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Impact of Some Intervention Practices on Spider Diversity in Rice Ecosystem

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Spiders have the ability to build in high population densities in short span of time and their general insectivorous behavior makes the m generalist super predators in rice ecosystem. Survey of spiders in rice ecosystem resulted 11, 17 and 18 different species during Kuruvai, Samba and Thaladi seasons, respectively. Intercropping of *Sesbania rostrata* (8:1) or application of azolla @2 kg /40 m^2 favoured higher numbers of 4.90 and 4.59 spiders per hill while NSKE 5%/ insecticide/fungicide spray based on ETL recorded populations equal to that of untreated plots. Spraying of insecticide on calendar basis recorded significantly the lowest numbers of spiders (3.34/hill.)

Key Words: Rice, spider diversity, cultural practices.

The Order Aranea ranks seventh in global diversity of animals,after the five largest insect orders (Coleoptera, Hymenoptera, Lepidoptera, Diptera and Hemiptera) and Acari among the arachnids in terms of species described or anticipated. Among these taxa, spiders are exceptional for their complete dependence on predation as trophic strategy. Spiders are obligate suctorial carnivores. They form the principal part of the predatory fauna in rice agro ecosystem. In recent times there has been increased interest in the conservation of spiders as natural enemies to contain and regulate pest populations in rice eco system (Chandra, 1979) and focus was diverted on taxonomy, bionomics and food web of common rice field spiders upon which pest management programmes were built (Barrion and Litsinger,1980). Because of their ability to build up in high population densities in short span of time and their insectivorous feeding behaviour, it is believed that under favourable habitats spiders play key role as mortality agents of rice insect populations (Kiritani, 1972). The cannibalistic behaviour of spiders restricts the scope of mass culture for use in biological control programmes. Therefore conservation of spider fauna in crop eco system would be the best choice for the execution of integrated pest management programmes in rice (Kenmore, 1979). Cultural practices adopted in rice cultivation might affect spider populations directly or indirectly in conservation. With a view to gather information on spider diversity and to study the effect of some of the cultural practices on populations of spiders, field experiments were conducted at the Soil and Water Management Research Institute, (Tamil Nadu Agricultural University), Thanjavur. The details of experiments and results are presented hereunder.

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Materials and Methods

Weekly surveys were conducted in selected paddy fields and spider samples were assessed during *Kuruvai* (June -Sep.), *Samba* (Aug-Dec.) and *Thaladi* (Oct-Jan) seasons of 2004-2005 following the method of Kamal *et al*., (1990). Collections were made using a sweep net and the collected spiders were killed with chloroform and preserved temporarily in 70 per cent alcohol for enumeration and identification. Spiders were identified based on published literature, keys, faunistic records and illustrations by comparing morphological, taxonomical features and measurements.

Regarding the effect of intervention practices seven treatments comprising important cultural practices *viz*., insecticide spray based on ETL, fungicide spray based on disease intensity, calendar based insecticide spray, neem seed kernel extract (NSKE) 5% spray based on ETL, weed control by pre-emergence application of butachlor @ 1 Kg a. i. / ha, intercropping of *Sesbania rostrata* (8:1); azolla application @ 2 Kg/40 m^2 were included with an untreated check. Field experiments were conducted in randomized block design with four replications in plots of size of 40 sq.m. ADT43 and ADT39 cultivars were used during *Kuruvai* and *Thaladi* seasons, respectively. Other agronomic practices were followed as per the common recommendations applicable to rice cultivation.

Observations were made on the occurrence of spiders on 20 hills at random per plot in a diagonal transect way on maximum tillering, panicle initiation, flowering and maturity stages of the crop. When pests crossed ETL,application of insecticide, fungicide and NSKE was taken up in the respective

treatments. In both years of study and seasons, once the leaf folder and twice the stem borer crossed ETL. Whereas in the calendar based application, first application of monocrotophos was given 20 DAT, second on 40 DAT and third spray on 60 DAT. Due care was taken to prevent spray drift between treatments. NSKE 5% was prepared in the laboratory as per procedure. While applying NSKE 'teepol' was added to the spray fluid @ 1 ml per litre as sticking agent. For spraying a high volume sprayer was used. The data were statistically analysed and results presented.

