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Biological Control of Mustard Aphid, *Lipaphis erysimi* (Kaltenbach) in the Punjab

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ABSTRACT

Mustard aphid, *Lipaphis erysimi* (Kaltenbach) is a serious pest of rapeseed and mustard in Punjab. The coccinellids, *viz. Coccinella septempunctata* Linnaeus and *Cheilomenes sexmaculatus* Fabricius were the most common predators of *L.erysimi*. The studies on the feeding potential indicated that *C.septempunctata* and *C.sexmaculatus* consumed 380.4 and 304.3 aphids respectively during their larval development.Releases of 2nd instar larvae of *C.septempunctata* and *C.sexmaculatus* in the mustard field @ 1000/ha proved effective in reducing mustard aphid population. *C.septempunctata* proved significantly better than *C.sexmaculatus* for the control of mustard aphid.

KEY WORDS : *Coccinella septempunctata, Cheilomenes sexmaculatus, Lipaphis erysimi*, Biological Control

The mustard aphid, *Lipaphis erysimi*(Kaltenbach) is a serious pest of rapeseed, mustard and cruciferous vegetables in Punjab. It has been reported to cause 22.6 to 52.5 per cent loss in yield of *Brassica* spp. (Brar *et al.*, 1987). Many insecticides have been recommended for its efficient control (Anonymous, 1995). These insecticides are known to cause mortality of the beneficial organisms, residue problems, hazards to man and animal and cause pollution of the environment. Five species of coccinellids have been reported to feed on the mustard aphid in India (Singh and Bindra, 1976). However, two species *Coccinella septempunctata* Linnaeus and *Cheilomenes sexmaculatus* Fabricius are most prevalent in Punjab. (Mathur, 1983; Kumar, 1992). Therefore, the present studies were undertaken to study the feeding potential and field evaluation of these two important predators.

MATERIALS AND METHODS

The adults of *C.septempunctata* and *C.sexmaculatus* were collected from different field crops. The coccinellids were reared in the laboratory as suggested by Gautam (1989, 1990). Adults of both the species were kept in glass jars (17.0x10.5 cm) separately and mustard leaves infested with mustard aphid were provided for egg laying. The eggs laid by each species on leaves were removed and kept in Petri-dishes (100x17 mm) for hatching. Ten newly hatched larvae were transferred to glass vials (4x1 cm) individually and plugged with cotton wool. Each larva was provided with 150 aphids of uniform size daily at 11 AM till pupation. The exuviae were removed after the larvae entered the next instar. The number of aphids consumed by each larvae was determined twice daily at 10.00 A.M. and 4.00 P.M. The dead and unconsumed aphids of the previous day were discarded and fresh preys were provided. Thus, aphids consumed by each instar and total consumption by the two species was worked out. During the period of study the temperature and RH were 26.5 ± 1.2^0C and $58.5 \pm 6.3\%$ respectively.

An experiment was conducted at farmer's field near village Lassara (Distt. Jalandhar) to evaluate the coccinellids against *L. erysimi*. The coccinellids for use in this experiment were multiplied in the laboratory. Three fields of the mustard crop each measuring 0.4 ha were selected at a distance of 500m from one another. The second instar larvae of both the

species were released in separate fields @1000/ha on January, 11, 1994 and the third plot was kept as control. Observations on the aphid population were recorded from two plants selected at random from five spots in the field during each observation. For counting the aphids, 5 cm top portion of the central shoot was observed. The data were analysed by factorial analysis.

RESULTS AND DISCUSSION

The data revealed that the number of aphids consumed by each instar differed significantly (Table 1). The lowest consumption was by first instar followed by the second and third instars. The maximum consumption of the aphids was by fourth instar larvae (126.4) and it was significantly higher than all other instars. The consumption by the fourth instar was almost double than that of second instar and four times than that of the first instar.

