STUDIES ON BIOAGENTS OF PIGEONPEA POD BORERS IN NORTH GUJARAT

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ABSTRACT

Surveys conducted at five locations of Banaskantha district viz., Dantiwada, Deesa, Palanpur, Danta and Amirgadh during 2011-12 and 2012-13 resulted in collection of six predator species viz., Spiders, Coccinella Septempunctata, Menochilus sexmaculata, Mantis religiosa, Chrysoperla carnea and Vespa sp. in pigeonpea. Ladybird beetles viz., M. sexmaculata (24.14%, 26.84%, 25.99%, 20.03% and 23.08%) and C. septempunctata (24.54%, 20.55%, 24.76%, 31.27%, 25.42%) dominated the pigeonpea ecosystem at Dantiwada, Deesa, Palanpur, Danta, and Amirgadh, respectively. Total nine parasitoids were recorded from pod borers viz., Helicoverpa armigera (Carcelia spp., Goniopthalmus halli and Chelonus sp.), Maruca vitrata (Habrobracon hebetor, Tetrasticus sp., and Elasmus sp.) and Melanagromyza obtusa (Euderus lividus, Orymyrus sp. and Eurytoma sp.). Maximum parasitism was observed in case of Carcelia spp. on H. armigera (15.41% at Amirgadh in January), H. hebetor on M. vitrata (16.67% at Danta in December) and E. lividus on M. obtusa (13.33% at Amirgadh in January).

KEY WORDS: Bioagents, Pod borers, Pigeonpea, Survey

INTRODUCTION

Pigeonpea, *Cajanus cajan* (L) Mill. is an important grain legume crop of semi-arid tropical and subtropical farming systems. Being rich source of protein (18 to 26 %), it is the second most important pulse crop grown in the country next to chickpea. India ranks 1st in terms of area and production in the world with 80 per cent and 67 per cent of world's acreage and production in the year 2016-17, respectively with 45.99 lakh tonnes pigeonpea seeds from an area of 53.87 lakh hectares (3rd Adv. Estimates). Gujarat contributes only 3.69 lakh tonnes of pigeonpea seeds from an area of 3.34 lakh hectares (Anon., 2017). Among several factors confining its potential production, damage by insect pests is predominant. Pod borer complex *viz*., *Helicoverpa armigera* (Hubner), *Maruca vitrata* Fabricius and pod fly, *Melanagromyza obtusa* Malloch were considered as the primary biotic constraints to pigeonpea production causing losses up to 100 per cent (Sharma *et al*., 2009), 51 per cent (Vishkantaiah and Sundarababu, 1980) and 63 per cent (Ahmed, 1983), respectively. Apart from these notorious pests, there may be some bioagents present in the crop which directly or indirectly influence the pest population. The information regarding influence of these biotic factors on pod borers is very scanty in North Gujarat. Therefore, present

investigation was conducted to study the various bioagents of pigeonpea pod borers and their relative abundance in North Gujarat.

MATERIALS AND METHODS

Relative abundance of bioagents in pigeonpea was studied at five different locations *i.e.* Dantiwada, Deesa, Palanpur, Danta, and Amirgadh of Banaskantha district. Three fields from each location were selected. In each field, ten plants were selected randomly and tagged for study purpose. Populations of predators were recorded from these tagged plants at fortnight interval. The data on predator population so obtained were subjected to mathematical/ statistical analysis towards estimating mean density and relative abundance.

(i) Mean density:

$$\text{Mean density} = \frac{\sum Xi}{n} \qquad (i= 1, 2, 3\ldots\ldots\ldots\ldots\ldots.., n)$$

Where,

Xi = Number of predators in i^{th} months

n = Total number of observations

(ii) Relative abundance (%):

$$\text{Relative abundance (\%)} = \frac{\text{Number of individuals of one species}}{\text{Number of individuals of all species}} \times 100$$

For studying the prevailed parasitoids, larvae of *H. armigera* and *M. vitrata*, were collected from these selected fields of different locations. Thus, fortnightly a total of twenty larvae of respective pests were brought to Entomology Laboratory of Centre of Excellence for Research on Pulses, S. D. Agricultural University, Sardarkrushinagar. The larvae were fed with flower buds, flowers and tender pods till pupation. The parasitoids emerged were collected and counted to calculate per cent parasitization under field conditions.

