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Diversity of spiders on post rainy season crops in Jabalpur, Madhya Pradesh

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Abstract

The present study was based on the surveys conducted on crops cultivated post rainy season in the Jawaharlal Nehru Agricultural University farms, Jabalpur during two consecutive years, 2016 - 2018. Spiders of 28 species representing 17 genera under 14 families were identified. Among all these spider family the predominant diversity was represented by 3 families-Araneidae, Thomisidae and Salticidae. The most common families recorded among the crops were Araneidae (24%), Tetragnathidae (30%), and Salticidae (13%). Other families recorded were Clubionidae 9%, Oxyopidae & Thomisidae 6%, Lycosidae 5%, Dictynidae & Arctiidae 3%, Uloboridae & Naphosidae 2%, Gnaphosidae, Sparassidae and Theridiidae 1%. The spider diversity index estimated as 1.31 and 1.27 in respective years. The study indicates that the post rainy season crops cultivated in the JNAU farms are harboring a great variety of spiders.

Keywords: Spider diversity, post rainy season crops

1. Introduction

The survey was conducted on farms of the biggest multi-campus university (Jawaharlal Nehru Krishi Vishwa Vidyalaya) in the heart of India, located about 7 km North of Jabalpur town on National Highway No. 7. At present, the University holds an area of about 1544 ha of land. Spiders are an important group of predators with regards to species diversity and ranking seventh in the global diversity after insect orders^[16]. They are distributed on every continent except Antarctica and have adapted to all known ecological environments except air and open sea^[7]. Spiders include over 114 families, in nearly 4,078 genera and around 46,967 species in the world^[34]. Spiders, the most common ubiquitous animal on land constitute an essential portion of predaceous arthropods inhabiting the agro ecosystem and there by maintaining ecological equilibrium^[4]. This natural control is an implementation of an ecological concept known as "community stability" that takes benefits of high biodiversity, where pests present with their natural enemies^[33]. Biodiversity of spider species in natural ecosystems, including agriculture is high^[24] and this predator community is closely related to the characteristics of the plant community where it lives^[7]. High abundance and diversity of spiders is considered to be important in both conventional and organic cropping systems because of its predatory function^[21, 1, 17, 15]. For pest suppression, both the density and diversity of spider populations are of interest in agricultural fields. The spider fauna in agricultural areas has so far been little studied^[3, 25, 26]. The present studies have exhibited the importance of spiders as ecological indicators. The objective of the study was to explore the fauna of spider community in agro ecosystem to provide the most powerful demonstrations of the efficacy of spider species and assemblages as biological control agents.

2. Materials and Methods

2.1 Survey Site: The survey of the spiders was conducted during 2016-2018 on different post rainy season crops cultivated in the JNAU farms located at Jabalpur viz. Adhartal tank area, Dusty acre, Instructional farm and Maharajpur farm.

2.2 Methods: For the systematic recording of the data, each field was divided into 4 equal blocks. Quadrant method was used for the study^[13]. From each block five quadrates of 1x1 m² were selected. Spiders were collected randomly from each quadrate. Collection was conducted mainly by four different collection techniques- by locate-and-find hand-collection^[19], by visually^[30], by insect-net sweeping^[14], and by beating the crop^[6]. Observations were

recorded as proposed by [11] once in a standard week both during day and dusk times. It was initiated from germination of the crop and continued upto its maturity.

2.3 Sample Crops

Spider species were observed on eight cultivated crops: Wheat (*Triticum aestivum*), Mustard (*Brassica juncea*), Pigeonpea (*Cajanus Cajan*), Onion (*Allium cepa*), Coriander (*Coriandrum sativum*), African marigold (*Tagetes* sp.), Cauliflower (*Brassica oleracea*), and Linseed (*Linum usitatissimum*). The spiders collected were killed, put into 70% alcohol and labeled. They were brought in the laboratory for identification.

2.4 Statistical analysis details: Quantitative estimation of individual spider species in agroecosystem of JNAU farms were made using the data derived from field surveys. Species diversity (H') was based Shannon-Wiener function as detailed by [18] is given below:

$$H' = -\sum p_i \log_{10} p_i$$

Where,

Pi = Ni/N; Ni = Total number of individuals in a species;
N = Total number of individuals in all the species.

