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Spiders (Araneae) from Five Major Agro-Ecosystems of Jambughoda Village, Panchmahal District, Gujarat, India

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Abstract: ***Spiders are one of the predatory fauna found in agriculture fields which feeds on a wide range of insect pests and hence acts as buffer to limit pest populations. The present paper deals with the study of spider diversity from five major agriculture fields of Jambughoda village, which lies in the protected area of Jambughoda Wildlife Sanctuary, Panchmahal district, Gujarat. A total of 67 species belonging to 43 genera and 17 different families were recorded during the study. Araneidae and Salticidae were found to be dominant families followed by Oxyopidae and Thomisidae. Maximum diversity of spider was recorded from corn fields due the complexity in the structure which provides more hiding places for spiders to inhabit. Also these agricultural fields lie in the forest area which has potential to maintain the spider populations in agricultural fields by providing alternative habitat to sustain spiders when the fields are disturbed during farming practices.***

Keywords: Agricultural fields, Diversity, Gujarat, Jambughoda, Spiders

1. Introduction

Spiders are known to occupying most of the terrestrial habitats. They are generalist predator, which can act against a broader range of insect pests [13]. Spiders are considered to be of economic value to farmers as they play valuable role in pest management by consuming large number of prey in the agriculture fields without any damage to crops [10], [12]. In spite of their importance as generalist predator, the role of spiders in agro-ecosystems is usually ignored, mainly because spiders do not fit the conventional profile of biological control agents [14]. Earlier studies on diversity of spiders were restricted to a single agricultural crop resulting into lack of cumulative studies on agricultural fields which can give overall idea about the species distribution in an area where a variety of crops has been planted in and around the adjacent fields. When there is continuous disturbance in the field due to farming practices, the spiders prefer to move to adjacent areas or fields where there is possibility of getting high densities of prey [1]. This affects the diversity data, if collected in that particular period of time and there are chances of getting fluctuations in the density and diversity of spiders from a single agriculture field studies. Hence, we were interested in knowing spider diversity in various agricultural fields, so as to know the overall pattern in distribution and assemblage of spiders. For this we focused on cumulative studies from five major agricultural fields of Jambughoda village. The agricultural ecosystem in Jambughoda village is entirely dependent on rainy season as there is hardly any irrigation facility available in this area. Also the agriculture fields are continuously been disturbed by farmers for getting fodder (weeds grown in between the main crops) to feed their cattle's. In the present paper, we documented the spider diversity of five major agro-ecosystems namely castor, corn, cotton, paddy and pigeonpea. These crops are economically important for farmers as there is no other source of income for them in the village.

2. Materials and Methods

2.1 Study Site

The study was conducted in the agriculture fields of Jambughoda village which is located in the protected area of Jambughoda Wildlife Sanctuary. It lies between latitudes 22º20'-20º33' N and longitudes 73º35'-73º45' E in the Panchmahal and Vadodara districts of Gujarat State, India. Altitudes ranging from 230 to 354 m above mean sea level. There are about 51 villages located in and around the sanctuary, out of which Jambughoda village is one of them, after which the sanctuary is named. The mean annual temperature in the sanctuary is 25.5ºC, with a maximum of 45ºC and a minimum of 7ºC. The rainfall in general is erratic and irregular, consisting of few heavy showers interspersed with long spells of drought. The area receives an average annual rainfall, which ranges between 900mm to 950mm. All throughout the rest of the year the climate is dry. Terrain is undulating covered by hills, forests and cultivated lands in villages situated in the valley [19]. From the Jambughoda village five major agro-ecosystems were selected namely castor, corn, cotton, paddy and pigeonpea based on their economic importance for the village people.

2.2 Collection of Spiders

For collection of spiders sampling was done in the months of June 2013 to December 2014. A combination of three sampling methods namely pitfall sampling, vegetation beating and hand collection [6], [11] was applied in each agricultural field.

2.3 Preservation, Labeling and Identification

All the collected specimens were preserved in 70% ethanol (ethyl alcohol) and stored separately in clear plastic bottles

with tightly fitted caps. Each specimen was labeled with date, locality of collection (agriculture field) and the name of collector. Further these preserved specimens were identified under a stereoscopic dissecting microscope (WILD™ Stereomicroscope). Spiders were identified up to species level using the standard monographs [17], [2], [16], [3], [4], [5]. Immature spiders were classified up to the morpho species level.

