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FEEDING PROPENSITY OF MAJOR APHIDIPHAGOUS COCCINELLIDS ON MAIZE APHID *RHOPALOSIPHUM MAIDIS* (FITCH)

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ABSTRACT

The predator prey relationship manifested by functional response of three dominant coccinellids was studied under ambient conditions of atmospheric temperature and relative humidity in the laboratory of Department of Entomology, Rajasthan College of Agriculture, Udaipur during 2013. The three dominant coccinellids viz., *C. septempunctata, I. cincta* and *Ch. sexmaculata* showed a varied functional response while feeding on maize aphids. All the three coccinellid grubs and adult beetles consumed relatively more aphids at lower aphid densities (25, 50 and 75), significantly being the maximum at a prey density of 75. At higher aphid densities (100, 125 and 150) the consumption rates declined. The feeding behavior of coccinellids showed a sharp decline in percentage feeding with an increase in prey density for both adults and grubs.

Key words: Feeding propensity, *Rhopalosiphum maidis,* Coccinellid beetles

INTRODUCTION

Coccinellids exhibit a key role in the suppression of aphid populations in diverse agro-ecosystems; some of them being euryphagous like, *Coccinella undecimpuntata* L. (Hodek and Honek, 1996). They accept a wide range of food and the larvae eat the same prey as adults; however, for the completion of larval development to reach adulthood and produce viable progeny they consume their "essential food" (Hodek, 1973). Aphidiphagous coccinellids have generalist tendencies to feed on alternate prey species (Hodek and Honek, 1996; Dixon, 2000). Obrycki and Kring (1998) opined that emphasis on biodiversity studies, evaluation, predation specificity, colonization in a new environment and assessment of community level interventions is necessary to maximize the use of coccinellids in bio-control programs. The present investigation was conducted to evaluate the predation potential of more dominant aphidophagous coccinellid species in maize and maize based inter-cropping system.

MATERIALS AND METHODS

The comparative feeding propensity of three major aphidophagous coccinellids was studied under laboratory conditions including *Coccinella septempunctata* Linneaus*, Cheilomenes sexmaculata* (Fabricius) and *Illeis cincta.*

Maintenance of laboratory culture. The adult coccinellids were field collected from the untreated crop fields of the Instructional Farm of the College and brought to the laboratory to maintain a stock culture under ambient conditions of temperature and humidity. The mean atmospheric temperature ranged from 23 to 34^{o}C and at 51 to 74 per cent relative humidity. Mating pairs were kept in glass jars (500ml capacity) covered with muslin cloth that was fastened with rubber bands. The eggs laid on maize leaves (20) were placed into fresh glass jars till the first instar grubs emerged, which were then provisioned with fresh maize aphids daily as food. To evaluate the predation potential of coccinellid grubs at different aphid densities (25, 50, 75, 100, 125 and 150), four healthy second instar grubs were separated with the help of a camel hair brush after the first moult and transferred into individual glass jars of 500ml capacity covered with a muslin cloth held together by rubber bands, considered as 4 replicates. Observations on the consumption of aphids were recorded in each replicate under the different treatments after 24h. The experiment was continued for 5 days. The left over aphids and dried maize shoots were replaced daily with fresh ones to avoid contamination and consequent mortality. The adult beetles were starved for 6h before the provision of aphid prey. They were individually transferred to glass jars with different aphid prey densities on fresh maize leaves replicated 4 times. Observations on consumption of aphids were recorded in each replicate

under the different treatments after 24h. The following mathematical analysis was made towards estimating the predation efficiency of dominant aphidophaous coccinellid by determination of the voracity following the model of Soares *et al*. (2003):

$$Vo = (A - a\,24)\ ra\ 24$$

Where,

Vo = number of aphids eaten;

A = number of aphids available

a 24 = number of aphids alive after 24 h and

ra 24 = ratio of aphids found alive after 24 h in the absence of predators.

RESULTS AND DISCUSSION

The predation potential of the dominant aphidophagous guild comprising the adult and grubs of coccinellids of three species was evaluated by their feeding behavior at different aphid prey densities (25, 50, 75, 100, 125 and 150 per beetle). From the Table (1) it can be inferred that the grubs of *Coccinella septempunctata* could feed significantly more aphids at the different densities evaluated followed by *Illeis cincta* and *Cheilomenes sexmaculata*. All the three coccinellid grubs increasingly and significantly consumed more aphids at aphid densities of 25, 50 and 75; but, at higher aphid densities (100, 125 and 150) the consumption rate declined. The prey consumption on a number basis differed significantly at different densities with *C. septempunctata* feeding 20.55 to 24.70; *I. cincta* feeding 19.70 to 23.00 and *Ch. sexmaculata* feeding 18.95 to 21.15 aphids in 24 hours with the maximum being when 75 aphids as prey were provided. From the Figure (1) on feeding behavior it becomes clear that an increase in prey density sharply decreased the per cent feeding by the grubs. Notwithstanding the fact that aphidophagous coccinellids prefer to feed on aphids, they are specific predators of aphids at low densities between 25 and 50. However, this gives an indication that field releases of coccinellid grubs might prove useful at higher aphid densities considering the feeding ability of a single coccinellid grub.

