Indian Journal of Applied Entomology **23**(1) : 36-39 (2009)

PREDATORY POTENTIAL OF COCCINELLIDS AGAINST APHID, *ROPHALOSIPHUM MAIDIS* (FITCH.) INFESTING MAIZE IN SOUTHERN RAJASTHAN

HEMANT SWAMI AND N.K. BAJPAI

Department of Entomology, Rajasthan College of Agriculture (MPUAT), Udaipur

ABSTRACT

The feeding and predatory potential of *C. septempunctata*, *C. sexmaculata* and *B. suturalis* was studied against *R. maidis* under laboratory conditions at 27±1°C and 80±5 per cent RH. *C. septempunctata* was found very effective in managing the aphid population at tested prey predator ratio 1:25 to 1:200. The maximum prey consumption ; maximum feeding ; highest feeding per predator and maximum area of discovery for *C. septempunctata* varied from 79± 2.26 to 169±5.25, 39.5 to 84.5 per cent; 10.56 to 39.5 per cent and 0.233 to 0.503 respectively followed by 59± 1.25 to 146±7.01; 29.50 to 73.06; 9.12 to 29.50 and 0.164 to 0.305 for *C. sexmaculata*. *B. suturalis* was found less effective in comparison to *C. septempunctata* and *C. sexmaculata*.

Key words: Coccinellids, *C. septempunctata, C. sexmaculata, B. suturalis,* maize aphid, *R. maidis*.

INTRODUCTION

Maize being staple food is widely grown in south western parts of Rajasthan which is attacked by a large number of insect pests (Sarup, 1980). Among sucking pests, the aphid, *Rophalosiphum maidis* (Fitch.) is economically important and causes damage on flowering parts of maize crop, resulting in heavy losses to yield (Foott, 1975). Though, several chemical insecticides are found effective against aphids but their application is not easy due to height of the crop; further, they cause ecological problems and are also costly. Maize in the region is considered as low input and poor farmer's crop, where insecticide usages are very negligible, hence alternate control measures are urgently needed.

Several predacious coccinellids are available naturally in maize agro ecosystem which is reducing the aphid numbers. Among them *Coccinella septumpunctata* Linnaeus., *Cheilomens sexmaculata* Fabricius. and *Brumus suturalis* Fabricius have been observed in dominating numbers. Looking to their impact on aphid management, it was planned to evaluate the feeding and predatory potential of these coccinellids against *R. maidis*.

MATERIALS AND METHODS

The feeding and predatory potential of *C. septempunctata, C. sexmaculata* and *B. sutralis* on maize aphid *R. maidis* was investigated in the maize laboratory of Department of Agricultural Zoology and Entomology, Rajasthan College of Agriculture (MPUAT), Udaipur, at 27 ± 1° C temperature and 65 ± 5 per cent relative humidity. The adults and nymphs of *R. maidis* were collected from infested maize plants from College farms and then laboratory culture was maintained on aphids reared in laboratory on maize seedlings, which were further utilized for the present studies. The fourth instar grubs were utilized for the studies.

The predatory potential of different coccinellid species *C. septumpunctata, C. sexmaculata* and *B. suturalis*, was evaluated after the release of fourth instar twelve hour starved grub at different host predator ratio *viz*, 1:200, 1:100, 1:50 and 1:25 in separate jars with ten replications. The jars were covered with muslin cloth and tightened with rubber bands. After an exposure of three hours, the predators were taken out from the jar and unconsumed aphids were counted. The prey consumption per predator and per cent prey consumption was calculated by taking the ratio of number of prey consumed and predator density. The data thus obtained were subjected to statistical analysis of variance of CRD.

