STUDIES ON POPULATION BUILD-UP OF SPIDERS FAUNA IN RELATION TO ABIOTIC FACTORS IN RICE ECOSYSTEM OF GUJARAT

PATEL M. L., PATEL K. G. AND JETHVA D. M. *

COLLEGE OF AGRICULTURE, DEPARTMENT OF ENTOMOLOGY
JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH - 362 001, GUJARAT, INDIA

E-mail: dr_dharmraj@yahoo.co.in

ABSTRACT

The population build-up of spiders varied greatly throughout the experimental period in rice ecosystem. The population of spiders remained in lower form at initial stage and it gradually increased with crop growth stage up to 12th week of transplanting (0.44 to 4.64 spiders per plant). The population of predatory spiders increased as the incidence of GLH, BPH and LF were increased during the crop period. The spider population showed positive correlation with all the climatic factors except relative humidity, average relative humidity, rainfall and rainy days that manifested negative correlation.

KEY WORDS: Ecosystem, population, rice, spider fauna

INTRODUCTION

Spiders are the most common and abundant arthropods in almost all the ecosystem of the world (Nyffeler, 1982). Thirty four thousand species of spiders have been identified in the world (Platnick, 2005), of which 1066 species under 43 families have been listed from India (Tikader, 1987). They are discharging nature' gifted duty in favour of farmers by suppressing pest populations in different agro-ecosystems (Khan and Misra, 2003a). In the present context of IPM, non chemical approaches including optimization of natural bio-control is the need of the time (Khan and Misra, 2003b; Khan, 2009). Realizing the fact there are a growing number of investigations in which spiders are used as tools as generalist predators both in community and ecosystem. Therefore, it was thought pertinent to undertake the present study on population build up of spiders in relation to abiotic factors in different rice ecosystem of Navsari, Gujarat as prerequisites for exploitation of spider as a bioagent.

MATERIALS AND METHODS

Samples were collected from rice ecosystem at the National Agricultural Research Project farm, Navsari Agricultural University, Navsari, Gujarat during *kharif* 2002. The samples were collected at weekly intervals. For collection of adequate number of spiders, two techniques were adopted, *viz*., (i) vial-tapping or hand picking and (ii) quadrate method.

Hand picking or Vial picking method

Empty vials (5 cm high and 3 cm diameter) were placed beneath the leaf blades or webs and spiders were then tapped loose with the cap. Smaller species were picked up with a moist finger or by small camel's hair brush. For this purpose, number of spiders

was counted at weekly interval on five plants per sample.

Quadrate method

Collection of spiders was made early in the morning from ten randomly selected quadrates (1.0 m x 1.0 m) from untreated field commencing after 1st week of August to 1st week of November during crop period after transplanting. All collected spiders were brought to the laboratory for sorting, counting and identification. The collected specimens were preserved 70 per cent ethyl alcohol for identification and further study.

Correlation between spiders and insect pests of rice

Number of spiders and insect pests of rice *viz*., green leaf hopper (GLH) *Nephotettix* sp. and brown plant hopper (BPH) *Nilaparvata lugens* were counted on 5 plants from each of the 10 randomly selected quadrates (1.0 m x 1.0 m) from the untreated field. The number of leaves damaged by larvae of rice leaf folder (LF) and total leaves were also counted from same plant to calculate the per cent rice leaf folder (LF) damage. The observations were recorded early in the morning at weekly interval commencing from 1st week of August to 1st week of November during crop period after transplanting. Weather data were recorded during the study period and multiple correlation co-efficient of spider population with different parameters were also workout.

RESULTS AND DISCUSION

The data (Table 1) pertaining to the population of spider and the prevalent abiotic factors was collected and The spiders population was recorded weekly on untreated field of rice crop at the Farm of National Agricultural Research Project, NAU, Navsari. The spider population ranged from 0.44 to 4.64 per plant in rice ecosystem.

Correlation of spiders population with weather parameters

The correlation coefficient values presented in Table 1 indicated that spiders population exhibited significant positive correlation with maximum temperature (X1) (r = 0.82499*), average temperature (X3) (r = 0.73018*) and sunshine hours (X7) (r = 0.89105*); significant negative correlation with minimum relative humidity (X5) (r = -0.70647*), average relative humidity (X6) (r = -0.62193*), rainfall (X8) (r = -0.60775*) and rainy days (X9) (r = -0.65263*) whereas minimum temperature (X2) (r = -0.50310) and maximum relative humidity (X4) (r = -0.35900) exhibited negative correlation with population of spiders. These results are in accordance with the results of Xu-js *et al*. (1987), wherein they found that rainfall affected the population of the spiders in the field of rice from China. Again the results are more or less similar to the finding of Singh *et al*. (2000), wherein they found that most of abiotic factors had negative correlation with spiders population in the rice field from Faizabad.