The Table (2) indicates that the adult coccinellids showed little difference in their feeding potential. Similar to the behavior of grubs, all the three adult coccinellids consumed more aphids with increase in the prey density up to 75 aphids per adult; thereafter their feeding capacity declined. The prey consumption on a number basis did not differ much at different densities with *C. septempunctata* feeding 18.70 to 22.55; *I. cincta* feeding 17.80 to 20.95 and *Ch. sexmaculata* feeding 15.95 to 19.35 aphids in 24 hours with the maximum being when 75 aphids as prey were provided. Similar to the feeding behavior of grubs, from the Figure (2) it can be observed that an increase in prey density sharply decreased the per cent feeding by adult beetles. Earlier, Harjit Kaur and Deol (1999) observed the mean daily consumption of the aphid, *R. maidis* by adults and larvae of *C. septempunctata* to be 30.4 and 27.7 at 18.6°C and 71 per cent relative humidity that increased with an increase in the daily temperature. Contrary to our findings that coccinellids were more efficient at lower aphid densities, Dicko (2000) reported that the number of attacks by coccinellid adults increased significantly and linearly with increasing prey density. Adult consumption rates were 82-85 per cent in 1997 and 76-97 per cent in 1998. Larval consumption also increased significantly and linearly with prey density and the consumption rates were 80-93 per cent in 1997 and 85-94 per cent in 1998. Singh and Marwaha (2002) reported that adults of *C. septempunctata* consumed a significantly higher number of aphids than larvae of *Syrphus* sp., but less than adults of *M. sexmaculata*. Adults consumed a

Table 1. Feeding behaviour of aphidophagous coccinellid grubs at different prey densities

Aphid Prey Provided (^{1}:s/ 24h)	*Coccinella septempunctata*		*Illeis cincta*		*Cheilomenes sexmaculata*	
	Prey Consumed (^{1}:s/ 24h)	Feeding (%)	Prey Consumed (^{1}:s/ 24h)	Feeding (%)	Prey Consumed (^{1}:s/ 24h)	Feeding (%)
25	20.55^{a}	82.20	19.70	78.80	19.00	76.00
50	22.95^{b}	45.90	21.65	43.30	20.55	41.10
75	24.70^{c}	32.93	23.00	30.66	21.15	28.20
100	22.10^{ab}	22.10	20.75	20.75	19.80	19.80
125	22.30^{ab}	17.84	21.72	17.37	20.05	16.04
150	21.40^{ab}	14.26	20.00	13.33	18.95	12.63
S. Em.±	0.73		0.49		0.34	
C.D. (5%)	2.20		1.47		1.03	

Prey = Maize aphid; values with similar letters are statistically at par.

