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Population Dynamics of Predators and Parasitoids of Shoot and Fruit Borer, *Earias* spp in Okra Ecosystem

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A B S T R A C T

A field experiment was conducted during the *Kharif* seasons 2012 and 2013 at Students Instructional Farm and Vegetable Research Farm, NDUA&T, Kumarganj, Faizabad (UP) to find out the natural enemies of shoot and fruit borer in okra. The eggs parasitoids *Trichogramma chilonis*, parasitized 6.25 and 7.40% egg of *Earias* spp *Kharif*, 2012 and *Kharif*, 2012 respectively. Among predators, maximum population of Coccinellids 4.36 and 4.05 adult per 5 plants was recorded in third week of August. The maximum population of spiders 6.40 and 6.22 individuals per 5 plant were in the last week of July, Ants population were 4.38 and 4.22 in the mid July of and Mirid bug ranged from 1.42 to 3.88 and 1.08 to 3.56 adult/ 5plant. The population of Coccinellids, spiders, ants and mirid bugs were positive correlated with minimum temperature i.e. (0.921, 0.809, 0.777 and 0.810) and (0.595, 0.407, 0.347 and 0.399) respectively during *Kharif*, 2012 and 2013.

Introduction

Okra (*Abelmoschus esculentus* L. Moench.) is also known as Lady's finger, is a popular home garden vegetable in India and also cultivated in tropical and subtropical part of the world. It is a good source of vitamins, minerals, protein, fat, carbohydrate and has high caloric value. India has area under okra 511 thousand ha and production 5849 thousand MT during 2015-16. About 13 insect pests have been recorded that are known to cause damage to okra (Mandal *et al.*, 2006). The shoot and fruit borers, *Earias vittella* is one of the major limiting factors in the production of quality fruits of okra (Kharbade *et al.*, 1998). The infestation to okra accounted for nearly 22.5% in Uttar Pradesh (Verma *et al.*, 1985), 25.9% to 40.9% in Madhya Pradesh by the shoot and fruit borer (Dhamdhare *et al.*, 1984). Among natural enemies Spider, ants and Coccinellids are some that contributed to the reduction of insect pest of okra.

Keeping in view the importance of losses caused by different insect pests, the present study population dynamics of insect pests and its natural enemies were carried on okra.

Materials and Methods

The experiment was conducted during the *Kharif* seasons 2012 and 2013 at Students Instructional Farm and Vegetable Research Farm, NDUA&T, Kumarganj, Faizabad (UP).

The seed of okra (variety- Arka Anamika) was sown in the month of last week of June in both season and all the agronomic and cultural practices recommended for its cultivation were followed as per the requirement. The crop was sown in the plots of 4.5 m x 3 m with row to row and plant to plant spacing 60 cm x 45 cm respectively.

Observations

The eggs, larvae and pupa of okra shoot and fruit borer were collected along with their natural enemies from the experimental field and farmer's field at weekly interval and reared them in the laboratory in natural medium till the emergence of eggs, larval and pupal parasitoids.

The collected natural enemies were identified by taxonomic key and percentage of eggs, larval and pupal Parasitization were work out. The predators associated with the insect- pest of okra were recorded on five randomly selected plants at each replication and mean number of individual predator were calculated.

The data on meteorological parameters viz. temperature (minimum and maximum °C), relative humidity (%), rain fall (mm) and sunshine hours taken from the department of Agro Meteorology have been used to find out the correlation between natural enemies population with abiotic factors.

Results and Discussion

The natural enemies observed during experimentation are given in Table 1.

Parasitoids

A total number of 112 and 135 eggs of shoot and fruit borers were collected but only 7 and 10 eggs were parasitized by the egg parasitoid, *Trichogramma chilonis* during both the seasons.

The egg parasitization was 6.25 and 7.40 per cent during *Kharif*, 2012 and *Kharif*, 2013 respectively.

Predators

The large numbers of predators were collected from the experimental field of okra were collected and placed in four groups i.e. coccinellids, spiders, ants and mirid bugs.

Lady bird beetle

The coccinellids i.e. (*Coccinella septempunctata*, *Microspis discolor* and *Brumoides suturalis*) were first appeared in the last week July (2.80 and 2.57 adult /5 plants) i.e. 31 Standard Week (SW) and there after continuously present throughout the crop season during *Kharif*, 2012 and 2013 respectively.

The maximum population of coccinellids (4.36 and 4.05 adult /5 plant) was recorded in third week of August (34th SW) followed by (4.15 and 3.80 adult /5 plant), (3.93 and 3.72 adult/5 plant) in 33rd and 36th SW, respectively and minimum was recorded (1.25 and 0.80 adult/5 plant) in 40th SW respectively during *Kharif*, 2012 and *Kharif*, 2013.

