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Evaluation of Integrated Management of Aphid Pests, *Brevicoryne Brassicae* and *Lipaphis Erysimi* on Canola Crop in Southern Punjab, Pakistan

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Abstract.- The study was conducted to evaluate various measures, *viz*., application of insecticide methomyl @ 560 gm/ha, plant spraying with tap water, release of *Coccinella septempunctata* (L) @ 50 grubs per plot, release of another predator *Chrysoperla. carnea* (Stephen) @ 1000 eggs per plot and release of both predators together for the control of canola pests, *Brevicoryne brassicae* and *Lipaphis erysimi* during 2002- 2003. Methomyl was found to be the most effective treatment resulting in maximum control of aphids till seventh day after treatment followed by the plant washing with tap water and release of both predators. Blank spray with tap water gave satisfactory control of the pest till 48 hours after application. The efficiency of the predators when released singly or released together was increased as the releasing period was prolonged. Plant height, number of branches per plant, number of pods per plant, number of grains per pod and grain yield were significantly affected in all the treatments.

Keywords: IPM, canola, aphids, predators, methomyl, Southern Punjab, Pakistan.

INTRODUCTION

Aphids are serious pests of oilseeds like sarson, rapeseed, canola, sunflower etc., fruit trees such as peach plums, vegetables like cauliflower, cabbage, potato graminacious crops like wheat, maize, barley and forage legume, crops like lucern and cotton in Pakistan. *Acyrthosiphon pisum* (Harris), *Aphis craccivora* Koch. *Theraphis trifolli* attack on legumes, *Rhopalosiphum maidis* (Fitch), *R. padi* (L.) *Shizaphis graminum* Rond., *Macrosiphum avenae* (F.) and *M. granarium* attack on graminacious crops. *Myzus persicae* (Sulz) affects fruit crops, while *Liphaphis erysimi* (Kitb), Pseudobrassicae (Davis) and *Myzus persicae* attack *Brassica*. These aphid species of Pakistan has been studied by several workers Aheer *et al*., 1997; Ahmad and Soomro, 1997; Amjad *et al*., 1999, Azimi, 1987; Inayatullah *et al*., 1993; Karimullah *et al*., 1995; Nasir and Yousaf 1992; Soomro and Khalid, 1994; Buriro *et al*., 1997; Hamid, 1974; Mustafa *et al*., 1996. Chemicals have so for been considered the most effective means of control of the pests Azimi, 1987; Ghaffar *et al*., 1996; Karimullah and Ahmad, 1995; Manzoor and Stringam, 1992; Tahir *et al*., 1999; Zafar, 1985; Zaman, 1992.

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Since the use of pesticides is wrought with several disadvantages such as development of insecticide resistance, hazards to non target organisms including human etc, biological control program based on integrated pest management is more rational strategy. Little efforts have been done in this direction in Pakistan (Irshad, 1987; Mohyuddin, 1981). The reports on biological control of aphid from Pakistan deal with the record of natural enemies, their incidence biology, ecology and host range (CIBC, 1977; Hamid *et al*., 1974; Khan *et al*., 1990; Mughal and Munshi, 1985; Mustafa *et al*., 1996; Pirzada *et al*., 1996; Stary *et al*., 1998; Suhail *et al*., 1999). Stoyenoff (2001) evaluated changes in aphid on *Hibiscus* plants and suggested that plant washing can provide a viable means of management for aphids.

Singh *et al*. (2003) evaluated low cost pest management strategies in *Brassica* crop including sowing time, seed treatment, biological agents like fungus and *Trichoderma viridae* as soil application, mechanical removal of aphid infested twigs and inoculative release of *C. carnea*. They concluded that integrated pest management (IPM) model

reduced the pest attack on the crop and gave higher yield as compared to untreated plots.

Keeping in view the above facts the present project was undertaken to integrate various control methods *viz*., application of effective insecticides, release of *C. septempunctata* and *C. carnea* alone and in combination, blank (tap water) spray alone and blank spray with combination of predators with the objective to find the most effective treatment for the control of aphids on canola crop.

MATERIALS AND METHODS

The experiment was conducted at Agriculture Farm of the University College of Agriculture, Bahauddin Zakariya University, Multan during 2002-2003. Canola was sown in field measuring 30-m x 34-m by broadcast method on October 24, 2002. There were seven treatments including control in each field and every treatment was replicated four times under Randomized Complete Block Design (RCBD). Field was divided into 7 plots each measuring 6-m x 4-m. An area of one meter between treatments and two meters between replication was maintained as path.

