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Preying Propensity of Larvae/ Grubs of Syrphid and Coccinellid Predators on Mustard APHID, *Lipaphis Erysimi* (KALT.)

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Abstract

Experiments on preying capacity of different stages of grubs of the lady bird beetle, Coccinella septempunctata Linnaeus and different syrphid flies (Syrphus confrater, Syrphus balteatus and Ischiodon scutellaris) on L. erysimi. was conducted under the laboratory conditions during the Rabi cropping season of 2010-11 and 2011-12. Results revealed that the larvae of the lady bird beetle are a mightiest predator amongst these predators. The larvae of the C. septempunctata preyed higher number of mustard aphids (pooled average 56.02 aphids/day) followed by S. confrater (49.43 aphids/day), S. balteatus (41.54 aphids/day) and I. scutellaris (35.91 aphids/day) during their larval life span. Results revealed that the grubs of all the tested predators became almost always active against nymph of L. erysimi Kalt. during entire period of study. Among the larval stages of the syrphid and coccinellid predators, it was also analyzed that the last instars larvae/grub of the predators are proved mightiest devourer against aphid, L. erysimi. These predators could be used effectively for management of L. erysimi on mustard. Potentiality of these predators was established in the present study indicated that these could be integrated with other biocontrol tools.

Keywords: Preying efficiency, predators, Lipaphis erysimi Kalt.

1. Introduction

Rapeseed-mustard (*Brassica juncea* L.) is a very important oilseed crop and constitute the major source of edible oil in the country. It ranks second in area and production among all the oilseed crops only after groundnut. With demand for oilseed running ahead of supplies, the production trends have been unsatisfactory due to attack of various insect-pests. It is prone to attack a number of insect pests (Rai, 1976). More than three dozen of pests are known to be associated with various phonological stages of rapeseed and mustard crops in India (Bakhetia *et al.*, 1989). Among the insect pests attacking rapeseed and mustard aphid, *L. erysimi* (Kalt.) is a serious insect pest, infesting the crop right from seedling stage to maturity but that ravages the crop during the reproductive phase and act as a limiting factor in the production. Due to sap sucking, leaves become curled and discoloured, spots appear on the foliage, plant may gradually wilt, turn yellowish or brownish and die. Besides these, aphids secrete honeydew, which encourage the growth of the sooty moulds giving the stem and leaves black appearance and interfere the photosynthesis. The losses in yield caused by mustard aphid ranged from 9 to 95% (Singh *et al.*, 1980), 35.4 to 72.3 per cent (Bakhetia, 1986), 24.00 to 96.00 per cent (Phadke, 1985), up to 96% (Verma, 2000) at different places of India. The infestation of pest not only results in reduced yield of the seeds but also reduces the oil content upto 66.87 % (Singhvi *et al*., 1973). The use of insecticides for controlling this pest cause several adverse side effect i.e. toxic effect to non-target species, secondary pest out-break, residual effect on food chain, non biodegradable, pollution hazard, and problems of residue hazard to man, animals and environment. These ill effects of synthetic insecticides can be overcome by the use of biological control agent. Among the several bio-agents, syrphid flies (*S. confrater*, *S. balteatus* and *I. scutellaris*) and lady bird beetle, *C. septempunctata* are the important entomophagous predators upon many species of aphids and observed as an efficient and mightiest predator of *L. erysimi* in field conditions. The bio-control agents like coccinellids and others have been reported to be effective for controlling the aphids, *L. erysimi* (Singh *et al*., 2012).

Keeping this in view, the present studies were undertaken in order to make the quantitative estimates of preying capacity of different larval instars, of *S. confrater* (Weid.), *S. balteatus* (Deg.), *I. scutellaris* (Fab.) and *C. septempunctata* (L.) on mustard aphid, *L. erysimi* (Kalt.).

2. Materials and Methods

The predation potential of the larvae of the different predators on mustard aphids, *L. erysimi* were investigated by feeding the grubs with aphids. The experiment was carried out in a completely randomized design and replicated ten times in the laboratory of Department Agricultural Entomology, Udai Pratap Autonomous College, Varanasi (U.P.) during the *rabi* cropping seasons of 2010-2011 and 2011-2012.

To evaluate the preying capacity of different predators, pupae were collected and reared in the laboratory for different larval instar. The stock culture of *S. confrater*, *S.*

balteatus, I. scutellaris and *C. septempunctata* was maintained at 22 ± 2^0C and relative humidity of 65 ± 5% on the leaves of the host plant in the laboratory. The leaves/twigs of host plants infested with mustard aphid, *L. erysimi* were collected from plants after counting the number of aphids on leaves/twigs. They were placed over a thin layer of moist soil and wet blotting paper in plastic containers so as to keep the leaf turgid.