For observing parasitoids of *M. obtusa*, twenty pupae from each replicated trial were collected at the time of harvesting and kept separately in plastic vials. The adult parasitoids so emerged were collected and per cent parasitization was calculated.

RESULTS AND DISCUSSION

Relative abundance of predators

Surveys conducted at five locations of Banaskantha district *viz.*, Dantiwada, Deesa, Palanpur, Danta, and Amirgadh during 2011-12 and 2012-13 resulted in collection of six predator species *viz.*, Spiders, *Coccinella septempunctata* (Linnaeus), *Menochilus sexmaculata* (Fabricius), *Mantis religios*a (Zagrosti), *Chrysoperla carnea* (Stephens), *and Vespa* sp. in pigeonpea. Based on two years data (Table 1), it was cleard that ladybird beetles *viz.*, *M. sexmaculata* (24.14, 26.84, 25.99, 20.03 and 23.08 % relative abundance) and *C. septumpunctata* (24.54, 20.55, 24.76, 31.27 and 25.42% relative abundance) dominated the pigeonpea ecosystem with higher relative abundance at Dantiwada, Deesa, Palanpur, Danta and Amirgadh, respectively. Spiders had also showed relatively higher abundance with a range of 16.60 to 23.33 per cent at different locations. The relative abundance of rest of three predator species *viz.*, *M. religiosa*, *C. carnea* and *Vespa* sp. varied considerably among the different areas, which ranged from 9.21 to 12.87 per cent, 8.76 to 11.32 per cent and 6.14 to 14.17 per cent at different locations,

respectively. Rajeswaran *et al.* (2005) and Kumar and Nath (2007) documented these predators species of common occurrence in pigeonpea, chickpea, cowpea, greengram, lentil and other pulse crops. Similarly, Sahoo and Senapati (2000) reported predators of pigeonpea pod borers as spiders, wasp and preying mantids. Mahendra *et al.* (2011) also recorded *C. septempuctata, M. sexmaculata, M. religiosa, Rhinocoris fucipes and C. carnea* as natural enemies of *H. armigera* in pigeonpea. However, according to Mittal and Ujagir (2005), spiders are more prevalent in pigeonpea than other natural enemies.

Activity of parasitoids on pigeonpea pod borers

It was observed that three parasitoid species *viz.*, *Carcelia* spp., *Goniopthalmus halli and Chelonus* sp. were found parasitizing pod borer, *H. armigera* in the field during study period (Table 2). Among these parasitoids, *Carcelia* spp. was most active and caused higher rate of parasitization (1.25 to 15.41 %) at all the locations (Dantiwada, Deesa, Palanpur, Danta and Amirgadh) surveyed. It was followed by *G. halli,* for which the rate of parasitization was noted with a range of 1.66 to 11.66 per cent at different locations. *Chelonus* sp. was observed moderately active and brought about as high as 8.75 per cent parasitization at Danta during the month of January. In earlier reports, tachinid flies (*Carcelia* spp. and *G. halli*) were recorded as active parasitoids of *H. armigera* (Bisane and Deotale, 2008) which support the present findings. Thanavendan and Jeyarani (2009) observed field release of braconid parasitoids, *Chelonus* effective against *H. armigera* in tomato and okra.

In all surveyed pigeonpea growing areas, spotted pod borer (*M. vitrata*) was observed to be parasitized by three parasitoids *viz*., *Habrobracon hebetor*, *Tetrasticus* sp. and *Elasmus* sp. during cropping season (Table 2). Braconid wasp, *H. hebetor* was recorded to be most active at all the locations with higher rate of parasitization in the tune of 1.25 to 16.67 per cent. The parasitizing activity of *Tetrasticus* sp. on *M. vitrata* was noted to be as high as 7.91 per cent at Danta during January. The maximum rate of parasitization for *Elasmus* sp. was observed as high as 6.66 per cent which was recorded at Amirgadh during the month of December. Experimental results of Mohapatra *et al.* (2008) support the present findings who reported larval parasitization of *M. vitrata* by *Bracon hebetor* in short duration pigeonpea, whereas *Tetrasticus* sp. and *Elasmus* sp. were reported parasitizing various lepidopterous pests (Mehrnejad, 2012).