Table 1. Spider fauna of rice ecosystem in Tamil Nadu

Family	Spider species	Season		
		Kuruvai	Samba	*Thaladi*
Araneidae	*Araneus* sp.	+	+	+
	Argiope catenulata Doleschall	+	+	+
	Larina tabida L. Koch	+	+	+
	Leucauge sp.	+	+	+
	Leucauge sp.	-	+	+
Clubionidae	*Clubiona pogonias* Simon	+	+	+
	Clubiona sp.	-	+	+
Lycosidae	*Lycosa phipsoni* Pocock	+	+	+
Oxyopidae	*Oxyopes javanus* Thorell	+	+	+
	Oxyopes rufisternum	+	+	+
Salticidae	*Cyrba* sp.	-	+	+
	Myrmarachne sp.	-	+	+
	Plexippus sp.	-	+	+
	Plexippus paykulli Aud. and Savigny	-	+	+
	Salticus sp.	+	+	+
Tetragnathidae	*Tetragnatha* sp.	+	+	+
	Tetragnatha javanus Thorell	+	+	+
Thomicidae	*Thomisus cherapunjeus* Tikader	+	+	+

'+' " Present, '-' " Absent

Results and Discussion

The survey showed 11 and 7 species of spiders from cultivated rice fields and bund weeds in *Kuruvai*,17 and 11 from Samba and 18 and 13 from *Thaladi* seasons, respectively, belonging to seven families(Table. 1). Of the spiders recorded, *Araneus* sp., *Argiope catenulata* Doleschall, *Larina tabida* L. Koch, *Leucauge sp.*, *Clubiona pogonias* Simon, *Lycosa phipsoni* Pocock, *Oxyopes rufisternum*, *Tetragnatha* sp., *Tetragnatha javanus* Thorell and *Salticus* sp. were observed in all the three seasons. Newer taxa recorded were *Araneus* sp., *Leucauge sp.*(Araneidae); *Clubiona* sp. (Clubionidae) and *Tetragnatha* sp.(Tetragnathidae). The occurrence of *Argiope catenulata*, *Larina tabida*, *Clubiona pogonias*, *Lycosa phipsoni*, *Oxyopes javanus*, *Oxyopes rufisternum, Plexippus paykulli*, *Tetragnatha javanus* and *Thomisus cherapunjeus* in different seasons of rice cultivation is reported for the first time in Cauvery Delta of Tamil Nadu.

Quantitative estimates of abundance of spiders in the rice agro ecosystem revealed that species richness was the highest in Samba season followed by *Thaladi* season. This might be due to prevalence of population promoting factors in that season apart from carry over from the preceding season. The abundance and diversity of spider species was related to the growth stages of rice. During the vegetative stage, jumping, hunting and other active spiders such as *Lycosa* sp., *Oxyopes* sp. and several species of salticids predominated in the fields. The orb weavers and other sedentary species such as *Tetragnatha* spp., *Argiope catenulata* showed preference to the reproductive stage of rice growth.