Application of insecticide

The insecticide was applied by using knapsack hand sprayer equipped with hollow cone nozzle when the population of aphid reached at Economic Threshold Level (ETL) of 30-40 aphids per 10 cm inflorescence on canola. Sprayer pressure was 18 Psi. Flat fan sprayer from a standard multi-spray pattern hose nozzle with outlet water pressure of 315 kha: The nozzle distance from plant was about 60 cm. The plants containing aphids were water sprayed with tap water.

Augmentation of biological agents

C. septempunctata and *C. carnea* were collected from cultivated vegetable area around Multan city and brought to the rearing laboratory of Entomology Department, University College of Agriculture, Bahauddin Zakariya University, Multan Pakistan. These beetles were reared in four muslin cloth cages each measuring 36 cm^3 under 28±2°C, 70±5% relative humidity and 12: 12 day: night regime. A wooden sheet covered with green cloth was kept on each rearing cage. Fresh and alive aphids were given to the beetles daily as diet. Honey, yeast and water (1:1:1) were given as food to adults of *C. carnea*. The beetle laid eggs in cluster. On emergence, 50 grubs were released in the fields @ one grub per plant of each respective treatment .In case of *C. carnea* the eggs laid on the underside of the wooden sheet were scratched and pasted on the paper cards (card size was 6 x 4 inches). Each card contained 200 eggs and 2 cards were hanged at 3-cm below from top of the inflorescence in the plot of canola.

The data regarding the population of aphids were collected from 10 cm inflorescence of randomly selected main stems of 10 plants per plot from all plots of each application before 1 day and 1, 2, 3 and 7 days after treatments. Aphid population was calculated by the following formula:

$$\text{Reduction \%} = \frac{\text{Population Before Spray} - \text{Population After spray}}{\text{Population before spray}} \times 100$$

Following observations were recorded:

i) Plant height was measured with the help of measuring tape. Main stems of 10 plants were selected at random from each plot of canola for this purpose.

ii) Ten plants from each plot were selected randomly and number of branches was counted at the time of harvest.

iii) Ten plants were selected randomly from each plot and the number of pods was counted from each branch of each plant.

iv) Fifty pods were plucked from randomly selected 10 plants of each plot before harvest and the number of grains was counted.

v) Grain yield was recorded from each plot after harvest. The data were then converted into per hectare basis with the following formula.

$$\text{Grain yield per hectare} = \frac{\text{Yield per plot X 10,000}}{\text{Plot size}}$$

Duncan's Multiple Range Test was applied to

find the significance of our results by using computer software M. Stat.

Table I.- Percent reduction in population of *Aphids* on canola at various intervals after different treatments.

Treatments	Dose/ha.	1 day before treatment	1 day after treatment	2 days after treatment	3 days after treatment	7 days after treatment
Control (T0)	-	38.48	0.00	0.00 f	0.00	0.00
Methomyl (T1)	560 g/ha	40.33	91.66	99.31 a	97.57	98.66
Blank spray (T2)	315 l/ha	38.00	79.21	71.20 c	44.55	18.64
Release of *C.septempunctat*a (T3)	50 grubs/plot	39.43	5.53	42.25 d	54.40	62.05
Release of *C. carnea* (T4*)*	1000 eggs/plot	38.80	2.83	18.61 e	51.98	59.91
Release of both predators (T5)	T3 + T4	39.93	8.89	50.42 d	73.16	83.49
Blank spray + Release of both Predators (T6)	T2 + T3 + T4	40.58	73.50	85.62 b	91.58	93.01
Overall average		39.36	37.37	52.49	59.04	59.39

Means sharing similar letters are not significantly different by DMR Test at P=0.05

RESULTS AND DISCUSSION

Impact of insecticide

The results revealed (Table I) that the application of methomyl resulted in 91.66%, 99.31%, 97.57% and 98.66% mortality 1, 2, 3 and 7 day after spray, respectively. Percent reduction at all the post treatment intervals remained effective for 7 days after application.

Impact of spray with tap water

Water spray (blank) was responsible for reduction of aphid population up to 79.21%, 71.20%, 44.55% and 18.64% after 1, 2, 3 and 7 days after application. The plant washed with the tap water did not show good results after 3 days of spray. It is suggested that blank spray may be effective, if this treatment is repeated after every 3 days. If the insecticides were applied after washing then population build up of aphids will be delayed and take longer time to sustain. That will be an integral part of IPM.

