



Evaluation of some bioagents against mustard aphid (*Lipaphis erysimi* (Kaltenbach)) (Hemiptera: Aphididae) on single plant in field condition

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ABSTRACT: Four bioagents, viz., *Coccinella septempunctata* L., *Menochilus sexmaculatus* (F.), *Chrysoperla carnea* (Stephens) and *Verticillium lecanii* (Zimmerman), were evaluated against mustard aphid, *Lipaphis erysimi* (Kaltenbach), on single plants covered with muslin cloth in the field at National Research Centre on Rapeseed-Mustard, Sewar, Bharatpur (Rajasthan) during 2005-06 and 2006-07. *C. septempunctata* @ two adults/plant was found to be the most effective, reducing 96.19% of the aphid population in 10 days followed by *C. septempunctata* @ two larvae per plant (93.42%), *V. lecanii* @ 10^8 spores^{-ml} (84.90%), *M. sexmaculatus* @ two adults (84.62%) and *C. carnea* @ four larvae^{-plant} (82.98%). *C. septempunctata* @ one adult per plant reduced the aphid population by 77.49% and *M. sexmaculatus* by 69.08%.

KEY WORDS: *Chrysoperla carnea*, *Coccinella septempunctata*, *Lipaphis erysimi*, *Menochilus sexmaculatus*, mustard aphid, *Verticillium lecanii*.

Rapeseed-Mustard crops are attacked by more than 40 insect pests. Among them, mustard aphid, *Lipaphis erysimi* (Kaltenbach), is considered as the key pest in almost all the parts of India. Mustard aphid causes 26 to 96% loss in seed yield and loss in oil content up to 15%. A large number of insecticides have been recommended by many workers for the management of this dreaded pest in different parts of the country. These insecticides cause serious problems such as environmental pollution, insect resistance and pest resurgence besides adversely affecting beneficial organisms. The use of natural enemies for the management of aphids has been emphasized. *Coccinella septempunctata* L., *Menochilus sexmaculatus* (Fabricius), *Chrysoperla carnea* (Stephens) and *Verticillium lecanii* (Zimmerman) have been reported for their potentiality against different aphid species (Honek, 1985; Singh and Singh, 1993; Singh *et al.* 2003; Purwar and Sachan 2004). Therefore, it was thought essential to evaluate these four bioagents for their efficacy against mustard aphid on single mustard plant covered with muslin cloth under natural conditions in the field.

The experiment was conducted at National Research Centre on Rapeseed-Mustard, Sewar, Bharatpur (Rajasthan) on *Brassica juncea* cv. PCR-7 and *B. rapa* var. brown sarson cv. BSH-1 during 2005-06 in pots kept in the field enclosed in iron cages covered with muslin. During 2006-07, the experiment was carried out only on *B. juncea* cv. PCR-7 sown in the field and healthy and vigorous plants were selected at suitable distance and enclosed in

iron cages covered with muslin cloth to avoid interference of other natural enemies (Fig. 1). The other plants from the experimental field were removed. The mustard aphid infested twigs were collected from the general crop fields to provide the augmented aphid population to these caged plants. The aphid-infested twigs were shaken on the caged plants to drop the aphids. The aphids were allowed to spread over the caged plants and counted when settled properly. The bioagents, viz., *C. septempunctata* @ one adult, two adults, one larva and two larvae per plant, *M. sexmaculatus* @ one adult, two adults, one larva and two larvae per plant, *C. carnea* @ 1, 2, 3 and 4 larvae per plant and *V. lecanii* @ 10^5 , 10^6 , 10^7 and 10^8 spores^{-ml} were released or sprayed on these caged plants in three replications. The larvae of *C. septempunctata*, *M. sexmaculatus* and *C. carnea* were released in 2nd instar stage and one-day-old adults of *C. septempunctata* and *M. sexmaculatus* were released irrespective of sex. The population of mustard aphids on each plant was counted again on 3rd, 7th and 10th day of the release/spray. Second application was provided 15 days after first application.

During 2005-06, in *Brassica juncea* (Var. PCR-7), *C. septempunctata* @ one adult, two adults, one larva and two larvae per plant reduced the aphid population by 18.49-92.62 per cent. *M. sexmaculatus* @ one adult, two adults, one larva and two larvae per plant reduced the aphid population from 15.88 to 81.61 per cent in 3-10 days after release.

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Table 1. Evaluation of bioagents against mustard aphid on single plant in field condition