The newly hatched larvae (1-4 h) of different predators maintained in separate jars were released. After every 24 h period, such aphid infested host leaves or twigs were changed. Preying propensity of different predators was evaluated by releasing 100 aphids/larva/day to first and second instar grubs, while it was 150 aphids/individual per day for the third and fourth instar grubs. The counting of preyed aphids was made 24 h after release by counting living individuals. The number of aphids consumed per day during the period of study was recorded in each treatment by counting the number of remaining aphids and subtracting them from the total number of aphids provided. Natural mortality of aphids was also observed in a separate jar containing 100 aphids kept as control. First instar nymphs and adults of the prey (*L. erysimi*) were not included in feeding efficiency tests and the prey population was again maintained after 24 hrs. Cleaning and sterilizing the petridishes were done after every 24 hrs with 70 per cent ethanol. The fresh leaves were provided with every change.

The actual number of aphids consumed by predators was calculated by using the formula and these corrected values were analyzed statistically. X= R – (T – C), where, X= actual number of aphids consumed by predator, R= total number of aphid released in petridishes, T= number of live aphids in petridishes and C= number of dead aphids in control.

3. Results and Discussion

Experimental data on predation efficiency of larvae of the different predators viz., *Syrphus confrater* (Weid.), *Syrphus balteatus* (Deg.), *Ischiodon scutellaris* (Fab.) and *Coccinella septempunctata* (Linn.) on mustard aphid *Lipaphis erysimi* (Kalt.) are presented in the table 1, 2, 3, and 4.

Table 1: Feeding potential of *Syrphus confrater* (Weid.) on *Lipaphis erysimi* (Kalt.)

Stage ⇓	**Average number of aphids consumed by different larval instars**							
	Cropping season 2010-11				**Cropping season 2011-12**			
	Range	Total	Per day	**SE ±**	Range	Total	Per day	**SE ±**
Ist instar	15-25	20.70	6.90	0.05	15-20	18.60	6.20	0.05
IInd instar	150-200	167.70	55.90	0.29	150-190	165.00	55.00	0.28
IIIrd instar	275-330	258.30	86.10	0.41	270-350	259.50	86.50	0.40
Total	425-555	446.70	148.90	0.75	435-560	443.10	147.70	0.73
Mean	141.67-185.00	148.90	49.63	0.25	145.00-186.67	147.70	49.23	0.24

Table 2: Feeding potential of *Syrphus balteatus* (Deg.) on *Lipaphis erysimi* (Kalt.).

Stage ⇓	Average number of aphids consumed by different larval instars							
	Cropping season 2010-11				Cropping season 2011-12			
	Range	Total	Per day	SE ±	Range	Total	Per day	SE ±
Ist instar	20-30	24.00	8.00	0.06	20-30	21.93	7.31	0.06
IInd instar	50-80	69.99	23.33	0.12	60-80	71.70	23.90	0.13
IIIrd instar	260-290	274.98	91.66	0.34	275-300	285.00	95.00	0.38
Total	330-400	368.97	122.99	0.52	355-410	378.63	126.21	0.57
Mean	110.00-133.33	122.99	41.00	0.17	118.33-136.67	126.21	42.07	0.19

Table 3: Feeding potential of *Ischiodon scutellaris* (Fab.) on *Lipaphis erysimi* (Kalt.).

Stage ⇓	Average number of aphids consumed by different larval instars							
	Cropping season 2010-11				Cropping season 2011-12			
	Range	Total	Per day	SE ±	Range	Total	Per day	SE ±
Ist instar	15-30	19.98	6.66	0.06	15-25	17.97	5.99	0.05
IInd instar	90-110	102.30	34.10	0.11	85-110	101.60	33.87	0.27
IIIrd instar	200-225	216.00	72.00	0.39	270-290	215.70	71.90	0.38
Total	305-365	338.28	112.76	0.56	370-425	335.27	111.76	0.70
Mean	101.67-121.67	112.76	37.59	0.19	123.33-141.67	111.76	37.25	0.23

Table 4: Feeding potential of *C. septempunctata* (Linn.) on *Lipaphis erysimi* (Kalt.)