The area of discovery for each predator at different density was also calculated by using the formula given by Nicholson and Bailey (1935) -

$$a \approx 1/P \log_e N/S$$

Where,

a ≈ Area of discovery,

N ≈ Number of prey exposed for predation,

P ≈ Predator density released for predation

S ≈ Number of prey surviving after predation

Table 1: Predatory potential and area of discovery of coccinellids against maize aphids

S. No.	Predator : Prey Ratio	*C. sexmaculata*				*C. septumpunctata*				*B. suturalis*			
		Total Prey consumed	Total Per cent feeding	Per cent feeding/ predator	Area of discovery	Total Prey consumed	Total Per cent feeding predator	Per cent feeding/	Area of discovery	Total Prey consumed	Total Per cent feeding	Per cent feeding/ predator	Area of discovery
1.	1:25	146 ± 7.01	73.06 (58.73)	9.12 (17.58)	0.164	169 ± 5.25	84.50 (66.58)	10.56 (18.96)	0.233	132 ± 4.47	66.02 (54.34)	8.25 (16.69)	0.135
2.	1:50	94 ± 1.67	47.00 (43.28)	11.75 (20.05)	0.159	136 ± 2.83	68.01 (55.55)	17.00 (24.35)	0.285	122 ± 2.87	61.00 (51.36)	15.25 (22.58)	0.235
3.	1:100	68.00 ± 2.11	34.00 (35.67)	17.00 (24.35)	0.208	93 ± 2.91	46.50 (43.00)	23.25 (28.83)	0.313	58 ± 2.75	28.99 (32.58)	14.59 (22.38)	0.171
4.	1:200	59 ± 1.25	29.50 (32.90)	29.50 (32.90)	0.305	79 ± 2.26	39.50 (38.58)	39.50 (38.58)	0.503	49 ± 1.33	24.50 (29.67)	24.50 (29.67)	0.281
	SEm ±	-	± 0.381	0.12		-	0.40	0.15		-	0.30	0.13	
	CD at 5%	-	0.91	0.33		-	1.13	0.15		-	0.85	0.37	

Figure in parenthesis represent the retransformed value

RESULTS AND DISCUSSION

The data clearly show that the predatory potential of coccinellids viz. *C. septumpunctata, C. sexmaculata* and *B. suturalis* increases with the increase in prey population in predator prey ratio from 1:25 to 1:200, whereas prey consumption per predator decreased with the increase in prey density. The maximum prey consumption was observed in *C. septumpunctata* at all the ratios viz. 1:25, 1:50, 1:100 & 1:200 ranging from 79 ± 2.26 to 169 ± 5.25 individuals of *R. maidis* followed by *C. sexmaculata* with consumption of 59 ± 1.25 to 146 ± 7.01 aphids. The minimum prey consumption, 49 ± 1.33 to 132 ± 4.47 aphids, was observed in *B. suturalis* at all the ratios. A significant increase in total feeding by coccinellids was observed as the predator prey ratio increased. The per cent aphid consumption per predator also increased significantly in all tested ratios. Among all coccinellids, *C. semptumpunctata* gave maximum per cent feeding per predator, 10.56, followed by 9.12 and 8.25 per cent in *C. sexmaculata* and *B. suturalis,* respectively at the 1:25 ratio. While at 1:200 ratio per cent feeding per predator was 39.50 in *C. septumpunctata* followed by 29.50 and 24.50 in *C. sexmaculata* and *B. suturalis*. The significant increase in feeding of coccinellids was observed as the ratio increased.

The decrease in prey consumption at higher predator prey ratio may be described to the limited time of predation and restricted area of searching. When time of predation was limited the predator has to face hindrance from increased number of prey, resulting in decreased prey consumption. The similar facts were also reported by various scientists *viz*., Mora *et al.* (1995) and Omkar and Barish (2003) who found that satiation may be a major factor in limiting the feeding at increased prey density since satiated beetles spent more time in prey handling due to which prey capture decreases. The results are also in agreement with findings of Veeravel and Bhaskaran, 1997 who observed that when more number of larvae of *C. transversalis* was introduced at constant prey density, the prey consumption increases but individually prey consumption decreased. Roger and Hassell (1974) and Evans (1991) were also of the view that the presence of more prey and less predator reduces the foraging and feeding success of conspecifics by consuming the prey sighted and interfering with them.

