Research Paper Zoology

# Spider diversity of Agroecosystem in Washim district (MS) India

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**ABSTRACT**

*Present study on spider diversity were made during 2011-12 in Agroecosystem dist. Washim. During investigation 11 family 30 genera and 65 species were recorded from agroecosystem. Prominent member of family salticidae(37%) followed by Araneidae(14%),and Thombicidae 14% were recorded from agroecosystem . Among Generic diversity Runcinia sp (4.79%); Opisthoncus sp (2.9%); Arnaeus Sp 1(2.77%); Cyclosa sp2 (2.65%), Phintela vitata 2.27% were observed in agroecosystem of Washim district*

Keywords : Attitude of teachers, classroom behavior, tribal children

**Introduction**

Recent trends in agriculture towards reduced pesticide use and ecological sustainability have lead to increased interest in spiders as potential biological control agents. Although the Chinese have augmented spider populations in field crops as a pest management strategy for centuries, much debate remains as to whether spiders will effectively control pest populations in U.S. agricultural ecosystems (Riechert and Lockley 1984; Riechert and Bishop 1990; Riechert 1999; Greenstone and Sunderland 1999; Darlene et al. 2003). Spiders may be capable of fulfilling both of pest reduction and pest stabilization requirements (Morin 1999; Pedigo 2001).

Although the spiders (Araneae) are a diverse arachnid order consisting of more than 1520 species in India (Sebastian and Peter, 2009), all are obligate predators, and many feed upon herbivorous pest insects. The orb-web weavers Araneidae and Tetragnathidae feed upon Homoptera such as leafhoppers, Diptera, and Orthoptera, especially grasshoppers. The smaller, sheet-web weavers such as Linyphiidae, Dictynidae, and Theridiidae capture Diptera, Hemiptera, and Homoptera (especially aphids and leafhoppers), as well as beetles in the family Curculionidae. The funnel-web weavers (Agelenidae, Atypidae, Ctenizidae, and Eresidae) prey upon Orthoptera, Coleoptera, and Lepidoptera (Riechert and Bishop 1990; Nyffeler et al. 1994a). Hunting spiders, (Lycosidae, Oxyopidae, Thomisidae, and Salticidae) frequently capture Orthoptera, Homoptera, Hemiptera, Lepidoptera, Thysanoptera, Diptera, and some Coleoptera and Hymenoptera (Riechert and Bishop 1990; Young and Edwards 1990; Nyffeler et al. 1994a).

Agriculture is a human activity which makes great use of terrestrial ecosystems. Land occupation associated with wrong use of pesticides has lead to serious environmental issues (Amaro, 2003; Norris et al. 2003). In India spider's knowledge on agroecosystems is very poor: many spider species still remain to be described and there is a great difficulty in this taxon identification, given the scarce information available (Cardoso, 2004). There are some studies on spiders in Rice fields (Ambalaparambil et al.2005) and Many researchers have provided descriptions of spider species abundance or composition in a variety of agroecosystems (Wisnieswka, Prokopy 1997), but none on cotton ,papaya , soyabean and on wheat crops . However, these studies were mostly limited to the identification of spiders and investigation of the dominant spider species. In this project, we document the araneofauna associated with the Papaya, soya, cotton and wheat farm ecosystem in Washim district (vidharbha), India, based on studies conducted during two crop seasons.

**MATERIALS AND METHODS**

Spider were collected from different agroeco system of Washim is a district of Maharashtra state in India. Washim is the district headquarters of newly formed Washim district. Washim district covers the 5150 Sq. Km. area. Washim district is located in the eastern region of Vidharbha. The district had a population of 1,020,216 of which 17.49% were urban as of 2001.

There are hilly ranges extending from through the tehsils of Malegaon, Washim, Mangrul Pir and Manora. There are some parts covered by the forests.

The present study is undertaken since July 2011 to February 2012 to make checklist of families, genera and species of spiders of agro-ecosystem in Washim district. This is the only preliminary study; still the study is in progress. In near future, more faunal surveys are planned to study in detail the spider diversity.

Following methods are used for the collection of spider. Spiders were collected from different region of Washim district. With the help of insects nets, pitfall trap, stroking sticks umbrellas were used. Selected specimens were preserved in 70% alcohol, labeled and identified according to Tikader (1962,1973,1982).

**Identification:**

Identification was done on the basis of morphometric characters of various body parts. The help was mainly taken from the keys and catalogues provided by Kaston (1978), Tikader and Biswas (1981),Tikader(1982), Davies and Zabka (1989), Plantnick (1989), Biswas and Biswas (1992), Barrion and Litsinger (1995), Gajbe (1987), Nentwig et al.(2003), Platnick (2004), and Vankhade et al (2008).