The data on field population of spiders are presented in Table 2 and 3. The results revealed that the spraying of insecticide on calendar basis without assessing the pest level during 20, 40 and 60 DAT recorded significantly the lowest numbers of spiders of 3.34 nos. per hill. Intercropping of *Sesbania rostrata* (8:1) or application of azolla @ 2 kg/40 m^2 favoured housing of higher numbers of 4.90 and 4.59 spiders per hill. This may be due to presence of higher foliage mass per unit area which might increase the foraging capacity of some spiders. Plots sprayed with NSKE / insecticide / fungicide on ETL basis recorded spider populations

Table 2. Effect of intervention practices on spider population (*Kuruvai* and *Thaladi* 2004)

Sl. No.	Treatment	No. of spiders / hill									
		Kuruvai 2004 (June-Sep)				Mean	*Thaladi* 2004 (Oct-Jan)				Mean
		Maximum tillering	Panicle initiation	Flowering	Maturity		Maximum tillering	Panicle initiation	Flowering	Maturity	
1.	ETL based insecticide spray	4.15	4.41	4.18	4.38	4.28	4.25	4.51	4.28	4.48	4.38
2.	Grade based fungicide spray	4.23	4.71	4.39	4.69	4.50	4.20	4.67	4.36	4.66	4.47
3.	ETL based NSKE 5% spray	4.13	4.35	4.16	4.36	4.25	4.18	4.58	4.35	4.53	4.41
4.	Azolla application @ 2 Kg/ 40 m^2	5.20	5.60	5.37	5.55	5.43	4.79	4.84	4.99	4.74	4.84
5.	Butachlor application @1 Kg a.i./ ha	4.77	4.82	5.00	4.70	4.82	4.25	4.80	5.26	4.65	4.74
6.	*S.rostrata* intercropping (8:1)	5.60	5.68	5.66	5.60	5.63	4.32	4.67	5.23	4.62	4.71
7.	Calendar based insecticide spray (Monocrotophos)	3.85	3.86	4.20	3.65	3.74	3.37	3.98	4.16	3.77	3.82
8.	Untreated check	4.71	5.20	4.73	4.87	4.87	4.69	4.73	4.88	4.62	4.73
		SED =0.119			CD= 0.25		SED=0.22			CD=0.45	

Table 3. Effect of intervention practices on spider population (*Kuruvai* and *Thaladi* 2005)

Sl. No.	Treatment	No. of spiders/hill									
		Kuruvai 2004 (June-Sep)				Mean	*Thaladi* 2004 (Oct-Jan)				Mean
		Maximum tillering	Panicle initiation	Flowering	Maturity		Maximum tillering	Panicle initiation	Flowering	Maturity	
1.	ETL based insecticide spray	3.76	3.81	3.99	3.69	3.81	3.77	3.73	3.92	3.66	3.77
2.	Grade based fungicide spray	3.45	4.06	4.40	3.85	3.94	3.72	3.68	3.61	3.87	3.72
3.	ETL based NSKE 5% spray	3.79	3.83	3.98	3.72	3.83	3.79	3.97	3.67	3.81	3.81
4.	Azolla application @ 2 Kg/ 40 m^2	4.07	4.34	4.10	4.30	4.20	3.73	4.19	3.75	3.89	3.89
5.	Butachlor application @1 Kg a.i./ ha	3.49	4.10	4.44	3.89	3.98	3.19	3.74	4.20	3.68	3.68
6.	*S.rostrata* intercropping (8:1)	4.23	4.45	4.26	4.46	4.35	4.73	5.17	4.77	4.89	4.89
7.	Calendar based insecticide spray (Monocrotophos)	2.58	3.19	3.53	2.98	3.07	2.25	2.80	3.26	2.74	2.74
8.	Untreated check	4.03	4.06	4.30	4.26	4.16	3.29	3.84	3.18	3.78	3.78
		SED = 0.14			CD = 0.29		SED = 0.18			CD = 0.38	

equal to that of untreated plots. Earlier workers Saxena *et al*., (1983) and Nirmala (1990) and reported the safety of neem products to spiders of rice eco system while Samiayyan (1996) reported that calendar based spraying of insecticides, drastically reduced the spider population. The present study recommends the avoidance of unscrupulous spraying of chemicals in rice field and inclusion of bio organics like green manures (*S.rostrata*), bio fertilizer (azolla) for sustenance, multiplication and activity of more of spiders in rice fields.

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