Further, it is clear from the data that the area of discovery of *C. septumpunctata, C. sexmaculata* and *B. suturalis* increased with the increase in prey predator ratio. The maximum area of discovery at all ratios was observed in *C. septumpunctata* which ranged from 0.233 to 0.503 followed by 0.164 to 0.305 and 0.135 to 0.281 in *C. sexmaculata* and *B. suturalis,* respectively. The increase in the area of discovery of fourth instar grub of the three coccinellid species with increase in predator prey ratio was possibly due to reduction in the searching area of predator and increased chance of prey predator interaction. At low ratio, the aphids were spaced out due to which predator spent most of their energy and time in foraging. Scarce prey density possibly stimulates foraging behaviour of predators. Thus, at higher prey ratio they need to search the prey by the predator decreased (Hassel & Varley, 1969 and Tripathi *et al.*, 2000).

Higher prey ratio also results in reduction of unsuccessful attacks of predator, as there are less chances of escape irrespective to those in scarce prey density, where there are more chances for the prey to escape from predator (O'Neil, 1988).

It is clear from the investigation that among the tested coccinellids, *C. septumpunctata* was more effective against *R. maidis* followed by *C. sexmaculata* and *B. suturalis* and hence can be released in maize ecosystem to reduce the aphid population below economic threshold level.

ACKNOWLEDGEMENTS

The authors are thankful to the Head, Department of Entomology, RCA, MPUAT, Udaipur and AICMIP, RCA, Udaipur for providing necessary facilities for carrying out the experiment.

REFERENCES

Evans, E.W. (1991). Intra-versus-inter specific interactions of ladybeetles (Coleoptera: Coccinellidae) attacking aphids. *Oecologia*, **87**: 401-408.

Foott, W.H. (1975). Chemical Control of the corn leaf aphid and effects on yields of field corn. *Proceedings of Entomological Society of Ontario*, **106**: 49-51.

Hassell, M.P. and Varley, G.L. (1969). New inductive population model for insect parasites and its bearing on biological control. *Nature,* **223**: 1133-1137.

Mora, J.G. Gapud, V.P. and Velasco, L.R.I. (1995). Life history and voracity of *Coelophora inaeqiualis* (Fabricius) (Coleoptera: Coccinellidae) on *Aphis craccivora* Koch. (Hemiptera: Aphididae). *Philippine Entomologist,* **9**: 52-553.

Nicholson, A.J. and Bailey, V.A. (1935). The balance of animal populations. pp. 551-598. Part-I. *Proceedings of Zoological Society of London*.

Omkar and Barish E. James (2003). Searching and feeding efficiency of lady bird beetle, *Coccinella transversalis* Fabricius on aphid, *Aphis gossypii* Glower. *Journal of Biological Control*, **17**: 107-112.

O'Neil, R.J. (1988). Predation by *Podisus maculiventris* Say on *Mexican* bean beetle, *Epilancha varvestris* Mulsant in Indian soybeans. *The Canadian Entomologists*, **120**: 161:166.

Rogers, D.J. and Hassell, M.P. (1974). General models for insect parasite and predator searching behaviour inference. *Journal of Animal Ecology*, **43**: 239-253.

Sarup, P. (1980). Significant results of investigations carried out under maize improvement project in recent years. *Breeding Production and Protection Methodologies of Maize in India*. AICMIP, IARI, New Delhi, pp. 190-192.

Tripathi, C.P.M., Siddique, A., Dubey, R.S., Sinha, G., Kumar, N. and Rai, S. (2000). Effect of food plant on the searching efficiency, mutual inference and killing power of the ladybird beetle, *Coccinella septumpunctata* Linn., a predator of *Lipaphis erysimi* (Kalt.). *Seventh National Symposium on Apidology.* 11-13 March, 2000 at DDV Gorakhpur University, Gorakhpur.

Veeraval, R. and Bhaskaran, P. (1997). Functional and numerical responses of *Coccinella transversalis* and *Cheilomens sexmaculata* Fabr. feeding on the melon aphid, *aphids gossypii* Glov. *Insect Sciences and its Application,* **17**: 335-339.