Correlation between spiders and insect pest of rice

The correlation coefficient values presented in Table 2 indicated that spiders population exhibited positive correlation with the incidence of all the three insect pests *viz*., green leaf hopper (GLH) *Nephotettix* sp. (r = 0.45286), brown plant hopper (BPH) *N. lugens* (r = 0.77822) and rice leaf folder (LF) *C. medinalis* (r = 0.78153) observed in the experiment. Thus, population of predatory spiders increased as the incidence of GLH, BPH and LF were increased during the crop period. However, the spiders did not seem to have any significant role for increase or decrease in the population of observed insects.

The results also indicated that the population of spiders remained in lower form at initial stage and it gradually increased with crop growth stage up to 12th week of transplanting (0.44 to 4.64 per plant) and then declined at the crop maturity stage and it is also revealed from the data that the population of GLH and incidence of LF remained higher than population of spiders throughout the crop period, whereas the population of BPH remained lower than the population of spiders up to 8th week transplanting later on the population of BPH increased than the population of spiders till the crop maturity stage.

These results are in the accordance with the result obtained by Luo (1985) from China, where he also found that spiders were positively correlated with that of *S. furcifera* and *N. lugens* in the field of rice. Cheng (1989) had also found positive correlation between the dynamic changes in the population of spiders and insect pests of paddy crop. Singh *et al*. (2000) also proved positive correlation of population of spiders and insect pest of rice at Faizabad. Similarly, Chander (2001) also reported that the number of spiders increased and decreased with increase and decrease in WBPH population, but the population of spiders did not seem to have any relation with leaf folder infestation.

CONCLUSION

From the study, it can be seen that the population of spiders remained in lower form at initial stage and it gradually increased with crop growth stage. The population of predatory spiders increased as the incidence of GLH, BPH and LF were increased during the crop period. The spider population showed positive correlation with all the climatic factors except relative humidity, average relative humidity, rainfall and rainy days that manifested negative correlation.

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Table 1: Multiple correlations between spiders and weather parameters during *kharif* season

Month & Year	Std. Week	Dates	Popu. of Spider/ Plant	Temperature (°C)			Relative Humidity (%)			Sunshine Hours (X7)	Rainfall (mm) (X8)	Rainy Days (X9)
				Max. (X1)	Min. (X2)	Av. (X3)	Max. (X4)	Min. (X5)	Av. (X6)			
Aug.	32	6-12	0.44	27.4	25.1	26.25	94	87	90.5	0.3	103.8	7
	33	13-19	0.60	29.0	26.0	27.50	85	78	81.5	2.0	6.3	0
	34	20-26	0.90	28.9	25.2	27.05	92	75	83.5	2.7	235.1	2
	35	27-2	1.48	28.8	24.4	26.60	93	76	84.5	5.0	75.1	3
Sep.	36	3-9	1.74	28.4	24.9	26.65	91	76	83.5	4.0	87.9	2
	37	10-16	2.56	29.6	24.3	26.95	88	67	77.5	9.3	0.0	0
	38	17-23	3.34	30.7	24.5	27.60	92	74	83.0	7.7	79.0	1
	39	24-30	3.44	31.9	24.9	28.40	91	63	77.0	8.3	0.0	0
Oct.	40	1-7	3.64	35.7	24.2	29.95	88	43	65.5	9.1	0.0	0
	41	8-14	3.90	35.7	24.6	30.15	86	47	66.5	8.7	0.0	0
	42	15-20	4.04	33.9	24.2	29.05	84	54	69.0	9.1	0.0	0
	43	22-28	4.64	35.5	20.5	28.00	79	45	62.0	9.1	0.0	0
	44	29-4	2.90	35.5	20.2	27.85	68	28	48.0	9.6	0.0	0
Nov.	45	5-11	2.70	35.0	21.7	28.35	71	39	55.0	9.3	0.0	0
Correlation Coefficient (r)				0.82499*	-0.50310	0.73018*	-0.35900	0.70647*	0.62193*	0.89105*	-0.60775*	0.65263*

Note : Number of observation : 14; * 'r' value significant at 5 per cent level of significance (r = 0.530)

Table 2: Multiple correlation between population of spiders and different insect pests of rice during kharif season

Month	Week After Transplanting	Population of Spider Per Plant	Number of GLH Per Plant	Number of BPH Per Plant	% Leaf Damage by Leaf Folder
August	1	0.44	4.26	0	0
	2	0.60	5.40	0	0
	3	0.90	6.80	0	0.7
	4	1.48	7.44	0	1.7
September	5	1.74	9.14	0	3.8
	6	2.56	11.38	0.64	4.6
	7	3.34	12.60	1.84	6.9
	8	3.44	11.06	2.92	7.5
October	9	3.64	10.06	5.36	7
	10	3.90	9.60	5.88	7.2
	11	4.04	8.12	6.12	4.5
	12	4.64	7.54	6.80	3.3
	13	2.90	4.16	7.24	3.3
November	14	2.70	3.82	7.36	3
Correlation coefficient (r)			0.45286	0.77882	0.78153

Note: Number of observation : 14;
**** 'r' value significant at 5 per cent level of significance (r = 0.530)***

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