Impact of release of biological agents

Release of *C. septempunctata showed* 5.53%, 42.25%, 54.40% and 62.05% reduction in aphid population. Similar observations were also made in the release of *C. carnea.* However, predators showed some significant control of aphids at all the post treatment intervals and reduction rate was increased with the passage of time. Present findings can partially be compared with the previous work conducted by many workers (mentioned earlier) who stated that application of biological agents have potential to control the aphids. The same is true in the present project but repeated applications of biological agents can produce significant results rather than single release of predators.

In the present study it was also found that plant washing with tap water and release of *C. septempunctata* and *C. carnea* were found very effective *i.e.* 73.50%, 85.62%, 91.58% and 93.01% after 1, 2, 3 and 7 after application. This treatment was found to be the next most effective after insecticides. However, if this operation was repeated at 15 days of intervals then we can manage to keep the pest population below ETL. The present work is inconformity with those of Kumar *et al*. (2001) who reported that application of endosulfan alone in two sprays on *Brassica* was the most effective treatment as compared to *C. carnea* released twice at 15 days intervals. Similarly in the present investigations the methomyl was noted to be the most effective treatment resulting in maximum control of aphids and yield was increased as compared to other treatments (Table II). Kumar *et al*. (2001) studied the effectiveness and economics of different control measures of *L. erysimi*. The application of endosulfan alone in two sprays on *Brassica juncea* was the most effective treatment as compared to *C. carnea* at 10,000 larvae per hectare release twice at 15 days interval and a single release of *C. carnea*

with 0.07 % endosulfan. They further observed that very high rate of *C. carnea* increase the cost of the plant protection and thus reduced its benefit. Singh *et al*. (2000) studied the potentiality of *C. carnea* in

Table II.- Different yield parameters in canola after various treatments.

Treatments	Dose/ha	Plant height (cm)	Increase over control (%)	No. of Branches per plant	Increase over control (%)	No. of pods per plant	Increase over control (%)	No. of grain per pod	Increase over control (%)	Grain yield (kg)	Increase over control (%)
Control (T0)	-	161.42 h		4.58 f		320.43 h		15.12 h		4.58 f	
Methomyl (T1)	560 g/ ha	174.12 b	6.00	7.40 b	8.45	456.3d	6.66	24.20ab	29.48	7.40 b	28.45
Blank Spray (T2)	315 l/ha	162.97 h	0.62	5.38 e	8.80	460.42 d	2.35	15.77gh	3.05	5.38 e	8.80
Release of *C. septempunctata* (T3)	50 grubs/ plot	166.17 g	2.21	5.63 e	9.08	358.4g	3.36	16.50 fgh	5.86	5.63 e	9.08
Release of *C. carnea* (T4)	1000 eggs/ plot	165.80 g	1.62	5.68 e	10.32	323.00 h	2.78	17.00fg	4.40	5.68 e	10.32
Release of both Predators (T5)	T3 + T4	168.07 fg	2.81	6.13 de	12.44	373.8g	4.67	20.72de	17.91	6.13 de	12.44
Blank spray + Release of Both Predators (T6)	T2 +T3 + T4	173.05 bc	4.63	6.55 cd	17.92	356.12 g	4.42	19.95 e	17.64	6.55 cd	17.92
Average		167.37 b	3.78	5.90 b	14.15	351.50g	3.79	18.46 b	13.22	5.90 b	14.51

Mean sharing similar letters are not significantly different by DMR Test at P=0.05

suppression of mustard aphid population.

All the yield parameters *viz*., plant height, number of branches per plant, number of pods per plant, number of grains per pod and grain yield showed significant variations in canola (Table II). Methomyl proved to be the most effective resulting in significant increase in plant height 6.00%, number of branches 8.45%, number of pods 6.66%, number of gains 29.48% and grain yield 28.45% over control. Plant washing with release of both predators together was found to be the next effective treatment resulting in 17.97% increase in yield over control. Release of both predators together was the third effective treatment resulting in 12.44% increase in yield over control. Minimum increase in yield over control was observed in blank spray, release of *C. septempunctata* and release of *C. carnea* treatments. The present study cannot be compared with those of Singh *et al.* (2003) because they integrated different control methods other than those applied in the present study.

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