3. Results and Discussion

In total 67 species belonging to 43 genera and 17 different families were recorded from the five major agro-ecosystems namely castor, corn, cotton, paddy and pigeonpea of Jambughoda village (Table 1). Amongst these 17 families the most dominant families were Araneidae (16 species & 9 genera) and Salticidae (9 species & 9 genera) followed by Oxyopidae (7 species & 2 genera) and Thomisidae (5 species & 2 genera). The maximum family diversity of spiders was observed in corn, cotton and pigeonpea (16 families each) followed by followed by castor (15 families) and paddy (14 families) whereas the maximum generic diversity of spiders was recorded from corn fields (42 genera) followed by pigeonpea (39 genera), castor (38 genera), cotton (36 genera) and paddy (33 genera). Also the maximum species diversity of spiders was recorded from corn fields (64 species) followed by pigeonpea (55 species), cotton (49 species), castor (48 species) and paddy (47 species) (Figure 1). The higher diversity of spiders in corn fields is due to habitat diversification; also corn provides provisioning of alternative food (pollen) and enhanced habitat resources [8]. In case of pegionpea, the plant structure affects the spider's efficiency to locate the insect pests [18]. The density and diversity of prey is directly correlated with the abundance of spiders in any agor-ecosystem. Although spiders had higher diversities and densities in cotton and castor fields but the fluctuation in their populations occurs due to pesticide spray and prey densities in the field [7], [9]. Whereas the diversity of spiders in paddy fields were found to be lowest as compared to other agricultural fields. This is because the young paddy plants are too small to provide habitat for spiders to survive and also the spiders immigration by the process of ballooning which occurs in these fields at the latter stage when the paddy plants are big enough to provide space for spiders to survive [20]. Also one of the major factors influencing the variation in spider diversity in all the agricultural fields is the frequent disturbance occurring in the fields by the spraying of pesticides and applying different farming practices.

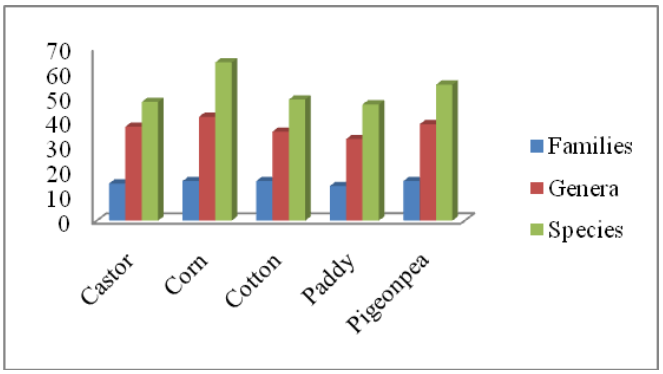

Figure 1: Total number of families, genera and species composition of spiders sampled from five major agro-ecosystems of Jambughoda village, Gujarat, India.

Table 1: List of spiders collected from five major agro-ecosystems of Jambughoda Village

Sr. No.	Family	Scientific Name	Castor	Corn	Cotton	Paddy	Pigeonpea
1.	Araneidae	*Araneus mitificus* (Simon, 1886)	√	√	√		√
2.		*Argiope aemula* (Walckenaer, 1841)	√	√			√
3.		*Argiope anasuja* Thorell, 1887	√	√	√	√	√
4.		*Cyclosa confraga* (Thorell, 1892)	√	√	√	√	√
5.		*Cyclosa moonduensis* Tikader, 1963	√	√			√
6.		*Cyrtophora cicatrosa* (Stoliczka, 1869)	√	√	√	√	
7.		*Cyrtophora citricola* (Forsskål, 1775)		√	√	√	√
8.		*Eriovixia excels* (Simon, 1889)	√	√		√	√
9.		*Eriovixia laglaizei* (Simon, 1877)	√	√	√		√
10.		*Gasteracantha kuhli*C. L. Koch, 1837		√	√		√
11.		*Larinia chloris* (Audouin, 1826)	√	√	√	√	
12.		*Neoscona mukerjei* Tikader, 1980	√	√	√	√	√
13.		*Neoscona nautica* (L. Koch, 1875)		√			√
14.		*Neoscona theisi* (Walckenaer, 1841)	√	√	√	√	√
15.		*Neoscona vigilans* (Blackwall, 1865)	√	√	√		√
16.		*Thelacantha brevispina* (Doleschall, 1857)	√	√			√
17.	Clubionidae	*Clubiona drassodes* O. Pickard-Cambridge, 1874		√		√	√
18.		*Clubiona sp.*	√	√	√		√
19.	Corinnidae	*Castianeira zetes* Simon, 1897	√	√	√		√
20.	Eresidae	*Stegodyphus sarasinorum* Karsch, 1892	√	√	√		√
21.	Eutichuridae	*Cheiracanthium inornatum* O. Pickard-Cambridge, 1874	√	√		√	√
22.		*Cheiracanthium sp.*		√	√	√	
23.	Gnaphosidae	*Drassodes sp.*	√	√		√	√
24.		*Haplodrassus sp.*	√	√			√
25.		*Scopoides sp.*	√	√	√	√	
26.	Lycosidae	*Evippa sp.* 1	√	√		√	√
27.		*Evippa sp.* 2		√		√	√
28.		*Hippasa sp.*	√	√	√	√	√

