zodarion sp.

Lyssomanes viridis

Plexippus petersi

Psellonus planus



Telamonia dimidita

Arctosa littoralis

Brettus cingulatus

Carrhotus viduus

Chalcotropis pennata

Thomisus onustus

Tetragnatha montana

Palystes castaneus

Micrommata virescens

Phinetella vittata

Crossopriza lyoni

Oxyopes javanus

Thomisus onustus

Hersilia clypealis (Baehr & Baehr, 1993)

Hyllus semicupreus

Heteropoda maxima

Hindumanes karnatakaensis

Fig 3: Spider species recorded in the study area

Conclusion

A total of 31 species of spiders under 13 genera and 13 families were recorded from the study indicate diversity of spiders in the area. Spiders like *Ctenus* sp. and *Draposa* sp. are natural enemies of insect pests of rice were also recorded in the study. This throw light on the beneficial role played by spiders as biological control agents of pests of paddy. Preservation of spiders necessitates abandoning of these pesticides, or spot treatment and rational use of the same. Once pesticides are kept away from the fields, spiders invariably take shelter in the fields, feed on the pests and add to the productivity. This is only the baseline study but a long-term inventory will fulfill the lacunae of spider diversity in the Cauvery Delta region.

Conflict of interest

The Authors does not have any conflict of interest.

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