**Collection Spiders:**

The easiest way to capture and collect spiders is to scare them into a dry container and then transfer them into a container with alcohol. The container can be placed in a freezer for a few minutes. In the freezer the spider will enter torpor and die relatively quick and may experience fewer traumas. Carbon dioxide gas can also be used to anesthetize spiders. The following are a few basic methods used while collecting spiders. 1. Visual search, 2. Sweeping, 3. Beating.

Spiders are identified by structure. They are classified into families by the arrangement of the eyes, number of claws, location and arrangement of certain specialized hairs and spines ,structure and arrangement of the spinnerets (silk spinning organs at rear end), and other characters that you cannot see with the naked eye. Within families, species are separated mostly by the fine structure of the sex organs, which can't be seen without high magnification. Color patterns can be very variable within species, and very similar between different species

**Results**

Present study on spider diversity were made during 2011-2012 in Agroecosystem dist. Washim (vidharbha), India. Spiders representing 11 families, 30 genera and 65 species were recorded from agro-ecosystem during the study (Tables 1, 2 and fig. 1- 68 ). This represents 18.33 % of the total families reported from India (Sebastian and Peter, 2009). Salticidae was the dominant family constituting 18 species from 11 genera. The Araneidae was represented by 17 species from 4 genera. On species level, Runcinia sp and Phidippus regius was the dominant species. Guild structure analysis revealed seven feeding guilds (Uetz et al. 1999). These are orb web weavers, stalkers, ground runners, foliage hunters, sheet web builders, scattered line weavers and ambushers (Table1). Stalkers constituted the dominant feeding guild representing 40 % of the total collection (Graph 2 ). They are followed by orb weavers , Ambushers, foliage hunters and ground runners constituting 39 %, 13 % and 3% respectively of the total catch.

Table:- 1. Total number of families, genera and species composition of spiders sampled from different agroecosystem of Washim districts.

| Family | Genera | Species | Individuals | Guilds |
|---|---|---|---|---|
| Araneidae | 4 | 17 | 242 | Orb weavers |
| Clubinoidae | 02 | 03 | 18 | Foliage runners |
| Eressidae | 01 | 02 | 30 | Orb web weavers |
| Lycosidae | 03 | 09 | 25 | Ground runners |
| Mimetidae | 01 | 01 | 4 | Foliage hunters |
| Oxypidae | 01 | 04 | 20 | Stalkers |
| Salticidae | 11 | 18 | 300 | Stalkers |
| **Sparassidae** | 01 | 01 | 01 | Foliage runners |
| Tetragnathidae | 01 | 03 | 40 | Orb weavers |
| Theridiidae | 01 | 01 | 12 | Space builders |
| Thombicidae | 04 | 06 | 100 | Ambushers |
| Total | 30 | 65 | 792 | |

Most of the spiders from Araneidae are inhabitants of shrubs and grasses. In Neoscona abdominal variations are noted with respect to colour patterns. The genus Argiope, commonly known as "Signature spider" is mostly found in orb web built in grasses and sometimes webs are built on shrubs like Lantana camera. Spiders belonging to the families, Tetragnathidae, inhabit river and stream beds in Sanctuary. Spiders from Tetragnathidae are found to feed on insect larvae. They are seen sitting on their single silk thread which extends from exposed stone to nearby stone in the river bed. During rest, they are seen hanging in a straight line with extended legs parallel to silk thread.

The spiders collected in the largest numbers were Araneus sp (2.77%) of total collection), Cyclosa sp2 (2.65%), Opisthoncus sp. (2.90 % ). Phidippus regius(3.28%) Phintella vittata(2.39%) Runcinia albostriata(2.90%) and Runcinia (4.79%), Hasarius adansoni , Paradosa sp1,and Clubiona recluse, Paradosa sp 3 , Uloborus sp and Plexippus paykulli, were recorded frequenly Table 2 . The major component of the spider population found in this ecosystem was the family Salticidae composed mainly of Telomonia dimidiate , Evrchasp. Phidipus sp. Phintela sp. Plexipus sp. And Marpisa sp. and the family Araneidae mainly composed of Araneus sp 1,Araneus sp 4 ,Araneus sp5 and Cyclosa sp . Besides the above, Thombicidae and Lycosidae were found in relatively large numbers. The families Salticidae constituted 37 % and Araneidae , Thombicidae 14% each respectively while Lycocidae and Clubinoidae constituted 10 % and 7% of the total collection (Graph1).

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 (Graph 2) and it comprised of 20 species of spiders. Spiders of the families Araneidae and Tetragnathidae fall under this category. Spiders of the category Stalkers formed the first order dominant guild in this ecosystem comprising of 22 species of spiders. Foliage runners (5 species), ambushers (6 species), ground runners (9 species) and Space builders (1 species) are the other functional groups.