Richness (ma) was computed by using formula [23].

$$Ma = \frac{S-1}{\log_{10} N}$$

Where,

S = Total number of species collected.
N = Total number of individuals in all the species.

3. Results and Discussion

Studies on spider diversity conducted at various farms of JNAU, Jabalpur over a period of two consecutive years revealed that spiders collected belongs to 28 species representing 14 families. Whereas, [6] found that the spiders of 118 species under 17 families, at Raigarh district of Chhattisgarh. Spider fauna of state Madhya Pradesh and Chhattisgarh has been compiled by [22] as an updated checklist of 214 species under 22 families. [8, 9, 10] documented 102 species of spiders from district Jabalpur, Madhya Pradesh. A check list of the spiders and family wise break up of taxes are presented in Table 1 and 2.

The quantitative estimation species diversity index (H') based Shannon-Wiener function was 1.31 and species richness was computed as 5.09 in the year 2016-17. Whereas, the year 2017-18 diversity index (H') was 1.27 and species richness was 5.05. The species diversity was in accordance with that of

[14].

The survey showed that on Wheat, 8 species belonging to 5 families, on Mustard, 7 species belonging to 5 families on Pigeonpea 16 species belonging to 10 families, on Onion 4 species belonging to 4 families, on Coriander 2 species belonging to 2 families, on Linseed 3 species belonging to 2 families, on Cauliflower and Tagetes 1 species belonging to one family were found [12] also found similar result as, they reported Araneidae represented 16 species, Clubionidae represented 01 species, eresidae represented 03 species, gnaphosidae represented 01 species, miturgidae represented 02 species, Oxyopidae represented 01 species, Salticidae represented 09 species, Theridiidae represented 03 species, philodromidae represented 03 species and Thomisidae represented 02 species. The Predominant diversity was examined in the families Araneidae (26 species) followed by Thomisidae (22 species), Gnaphosidae (18 species), Lycosidae (14 species) Oxyopidae (10 species) [6]. The family Araneidae dominated with numerical strength of 8 species followed by Salticidae with 6 species [2].

The most common families recorded among the crops in present studies at various farms of JNAU, were Araneidae (24%), Tetragnathidae (30%), and Salticidae (13%). Other families recorded were Clubionidae 9%, Oxyopidae & Thomisidae 6%, Lycosidae 5%, Dictynidae & Arctiidae 3%, Uloboridae & Naphosidae 2%, Gnaphosidae, Sparassidae and Theridiidae 1%. Other researchers like [27] reported that out of the total density recorded, the family Salticidae was the most dominant with 36% at Shimoga in Karnataka. The spiders are extremely sensitive to small changes in the habitat structure; including habitats complexity, litter depth and microclimate characteristics [5, 20]. Alternatively, crop fields could enhance spider assemblages in agricultural land through spillover of individuals that benefit from the high productivity of crops [32, 31, 28]. Conservation of spider will thus necessitate a greater understanding by the general public scientists, land managers and conservationists about the importance of conserving these fascinating creatures [29].

4. Conclusion

This survey indicates the great diversity of spiders in farms of JNAU at Jabalpur. Crops, sub crops, and the surrounding environment all seem to affect the diversity and density of spiders in cropped fields. The diversity index was 1.31 and 1.27 in both the consecutive years. In agro ecosystem they regulate the population of insect pests and other macro arthropods. They do not feed any part of the vegetation and do feed only the insects in it. Thus way they can able to control the pest attacks and thereby protects the crop from damages. Instead of chemical pesticides, these interesting model organisms can able to use as biological agents for insects control.