Name of bio-agents	No. of bio-agent released / sprayed	% Mean reduction in aphid population after two release/spray								
		2005-06						2006-07		
		PCR-7			BSH-1			PCR-7		
		3 rd day	7 th day	10 th day	3 rd day	7 th day	10 th day	3 rd day	7 th day	10 th day
<i>Coccinella septempunctata</i>	1 adult/plant	20.87	53.83	72.31	20.98	47.89	74.60	21.25	54.89	77.49
	2 adult/plant	27.28	74.91	92.62	27.49	64.65	85.72	24.90	71.60	96.19
	1 larva/plant	18.49	49.95	75.39	18.05	45.00	74.07	15.87	46.97	75.13
	2 larvae/plant	26.62	74.54	92.00	27.15	73.39	93.42	23.94	76.24	92.03
<i>Menochilus sexmaculatus</i>	1 adult/plant	15.88	32.98	58.01	14.37	30.45	51.89	16.65	33.52	69.08
	2 adult/plant	21.04	40.40	69.53	20.15	42.75	70.07	20.10	41.46	84.62
	1 larva/plant	20.38	43.77	68.97	17.39	34.30	57.81	17.31	35.78	63.60
	2 larvae/plant	24.03	48.20	81.61	21.01	43.96	72.02	22.05	48.90	77.76
<i>Chrysoperla carnea</i>	1 larva/plant	17.27	57.06	40.00	16.54	52.93	36.98	15.60	45.23	29.37
	2 larva/plant	24.18	61.72	43.50	20.50	59.92	43.36	23.54	54.60	34.08
	3 larva/plant	30.32	71.00	49.74	27.45	70.43	48.98	27.31	58.67	37.51
	4 larva/plant	41.04	82.98	61.59	33.34	78.60	57.00	32.37	67.15	44.60
<i>Verticillium lecanii</i>	10 ⁵ spores/ml	10.70	22.89	34.76	11.02	23.45	35.37	11.25	22.00	33.45
	10 ⁶ spores/ml	13.55	27.64	48.72	13.85	27.85	49.50	13.12	26.65	43.25
	10 ⁷ spores/ml	19.12	42.12	68.18	17.45	36.87	60.33	17.29	32.47	66.04
	10 ⁸ spores/ml	24.97	54.56	84.72	23.01	53.02	81.86	24.29	52.50	84.90

Releases of *C. carnea* @ one to four larvae per plant reduced the aphid population by 17.27 – 82.98 per cent, while *V. lecanii* @ 10⁵, 10⁶, 10⁷ and 10⁸ spores ml⁻¹ from 10.70 to 84.72 per cent in 3-10 days after release/spray. In *Brassica rapa* var. brown sarson (cv. BSH-1), *C. septempunctata* @ one adult, two adults, one larva and two larvae per plant reduced the aphid population by 20.98-93.42 per cent. *M. sexmaculatus* at various rates of release reduced the aphid population by 14.37-72.02 per cent in 3-10 days after release. The release of *C. carnea* at various rates reduced the aphid population by 16.54 to 78.60 per cent while *V. lecanii* @ 10⁵, 10⁶, 10⁷ and 10⁸ spores ml⁻¹ from 11.02 to 81.86 per cent during 3-10 days after release/spray.

During 2006-07, in *Brassica juncea* (Var. PCR-7), *C. septempunctata* at various rates of release reduced the aphid population by 15.87 – 96.19 per cent and *M. sexmaculatus* by 16.65 – 84.62 per cent in 3-10 days after release. The releases of *C. carnea* at various rates reduced the aphid population from 15.60 – 67.15 per cent, while *V. lecanii* @ 10⁵, 10⁶, 10⁷ and 10⁸ spores ml⁻¹ from 11.25 to 84.90 per cent in 3-10 days after release/spray. It was found that *C. septempunctata* @ two adults per plant was most effective reducing the aphid population by 96.19

per cent on 10th day, followed by *C. septempunctata* @ two larvae per plant (93.42 per cent), *V. lecanii* @ 10⁸ spores ml⁻¹ (84.90 per cent), *M. sexmaculatus* @ two adults (84.62 per cent) and *C. carnea* @ four larvae per plant (82.98 per cent on 7th day of release). All the bioagents provided maximum reduction in aphid population on 10th day of release / spray except *C. carnea* which gave maximum reduction on 7th day of release (Table 1).

Studies on the evaluation of these bioagents on single plant in field condition in enclosed conditions are lacking. However, Sharma *et al.* (1997), Behera *et al.* (1999), and Singh *et al.* (2003) have studied the feeding potential of *C. septempunctata*, *M. sexmaculata* and *C. carnea*, respectively, in the laboratory and their findings support our study. The variations in consumption may be due to the low temperature in field conditions. Purwar and Sachan (2004) reported reduction in aphid population (42.46 to 76.58 per cent) after 10 days of application of *V. lecanii* @ 5 x 10⁸ spores ml⁻¹ in the field, which is in conformity with the present study; however, minor variations may be due to climatic conditions. Our study indicates that bioagents, particularly *C. septempunctata*, *C. sexmaculata* and *V. lecanii*, are effective in field conditions against mustard aphid.

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REFERENCES

- Behera, M. K., Behera, R. and Patro, B. 1999. Biology and feeding potential of *Coccinella septempunctata* Linnaeus (Coleoptera: Coccinellidae) on the chrysanthemum aphid, *Macrosiphoniella sanborni* (Gillette). *Journal of Biological Control*, **13**: 39-43.
- Honek, A. 1985. Activity and predation of *Coccinella septempunctata* adult in the field. *Zeitschrift für angewandte Entomologie*, **100**: 399-409.
- Purwar, J. P. and Sachan, G. C. 2004. Bioefficacy of entomopathogenic fungi against mustard aphid, *Lipaphis erysimi* (Kalt.) on *Brassica campestris*. *Journal of Aphidology*, **18**: 5-10.
- Sharma, D. K., Varma, G. C. and Kishore, L. 1997. Feeding capacity of predators of mustard aphid, *Lipaphis erysimi* Kalt. *Journal of Aphidology*, **11**: 171-174.
- Singh, D. and Singh, H. 1993. Biology of ladybird beetle, *Coccinella septempunctata* Linn. *Annals of Biology*, **9**: 250-253.
- Singh, N. N., Latif, H. and Pandey, R. 2003. Preying capacity of *Chrysoperla carnea* (Steph.) on mustard aphid, *Lipaphis erysimi* Kalt. *Journal of Applied Zoological Research*, **14**: 57-58.

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