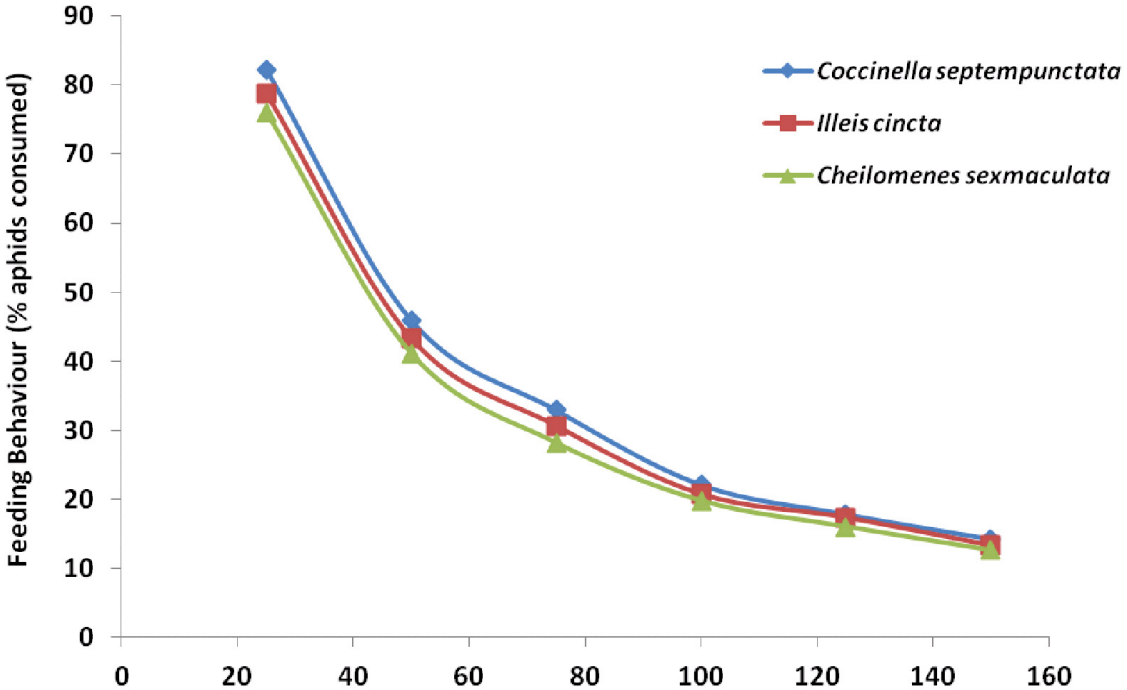


Fig. 1: Response of maize aphid density on coccinellid grub feeding behaviour during *kharif*, 2013

Table 2. Feeding behaviour of aphidophagous adult coccinellids at different prey densities

Aphid Prey Provided (¹:s/ 24h)	*Coccinella septempunctata*		*Illeis cincta*		*Cheilomenes sexmaculata*	
	Prey Consumed (¹:s/ 24h)	Feeding (%)	Prey Consumed (¹:s/ 24h)	Feeding (%)	Prey Consumed (¹:s/ 24h)	Feeding (%)
25	18.70[a]	74.80	17.80[a]	71.20	16.80[a]	67.20
50	20.40[b]	40.80	19.60[ab]	39.20	17.50[ab]	35.00
75	22.55[c]	30.06	20.95[c]	27.93	19.35[b]	25.80
100	20.10[b]	20.10	18.95[a]	18.95	17.20[a]	17.20
125	20.20[b]	16.16	19.20[ab]	15.36	17.35[ab]	13.88
150	19.55[ab]	13.03	17.95[a]	11.96	15.95[a]	10.63
S. Em. ±	0.35		0.39		0.46	
C.D. (5%)	1.05		1.18		1.39	

Prey = Maize aphid; values with similar letters are statistically at par

significantly higher number of maize aphids than immature stages. Grubs of *C. septempunctata* were more active than maggots of *Syrphus*.

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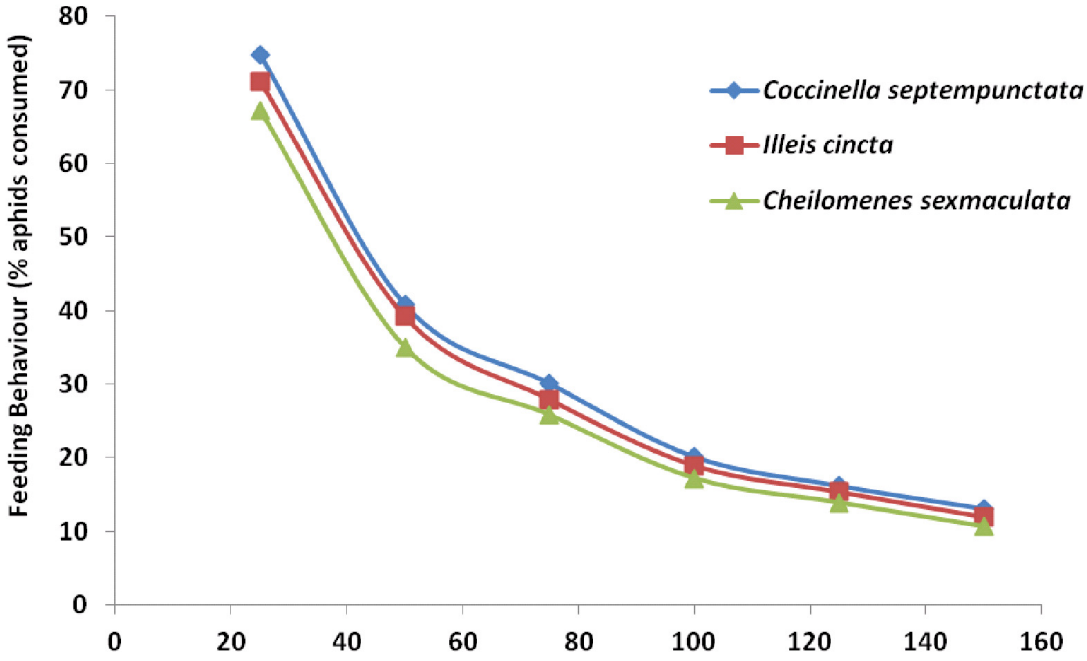


Fig. 2: Response of maize aphid density on adult coccinellid feeding behaviour during *kharif*, 2013

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