Family diversity: Out of the 60 families recorded in the Indian region, 11 families are discovered in Agro ecosystem. This represents 18.33 % of the total families recorded in India. Salticidae was the dominant family in this biome, which is composed of 18 species of 11 genera. Araneidae was the next dominant family with 17 species of 4 genera, Lycosidae (9

Graph:- 1 Percent occurrence of spider Graph :- 2 Guild structure of spiders collected from agro ecosystem , India families from Agro-ecosystem dist. Washim.

Table:- 2. Abundance data (total catches of two seasons) for spiders of Agro ecosystem of Washim District

| Species name | Individuals | % Occurrence | Species name | Individuals | % Occurrence |
|---|---|---|---|---|---|
| Family:- Araneidae | | | Family :-Salticidae | | |
| Araneus circe | 11 | 1.38% | *Cymbacha* sp | 12 | 1.51% |
| Araneus cyrtarachnoides | 09 | 1.13% | Euophrysfrontalis | 13 | 1.64% |
| Araneus mitificus | 15 | 1.89% | *Evarcha flavocincta*_ | 10 | 1.26% |
| Araneus sp 1 | 22 | 2.77% | Hyllus semicupreus | 16 | 2.02% |
| Araneus sp 2 | 15 | 1.89% | Marpissa sp | 09 | 1.13% |
| Araneus sp 3 | 11 | 1.38% | Marpissa sp | 11 | 1.38% |
| Araneus sp 4 | 20 | 2.52% | Myrmarachne sp | 20 | 2.52% |
| Araneus sp 5 | 22 | 2.77% | Opisthoncus sp. | 23 | 2.90% |
| Argiope pulluchella | 15 | 1.89% | Phidippus otiosus | 05 | 0.63% |
| Cyclosa confusa male, female | 14 | 1.76% | Phidippus regius | 26 | 3.28% |
| Cyclosa conica | 06 | 0.75% | Phidippus sp2 | 07 | 0.88% |
| Cyclosa sp1 female male | 17 | 2.14% | Phidipus sp1 | 19 | 2.39% |
| Cyclosa sp 2 | 21 | 2.65% | Phintella vittata Female | 18 | 2.27% |
| Cyclosa sp3 | 15 | 1.89% | Phintella vittata male | 09 | 1.13% |
| Cyclosa sp 4 | 17 | 2.14% | Plexippus paykuli | 13 | 1.64% |
| Neoscona sp | 12 | 1.51% | Plexippus petersi female | 06 | 0.75% |
| Family Clubinoidae | | | Plexippus petersi male | 08 | 1.01% |
| Clubiona obese | 06 | 0.75% | Plexipus paykulli | 17 | 2.14% |

| | | | | | |
|---|---|---|---|---|---|
| Clubiona sp1 | 05 | 0.63% | Telamonia dimidiata (female) | 08 | 1.01% |
| Clubiona sp2 | 04 | 0.50% | Telamonia dimidiata (male) | 14 | 1.76% |
| Clubiona sp3 | 01 | 0.12% | Telomonia sp 1 | 15 | 1.89% |
| Clubiona sp4 | 02 | 0.25% | Unidetified 1 | 21 | 2.65% |
| Family : -Eressidae | | | **Family :- Sparassidae** | | |
| Stygodyphus sp1 | 16 | 2.02% | **Olios giganteus** | 01 | 0.12% |
| Stygodyphus sp2 male , female | 14 | 1.76% | Family :- Tetragnathidae | | |
| Family :- Lycosidae | | | Leucauge blanda | 09 | 1.13% |
| Lycosa Sp1 | 03 | 0.37% | Leucauge sp1 | 12 | 1.51% |
| Lycosa sp2 | 04 | 0.50% | Leucauge sp2 | 17 | 2.14% |
| Lycosa sp3 | 02 | 0.25% | Leucauge sp2 male | 02 | 0.25% |
| Paradosa sp1 female | 03 | 0.37% | Family:- Theridiidae | | |
| Paradosa sp5 male | 01 | 0.12% | Enoplognatha ovate | 12 | 1.51% |
| Paradosa sp2 male | 05 | 0.63% | Family :- Thombicidae | | |
| Paradosa sp3 female | 04 | 0.50% | Oxytate sp | 11 | 1.38% |
| Paradosa sp4 | 02 | 0.25% | Thomisus sp | 16 | 2.02% |
| Unidentified | 01 | 0.12% | *Misumenops tricuspidatus_* | 05 | 0.63% |
| Family :- Mimetidae | | | _Runcinia acuminate | 07 | 0.88% |
| Mimetus sp | 04 | 0.50% | _Runcinia albostriata | 23 | 2.90% |
| Family :- Oxypidae | | | Runcinia sp1 | 38 | 4.79% |
| Oxyopes sp 2 | 03 | 0.37% | | | |
| Oxyopes sp 3 | 05 | 0.63% | | | |
| Oxyopes sp1 female | 01 | 0.12% | | | |
| Oxyopes sp1 male | 06 | 0.75% | | | |
| Oxypes macilentus | 05 | 0.63% | | | |

species) and Thomisidae (6 species) was the order of dominance of the other major families in this ecosystem.