The mean aphid consumption by *C.septempunctata* (95.1) was significantly higher than that of *C.sexmaculatus* (76.1). The total consumption by the larvae of *C.sexmaculatus* was 304.3 as compared to 380.4 by *C.septempunctata*. The interaction between the predator species and their instars was also significant. The consumption by 2nd to 4th instar of *C.septempunctata* was significantly higher than that of the respective instars of *C.sexmaculatus*. However, the consumption by the first instar of both the species was at par with each other. Earlier, Kumar (1992) reported that larvae of *C.septempunctata* and *C.sexmaculatus* consumed 564.9 and 383.0 *L.erysimi* during their development. He also observed that the feeding capacity increased in every successive instars. Singh and Malhotra (1979) reported that total number of mustard aphid consumed by a larva was 284.6. However, Singh *et al.* (1994) reported that the four larval instars consumed 867.5 mustard aphids during February and 2047.5 during March. Varma *et al.* (1993) reported that *C.sexmaculatus* consumed 598.5 *Aphis gossypii* Glover during its larval stages. However, it consumed 143-189 individuals of *Aphis nerri* Boy. de Fonsc. (Bose and Ray, 1967) and 350- 400 nymphs of *A.craccivora* Koch (Patel and Vyas, 1986).

The data from the field experiment showed that the population of the aphids in the released fields was significantly lower than control on all the dates of observations (Table 2). The population of *L.erysimi* where *C.septempunctata* was released was significantly lower than in plots where *C.sexmaculatus* was released on all the dates of observations except March 25, 1994. The mean population in *C.septempunctata*-released field was 37.3 which was significantly lower than that in *C.sexmaculatus* released field which in turn was significantly lower than control.

It can be concluded that the two species of the coccinellids were able to reduce the aphid population below the economic threshold of

Table 1. Predation of two coccinellid species on *Lipaphis erysimi*

Coccinellid species	Mean* number of aphids consumed					Total
	I	II	III	IV	Mean	
C. sexmaculatus	28.2 (5.57)**	55.4 (7.43)	105.6 (10.26)	115.1 (12.53)	76.1 (8.95)	304.3
C.septempunctata	31.6 (5.64)	82.1 (9.04)	128.9 (11.73)	137.8 (13.92)	95.1 (10.08)	380.4
Mean	29.9 (5.61)	68.7 (8.24)	117.2 (11.00)	126.4 (13.22)		

* Mean of 10 replications ** Parentheses are square root transformations

CD (p=0.05) Predator : 0.23
Instars : 0.24
Interaction : 0.46

Table 2. Field evaluation of the coccinellid predators against *Lipaphis erysimi*

Date of Observation	Population* of the aphids/two plants (5 cm central shoot)			
	C.septempunctata	*C.sexmaculatus*	Control	Mean
Jan 11, 1994	12.0(3.45)	12.4(3.50)	13.6(3.65)	12.7(3.53)
Jan 25, 1994	54.8(7.29)	70.8(8.39)	107.2(10.34)	77.6(8.67)
Feb 8, 1994	43.4(6.54)	69.6(8.32)	127.8(11.30)	80.3(8.72)
Feb 15, 1994	38.4(6.15)	81.6(9.01)	176.6(13.29)	98.9(9.48)
Feb 22, 1994	47.2(6.84)	83.0(9.10)	274.6(16.55)	134.9(10.83)
Mar 16, 1994	46.1(6.80)	74.8(8.63)	186.2(13.64)	102.4(9.69)
Mar 25, 1994	19.0(4.21)	20.4(4.49)	91.4(9.52)	43.6(6.08)
Mean	37.3(5.90)	58.9(7.35)	139.6(11.19)	

* Mean of 5 replications

** Parentheses are square root transformations

CD (p=0.05) for treatment = 0.23
for period = 0.31
for interation = 0.60

mustard aphid, without the use of insecticides. The economic threshold of mustard aphid on rapeseed and mustard has been fixed as 50-60 aphids per 10 cm central shoot (Bakhetia *et al.*, 1989).Among the two predators, *C.septempunctata* was found to be better in controlling *L.erysimi* on mustard. Gupta and Yadava (1989) reported that five coccinellids *viz.*, *C.septempunctata, Coccinella* sp., *Brumoides suturalis,* F. *C.sexmaculatus* and *Adonia variegata* (Goeze) played an important role in reducing the population of *Myzus persicae* Sulzer on cumin under field condition from mid-February to March.Kumar(1992)obtained 75% control of mustard aphid within a week when released @ 30 grubs per $3m^2$. Tamaki and Long (1978) reported that predators had a major role in determining the abundance of aphids but their effect was greater at higher densities because the more voracious species respond preferentially to higher aphid population.

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