Spiders

The spiders were recorded throughout the crop season of okra and their population was ranged 2.88 to 6.40 and 2.51 to 6.22 individuals/ 5 plant during *Kharif*, 2012 and *Kharif*, 2013 respectively.

Table.1 Population of predators in okra ecosystem during *Kharif*, 2012 and 2013

Standard Week	Mean number of Predators per five plants							
	Coccinellids		Spiders		Ants		Mirid bugs	
	2012	2013	2012	2013	2012	2013	2012	2013
31	2.80	2.57	3.50	3.35	2.25	2.05	1.87	1.63
32	3.38	3.15	4.30	3.80	2.80	2.66	2.40	2.25
33	4.15	3.80	4.85	4.62	4.38	4.22	2.85	2.66
34	4.36	4.05	6.20	5.88	3.80	3.56	3.60	3.25
35	3.93	3.72	6.40	6.22	3.40	3.12	3.88	3.56
36	3.65	3.35	5.12	4.66	2.75	2.50	2.82	2.64
37	3.05	2.86	4.26	3.88	2.37	2.15	2.08	1.85
38	2.70	2.54	3.55	3.37	2.05	1.86	1.66	1.40
39	2.32	1.95	3.16	2.96	1.88	1.72	1.53	1.25
40	1.25	0.80	2.88	2.51	1.67	1.35	1.42	1.08
Mean	3.16	2.88	4.42	4.13	2.74	2.52	2.41	2.16
SEm±	0.12	0.09	0.11	0.10	0.15	0.14	0.14	0.11
CD at 5%	0.36	0.29	0.34	0.30	0.45	0.43	0.44	0.34

Table.2 Correlation coefficient between natural enemies with abiotic factors in okra (*Kharif*, 2012 and 2013)

Natural Enemies	Temperature				Relative Humidity (%)		Rain fall (mm)		Sunshine (Hrs)	
	2012		2013							
	Min.	Max.	Min.	Max.	2012	2013	2012	2013	2012	2013
Coccinellids	0.921**	-0.078	0.595	0.517	0.786**	-0.041	0.256	-0.427	-0.485	0.018
Spiders	0.809**	-0.119	0.407	0.204	0.704*	0.295	0.134	-0.632*	-0.354	-0.395
Ants	0.777**	0.094	0.343	0.184	0.570	0.085	0.073	-0.440	-0.234	-0.097
Mirid Bugs	0.810**	-0.045	0.399	0.170	0.646*	0.266	0.075	-0.681*	-0.273	-0.389

** Significant at 1 per cent level
* Significant at 5 per cent level

The maximum population of spider was recorded in 35th SW (6.40 and 6.22 individuals/5plant) due to maximum host availability followed by (6.20 and 5.88 individuals/5plant), (5.12 and 4.66 individuals/5plant) at 34th and 36th SW. The minimum population was 2.88 and 2.51 in 40th SW during *Kharif*, 2012 and *Kharif*, 2013 respectively.

Ants

The maximum number of black ants was noticed during the infestation of okra mealy bug because the ant feed on the honey dew secreted by the mealy bug and aphid. The ant was first time recorded at 31SW (2.25 to 2.05 adult/5 plant).

The population range 1.67 to 4.38 and 1.35 to 4.22 during *Kharif***,** 2012 and *Kharif*, 2013 respectively. The maximum population of ant was recorded 4.38 and 4.22 in 33th SW followed by (3.80 and 3.56) in 34th SW and minimum in 40th SW 1.67 and 1.35 adult/5 plants during *Kharif*, 2012 and *Kharif*,2013 respectively.

Mirid bug

The population of mirid bug ranged from 1.42 to 3.88 and 1.08 to 3.56 adult/ 5plant during *Kharif* 2012 and *Kharif*, 2013 respectively. The maximum population of mirid bug was recorded 3.88 and 3.56 in 35th SW followed by (3.60 and 3.25 adult/5plant), (2.88 and 2.66 adult/5plant) in 34th and 33th SW and minimum 1.42 and 1.08 adult/5plant in 40th SW during *Kharif*, 2012 and *Kharif*, 2013 respectively.

The result obtained on various natural enemies i.e., parasitoids and predators associated with the okra shoot and fruit borer during the respective years of the study is discussed as under (Table 2).

Parasitoids

The shoot and fruit borer's eggs parasitized by the egg parasitoid, *Trichogramma chilonis* during both the seasons. The egg parasitization was 6.25 and 7.40 per cent during *Kharif*, 2012 and *Kharif*, 2013 respectively. Maximum parasitization was recorded by egg parasitoid during *Kharif*, 2013. These finding collaborate with the studies of Telang *et al.*, (2004) where the authors had noticed the 9.50% eggs of *E. vittella* parasitization by the *Trichogramma chilonis*. Yadav *et al.*, (2009) reported 10 to 12 per cent parasitism of *E. vittella* eggs by *Trichogramma chilonis*.