Generic diversity: Out of the 252 genera recorded from the Indian region (Siliwal et al. 2005), 30 genera are discovered in Agroecosystem. Maximum generic diversity was found in Salticidae (11), Araneidae (4), Lycosidae (3) and Thomisidae (4). The number of genera recorded here is lesser as compared to natural forest ecosystem than that of other major Indian spider studies viz., Wan wild life sanctuaryy- 30 genera ( Bhatakar 2011),Andaman and Nicobar islands – 33 genera(Tikader1977), Hingolgarh Nature Education Sanctuary, Gujarat-34 genera Patel (2001),and lower than that of Sikkim – 41 genera and Calcutta – 47 genera (Tikader 1970,Tikader, Biswas 1981), Mannavan shoal – 57 genera (Sudhikumar et al. 2005), Mangalavanam forest Kochin -51 genera (Sebastian 2005), Madhya Pradesh and Chhattisgarh -69 genera (Gajabe 2003), Parabikulum Wildlife Sanctuary, Kerala-53 genera Patel (2003),Toranmal wildlife sanctuary -55 genera ( Meshram 2011). Genera such as Araneus (Araneidae); Marpissa, Phintella, Telamonia (Salticidae); Lycosa, Paradosa (Erresidae); Oxyopes , Hamataliwa (Oxiopidae); Runcinia, Misumenops and Thomisu (Thomisidae) are frequently recorded in agroecosystem.

Species richness: A total of 65 species are discovered from a limited area of 200 km2. This number is very high compared with other regions like Andaman and Nicobar islands – 65 species, Sikkim – 55 species and lesser than that of 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 two seasons .

Affinities: The present studies conducted in agroecosystem district Washim revealed that the spider fauna of this ecosystem bears affinities with Oriental and Palearctic regions. The presence of species like Cyclosa bifida (Araneidae);and Leucauge decorata bears oriental affinities. A small fraction of species, namely Araneus mitifica (Araneidae) show Palearctic affinities. Affinities with the island fauna of Sri Lanka are also pronounced. Argiope pulchella, Cyclosa insulana (Araneidae) are some of the species having Srilankan affinities discovered from Agroecosystem.

Faunal similarity: Faunal similarity of spiders found in Agroecosystem with other regions of India is also striking. Araneus mitificus (Araneidae); Telamonia dimidiate (Salticidae) and are species commonly found in the spider fauna of Andaman and Nicobar islands (Tikader 1977). Species like Cyclosa insulana (Araneidae); Oxyopes sp (Oxyopidae); Leucauge decorata, (Tetragnathidae). Argiope pulchella (Araneidae); Leucauge decorata (Tetragnathidae); Phintella vittata and Telamonia dimidiate (Salticidae) are also found in Calcutta (Tikader 1981). Spider fauna of Agroecosystem shows great similarities with above mention region .

**Discussion**

Present study was an attempt to record spider fauna from Agroecosystem dist. Washim in view of previous reports published by Tikader B.K. (1974) reported 14 families from different region of Maharashtra ; Hipargi et al. (2011) recorded 19 families from Lonar Crater Sanctuary, 25 from Melghat Sanctuary and 31 from Southern Tropical Thorn Forest and Meshram (2011) enlisted 20 families from Toranmal sanctuary and Bhatkar ( 2011) reported 19 families from Wan wild life Sanctuary.

The current global list of spider fauna is approximately 42,055 belonging to 3821 genera and 110 families (Platnick, 2011). The spider fauna of India is represented by 1520 spider species belonging to 377 genera and 60 families (Sebastian and Peter, 2009).Of about 1520 species reported from India (Sebastian and Peter, 2009),in present study 65 species have been recorded from study area . 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 on this ecosystem. 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 ecosystem holds many smaller but diverse environmental niches. The presence of diverse habitats like various crops, marginal bushes, toll trees and grasslands in this ecosystem is further evidence to this. This makes Agroecosystem an important centre for spider feeding center and they act as important biological agent for insect pest population without damaging other important flora and fauna of agroecosystem and protect crop from different pest.

**Conclusion**

From the above results agroecosystem are the main area where spider were present abundantly because of presence of different insect pest. Spider helps to protect agricultural crop without damaging ecosystem. Spider diversity indicate status of ecosystem. Spider helps to maintain harmonious nature of ecosystem.

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