The per cent parasitism of *M. obtusa* in pigeonpea indicated that three pupal parasitoids *viz*., *Euderus lividus*, *Orymyrus* sp. and *Eurytoma* sp. attacked on pod fly, *M. obtusa* in all pigeonpea growing areas surveyed (Table 2). Among these, *E. lividus* was observed more active, as it caused 9.17 to 13.33 per cent parasitization of the pest at various locations. In case of *Orymyrus* sp. and *Eurytoma* sp., the rate of parasitism was noted in the range of 6.67 to 9.17 per cent and 5.00 to 10.00 per cent at different locations. Dar *et al*. (2005) recorded *E. lividus*, *Orymyrus* sp. and *Eurytoma* sp. as active parasitoids of *M. obtusa* in pigeonpea which concord with the present investigation.

CONCLUSION

Ladybird beetles *viz.*, *M. sexmaculata* and *C. septempunctata* dominated the pigeonpea ecosystem with higher relative abundance as compared to spider, mantids, *Chrysopids* and *Vespa* sp. at various locations *viz*., Dantiwada, Deesa, Palanpur, Danta, and Amirgadh, respectively. Total nine parasitoids were recorded from pod borers *viz*., *Helicoverpa*

armigera (*Carcelia* spp., *Goniopthalmus halli* and *Chelonus* sp.), *Maruca vitrata* (*Habrobracon hebetor*, *Tetrasticus* sp., and *Elasmus* sp.) and *Melanagromyza obtusa* (*Euderus lividus*, *Orymyrus* sp. and *Eurytoma* sp.) during study period. *Carcelia* spp., *H. hebetor* and *E. lividus* were most active parasitoids against *H. armigera*, *M. vitrata* and *M. obtusa*, respectively.

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Table 1: Relative abundance of predators in pigeonpea growing areas

Predators	**Dantiwada**		**Deesa**		**Palanpur**		**Danta**		**Amirgadh**	
	Mean	Relative abundance (%)	Mean	Relative abundance (%)	Mean	Relative abundance (%)	Mean	Relative abundance (%)	Mean	Relative abundance (%)
Spider	5.57	23.33	4.07	17.30	4.13	18.94	3.44	16.60	4.32	19.10
C. septempunctata	5.88	24.54	4.57	20.55	5.38	24.76	6.26	31.27	5.51	25.42
M. sexmaculata	5.76	24.14	6.00	26.84	5.63	25.99	4.38	20.03	5.07	23.08
M. religiosa	2.19	9.21	2.32	10.30	2.82	12.87	2.63	12.38	2.69	12.09
C. carnea	2.13	8.87	2.44	10.86	2.51	11.32	1.88	8.76	2.13	9.92
***Vespa* spp.**	2.38	9.92	3.19	14.17	1.32	6.14	2.25	10.98	2.25	10.41

Table 2: Parasitism on pod borers in pigeonpea growing areas

Location	Month	Parasitism (%) on								
		H. armigera			*M. vitrata*			*M. obtusa* (at harvest)		
		Carcelia spp.	*G. halli*	*Chelonus* sp.	*H. hebetor*	*Tetrasticus sp.*	*Elasmus sp.*	*Euderus lividus*	*Orymyrus sp.*	*Eurytoma sp.*
Dantiwada	**Nov**	0	2.50	0	1.25	0.83	1.25	9.17	7.50	5.84
	Dec	7.50	5.83	2.50	7.92	4.17	3.33			
	Jan	11.25	7.08	2.50	8.33	6.25	3.33			
Deesa	**Nov**	0	2.08	0.83	1.25	0.84	1.25	10.84	6.67	8.34
	Dec	5.41	4.58	2.50	8.75	4.58	5.00			
	Jan	12.08	4.58	1.67	11.67	7.50	5.00			
Palanpur	**Nov**	1.25	1.66	0.83	2.92	1.25	1.67	11.67	7.50	5.00
	Dec	7.50	3.33	1.66	6.67	4.58	3.33			
	Jan	14.16	7.08	2.08	12.92	6.25	5.83			
Danta	**Nov**	1.91	2.08	0	4.58	2.09	1.25	11.67	8.33	9.17
	Dec	8.74	6.67	4.58	9.17	7.08	5.82			
	Jan	14.75	11.66	8.75	16.67	7.91	6.25			
Amirgadh	**Nov**	1.67	2.08	2.08	1.67	1.25	2.09	13.33	9.17	10.00
	Dec	7.50	5.41	3.74	10.83	6.66	6.66			
	Jan	15.41	7.50	5.83	10.75	6.25	2.92			

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