Predators

The four groups of predators i.e. coccinellids, spider, ants and mirid bug were seen during crop season of okra. The population of lady bird beetle, coccinellids appeared first time in the last week of July (2.80 and 2.57 adult/ 5 plants) i.e. 31 Standard Week (SW) and that prevailed throughout the crop season during *Kharif*, 2012 and *Kharif*, 2013 respectively. The maximum population of coccinellids (4.36 and 4.05 adult /5 plant) was recorded in third week of August (34th SW) followed by (4.15 and 3.80 adult /5 plant), (3.93 and 3.72 adult/5 plant) in 33rd and 36th SW, respectively and minimum was recorded (1.25 and 0.80 adult/5 plant) in 40th SW. The results of the present study are in conformity with the result of Mohanasundaram *et al.*, (2012) who has reported that the coccinellids population was highest when okra was intercropped with cluster bean (4.6 and 4.3 individuals /5plants) and was on par intercropped with baby corn (4.6 and 4.1).

The spiders were present constantly throughout the crop season and their populations were higher in 35th SW (6.40 and 6.22 individuals/5plant) due to maximum host

availability followed by (6.20 and 5.88 individuals/5 plant), (5.12 and 4.66 individuals/5 plant) at 34th and 36th SW. The minimum population was 2.88 and 2.51 in 40th SW during *Kharif* 2012 and *Kharif*, 2013 respectively. On the basis of two years population, the spider judged as dominant predator.

The maximum number of black ants was noticed during the infestation of okra mealy bug because the ant feed on the honey dew secreted by mealy bug. The population of ants ranged 1.67 to 4.38 and 1.35 to 4.22 during *Kharif*, 2012 and 2013. The maximum population of ants was recorded 4.38 and 4.22 in 33th SW followed by (3.80 and 3.56) in 34th SW and minimum in 40th SW (1.67 and 1.35 adult/5 plants) during *Kharif*, 2012 and *Kharif*, 2013 respectively.

The maximum population of mirid bugs was recorded 3.88 and 3.56 in 35th SW followed by (3.60 and 3.25 adult/5plant), (2.88 and 2.66 adult/5plant) in 34th and 33th SW and minimum 1.42 and 1.08 adult/5plant in 40th SW during *Kharif*, 2012 and 2013 respectively. The population of mirid bugs ranged from 1.42 to 3.88 and 1.08 to 3.56 adult/ 5plant during *Kharif* 2012 and *Kharif*, 2013 respectively.

Correlation between predators with abiotic factors in okra

The correlation coefficient of different predators i.e. Coccinellids, spiders, ants and mirid bugs with abiotic factors showed positive correlation with minimum temperature i.e. (0.921**, 0.809**, 0.777** and 0.810**) and (0.595, 0.407, 0.347 and 0.399) respectively during *Kharif*, 2012 and *Kharif*, 2013. It was significantly correlated at 1% level during *Kharif*, 2012 but non-significant during *Kharif*, 2013. The negative correlation was observed between the maximum temperature in coccinellids, spiders and mirid bugs i.e. -0.078, -0.119 and -0.045 but with ant the relation was positive (0.094) during *Kharif*, 2012 respectively. In *Kharif* 2013, the correlation with maximum temperature was positive with the predators. The relative humidity was positively correlated with the spiders (0.704** and 0.295), ants (0.570 and 0.885) and mirid bugs (0.646* and 0.266) during *Kharif*, 2012 and 2013, respectively but in coccinellids it was positive (0.786**) in *Kharif*, 2012 and negative in *Kharif*, 2013. Rainfall was positively correlated with natural enemies (0.073 to 0.256) in *Kharif*, 2012 and significantly negative with spiders (r-0.632*) and mirid bugs (-0.681*) at 5% level during *Kharif*, 2013. The sunshine was negatively correlated with the predators and varied (-0.234 to -0.485) and (-0.097 to-0.395) during *Kharif*, 2012 and *Kharif*, 2013 respectively. The result obtained on predatory population of shoot and fruit borer in okra during both *Kharif* season of study were similar to the finding of Mohanasundaram *et al.*, (2012) and Sardana *et al.*, (2005) who had reported that a large buildup of natural enemies *viz*, spiders and coccinellids were observed in unprotected crop module. Shinde *et al.*, (2007) found that neem seed powder and NSKE 5% recorded maximum population of lady bird beetles and spiders on okra. Abdalla (2012) reported that Chrysopids and spiders were the predominant predators in autumn and summer seasons, whereas syrphids, chrysopids and coccinellids were the abundant groups during winter. Singh *et al.*, (2013) reported that the coccinellids showed negative correlation with minimum and maximum temperature, rain fall and relative humidity.

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