Stage ⇓	Average number of aphids consumed by different larval instars							
	Cropping season 2010-11				Cropping season 2011-12			
	Range	Total	Per day	SE ±	Range	Total	Per day	SE ±
Ist instar	30-40	35.66	17.83	0.07	30-40	34.40	17.20	0.08
IInd instar	80-100	87.40	43.70	0.16	80-110	92.60	46.30	0.15
IIIrd instar	110-150	132.58	66.29	0.82	120-160	138.66	69.33	0.83
IVth instar	175-200	182.40	91.20	0.27	175-210	192.56	96.28	0.35
Total	395-490	438.04	219.02	1.32	405-520	458.22	229.11	1.41
Mean	98.75-122.50	109.51	54.76	0.33	101.25-130.00	114.56	57.28	0.35

3.1 Preying efficiency of *S. confrater* (WEID.)

The maximum predation was observed by the third instar of the *S. confrater* followed by second and first instar during both the years of study. The first instar larvae of *S. confrater* could feed up to 6.90 and 6.20 aphids per day during 2010-11 and 2011-12 respectively. Whereas, the corresponding values was 55.90 and 55.00 aphids per day, respectively, for the second instar larvae. The third instar larvae could devour 86.10 and 86.50 aphids per day during first and second year of investigation, respectively. The average feeding capability of the larvae during their different nymphal life span was 49.23 to 49.63 aphids per day. The differences between the aphid consumption by the different instars of the *S. confrater* were varied greatly during both the years of investigation.

3.2 Preying efficiency of *S. balteatus* (DEG.)

S. balteatus could consume 8.00, 23.33 and 91.66 aphids per day during their first, second and third instar of the development, respectively in the first year of investigation. The corresponding values for the second year of experiment were observed as 7.31, 23.90 and 95.00 aphids per day, respectively. The average feeding capability of the larvae during their different nymphal life span was 41.00 to 42.07 aphids per day. The significant differences were also observed in the preying capacity of different instar grubs of the predators during both the years of investigation.

3.3 Preying efficiency of *Ischiodon scutellaris* (FAB.)

The first instar larvae of *I. scutellaris* could consume 6.66 and 5.99 aphids per day during first and second year of investigation, respectively. The second instar larvae could devour 34.10 and 33.87 aphids per day during 2010-11 and 2011-2012 respectively. Similarly the corresponding values for third instar larvae were observed as 72.00 and 71.90 aphids per day, respectively. The average feeding capability of the larvae during their different nymphal instars was 37.25 to 37.59 aphids per day. Per day and total consumption of the aphids by the different instars of the grub was found significant.

3.4 Preying efficiency of *C. septempunctata* (LINN.)

In case of *C. septempunctata*, the first, second, third and fourth instar grubs efficiently consumed 17.83, 43.70, 66.29 and 91.20 aphids per day, respectively during 2010-11. The corresponding consumption values during 2011-12 were 17.20, 46.30, 69.33 and 96.28 aphids per day, respectively. The average feeding capability of the grub during their different nymphal instars was observed 54.76-57.28 aphids per day. The total and per day devouring capacity of different instar grubs greatly varied during both years of investigation.

Observations revealed that the grubs of all the tested predators became almost always active against nymph of *L. erysimi* Kalt. during entire period of study. It was also analyzed that the last instar larvae/grub of the predators are proved mightiest devourer against *L. erysimi* Kalt.

These findings are similar to the findings of Bunker and Ameta (2009) and several earlier workers worked on the feeding potential of coccinellids on aphids and found large variations. Bilashini and Singh (2009) observed and reported that the coccinellids was found to prey upon all the life stages of prey available within its reach. Among the larval stage highest voracity was observed in IV instars larvae. The preying potential range in between 39.00 to 161.30 aphids per coccinellids per day was also observed by Saxena *et al*., (1970). The present investigations are also in conformity with the findings of Lekha and Jat (2002), Pandey and Khan (2002), Singh *et al.*, (2012) and Singh and Singh (2013). The feeding potential of *C. septempunctata* increased with the increase in age of the grub. Fourth instar grub consumed 69.40 and 61.50 aphids per day of *L. erysimi* and *M. persicae* respectively (Jindal and Malik, 2006). Soni *et al*., (2008) also reported that two day old grub, second, third, fourth instar and adult consumed 14.50, 15.75, 26.50, 51.25 and 40.75 aphids, respectively within 24 hrs of release when 100 aphids were provided as food. Under present studies *C. septempunctata* adult consumed 78.26 and 78.96 aphids, *L. erysimi* per day during first and second year of investigation respectively.

This study thus pointed out the possibility of keeping the aphid population below economic threshold level by *C. septempunctata*, *S. confrater*, *S. balteatus* and *I. scutellaris* in mustard ecosystem. Last instar grubs/larvae consumed more number of aphids; therefore it could be used as potential bio-agent for controlling the mustard aphid.

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