29.		*Pardosa birmanica* Simon, 1884	√	√	√	√	√
30	Oxyopidae	*Oxyopes birmanicus* Thorell, 1887	√	√	√	√	√
31.		*Oxyopes pankaji* Gajbe & Gajbe, 2000	√	√	√	√	
32.		*Oxyopes sp.* 1		√		√	√
33.		*Oxyopes sp.* 2	√	√	√	√	
34.		*Oxyopes sp.* 3		√	√	√	
35.		*Peucetia akwadaensis* Patel, 1978		√	√	√	√
36.		*Peucetia viridana* (Stoliczka, 1869)	√	√		√	√
37.	Pholcidae	*Crossopriza lyoni* (Blackwall, 1867)	√	√		√	√
38.		*Pholcus fragillimus* Strand, 1907	√	√	√	√	
39.		*Pholcus phalangioides* (Fuesslin, 1775)		√	√	√	√
40.	Pisauridae	*Pisaura podilensis* Patel & Reddy, 1990				√	
41.	Salticidae	*Hasarius adansoni* (Audouin, 1826)	√	√	√	√	√
42.		*Hyllus semicupreus* (Simon, 1885)	√	√	√	√	√
43.		*Menemerus bivittatus* (Dufour, 1831)	√	√	√	√	√
44.		*Myrmarachne tristis* (Simon, 1882)		√	√		√
45.		*Phintella vittata* (C. L. Koch, 1846)		√	√		√
46.		*Plexippus paykulli* (Audouin, 1826)	√	√	√	√	√
47.		*Rhene albigera* (C. L. Koch, 1846)	√	√			√
48.		*Telamonia dimidiata* (Simon, 1899)	√	√	√	√	√
49.		*Thyene imperialis* (Rossi, 1846)	√	√	√	√	√
50.	Scytodidae	*Scytodes fusca* Walckenaer, 1837		√	√		√
51.	Sparassidae	*Heteropoda venatoria* (Linnaeus, 1767)	√	√	√	√	√
52.		*Olios milleti* (Pocock, 1901)	√	√	√	√	√
53.		*Olios sp.*		√	√		
54.	Tetragnathidae	*Guizygiella indica* (Tikader & Bal, 1980)		√	√	√	√
55.		*Guizygiella melanocrania* (Thorell, 1887)	√	√	√	√	
56.		*Leucauge decorata* (Blackwall, 1864)	√	√	√	√	√
57.	Theridiidae	*Argyrodes argentatus* O. Pickard-Cambridge, 1880	√	√	√		√
58.		*Argyrodes sp.*		√	√	√	√
59.		*Parasteatoda mundula* (L. Koch, 1872)	√	√	√	√	√
60.	Thomisidae	*Indoxysticus minutus* (Tikader, 1960)	√	√	√	√	
61.		*Thomisus elongatus* Stoliczka, 1869	√	√		√	√
62.		*Thomisus sp.* 1		√	√		√
63.		*Thomisus sp.* 2	√	√		√	√
64.		*Thomisus sp.* 3	√		√	√	√
65.	Uloboridae	*Uloborus danolius* Tikader, 1969	√	√	√	√	
66.		*Uloborus khasiensis Tikader, 1969*	√	√	√		√
67.		*Uloborus sp.*			√	√	√
		Total number of spider species	**48**	**64**	**49**	**47**	**55**

4. Conclusion

In particular, spiders are essential components of natural and agricultural ecosystems and are good indicators of ecosystem health and natural control dynamics [15]. The present study revealed that the agricultural fields adjoining the protected area have potential to maintain the population of spiders in the agricultural fields by acting as an alternative refuge for spiders when the agricultural fields are being disturbed by the farming practices. As a result the spiders in the agricultural fields are directly or indirectly protected and conserved and on the other hand they acts as predators to keep check on the pest populations.

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