Table 1: Family wise check list of total number of spiders per 5 square meter area during post rainy crops at Jabalpur during crops 2016-17

S.N	Family	Scientific Name	Wheat	Mustard	Pigeonpea	Onion	Coriander	Tagetes	Cauliflower	Linseed	No. of spiders in respected species
1	Araneidae	<i>Cyclosa</i> sp.			√						11
		<i>Cyrtophora</i> sp.			√						7
		<i>Larinia</i> sp.		√							4
		<i>Neoscona</i> sp.	√	√						√	9
		<i>Neoscona elliptica</i>			√						8
		<i>Neoscona vigilans</i>			√						6
		Undetected	√								1
2	Clubionidae	<i>Drassodes</i> sp.			√						11
3	Gnaphosidae	Undetected			√						2

4	Dictynidae	Spiderling		√	√						7
5	Lycosidae	Undetected	√	√							10
6	Naphosidae	Undetected	√		√						3
7	Oxyopidae	<i>Oxyopidae sp.</i>			√	√					12
8	Salticidae	<i>Hyllus semicupreus</i>							√		6
		<i>Marpissa sp.</i>						√		4	
		<i>Plexippus sp.</i>	√		√						2
		<i>Telamonia dimidiata</i>			√						14
9	Sparassidae	<i>Olios sp.</i>			√					1	
10	Tetragnathidae	<i>Guizygiella indica</i>		√	√						23
		<i>Guizygiella sp.</i>	√	√	√	√					22
		<i>Leucauge decorata</i>	√								15
11	Theridiidae	Undetected		√							1
12	Thomisidae	<i>Runcinia sp.</i>				√					3
		<i>Synema decoratum</i>			√						4
		<i>Synema sp.</i>							√		1
		<i>Thomisus sp.</i>						√			3
13	Uloboridae	<i>Uloborus sp.</i>				√	√				5
14	Arctiidae	Undetected				√					6
Total no. of spiders in 2016-17				52	33	65	13	9	11	6	201

Table 2: Family wise check list of total number of spiders per 5 square meter area during post rainy crops at Jabalpur during crops 2017-18

S.N	Family	Scientific name	Wheat	Mustard	Pigeonpea	Onion	Coriander	Tagetes	Cauliflower	Linseed	No. of spiders in respected species
1	Araneidae	<i>Cyclosa sp.</i>			√						13
		<i>Cyrtophora sp.</i>			√						7
		<i>Larinia sp.</i>		√							5
		<i>Neoscona sp.</i>	√	√						√	13
		<i>Neoscona elliptica</i>			√		√				12
		<i>Neoscona vigilans</i>			√						10
		Undetected	√							1	
2	Clubionidae	<i>Drassodes sp.</i>			√						19
3	Gnaphosidae	Undetected			√						1
4	Dictynidae	Spiderling		√	√						2
5	Lycosidae	Undetected	√	√							9
6	Naphosidae	Undetected	√		√						2
7	Oxyopidae	<i>Oxyopidae sp.</i>			√	√					12
8	Salticidae	<i>Hyllus semicupreus</i>								√	6
		<i>Marpissa sp.</i>							√		4
		<i>Plexippus sp.</i>	√		√						2
		<i>Telamonia dimidiata</i>			√						
9	Sparassidae	<i>Olios sp.</i>			√						1
10	Tetragnathidae	<i>Guizygiella indica</i>	√	√	√						22
		<i>Guizygiella sp.</i>	√	√	√	√					22
		<i>Leucauge decorata</i>	√		√						15
11	Theridiidae	Undetected		√							2
12	Thomisidae	<i>Runcinia sp.</i>				√					1
		<i>Synema decoratum</i>			√						1
		<i>Synema sp.</i>							√		1
		<i>Thomisus sp.</i>						√			1
13	Uloboridae	<i>Uloborus sp.</i>				√					5
14	Arctiidae	Undetected				√					6
	Total no. of spider	2017-18	54	35	68	15	8	14	5	10	209

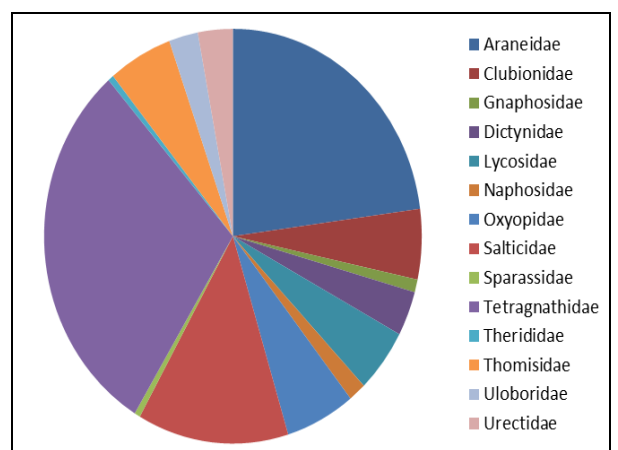
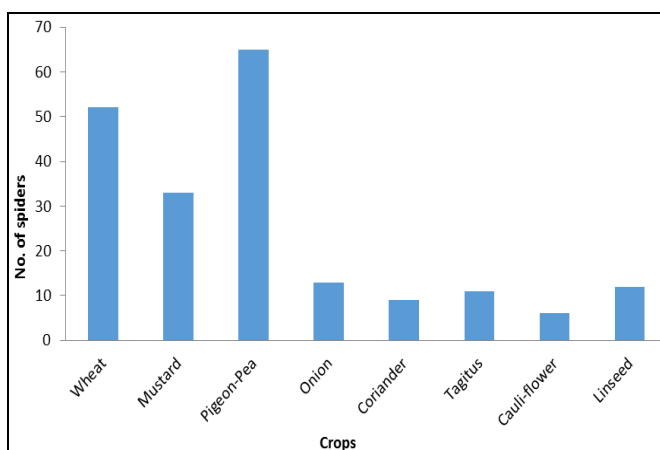


Fig 1: Spiders on post rainy season crops at Jabalpur during 2016-17

Fig 2: Distribution of spider families on post rainy season crops at Jabalpur during 2016-17

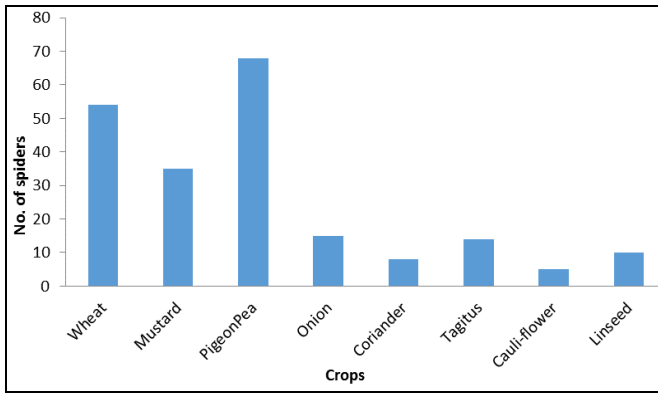


Fig 3: Spiders on post rainy season crops at Jabalpur during 2017-18

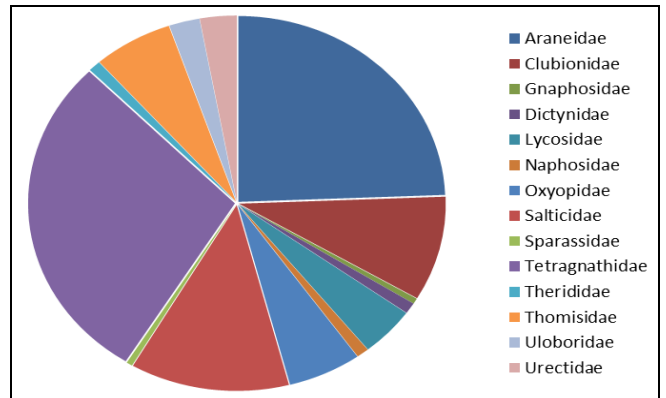


Fig 4: Distribution of spider families on post rainy season crops at Jabalpur during 2017-18



A



B



C



D



E



F



Plate 1: Different spiders collected from agroecosystem of J.N.K.V.V. Farms Jabalpur. (a) *Cyrtophora sp.* F- Araneidae (b) *Synema sp.* F- Thomisidae (c) *Thomisus sp.* F- Thomisidae (d) *Neoscona sp.* F- Araneidae (e) *Guizygiella indica* F- Tetragnathidae (f) *Telamonia dimediata* F- Salticidae (g) *Guizygiella sp.* F- Tetragnathidae (h) *Leucauge decorate* F- Tetragnathidae (i) F-Naphosidae (j) *Oxyopes sp.* F-Oxyopidae (k) F- Therididae (l) F-Urectidae.

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