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Population Trend of Canola Aphid, *Lipaphis Erysimi (*Kalt) (Homoptera: Aphididae) And It's Associated Bio-Control Agent, *Coccinella Septempunctata* (Linnaeus) (Coleoptera: Coccinellidae) in Different Brassica Lines

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Abstract
Studies regarding the determination of population trend of Lipaphis erysimi (Kalt) and its associated bio-control agent, Coccinella septempunctata (Linnaeus) in different brassica lines, were conducted at the New Developmental Farm, The University of Agriculture Peshawar during cropping season (2012-2013). Four different brassica lines IBGE-I, IBGE-II, IBGE-III and IBGE-IV were used, which were replicated four times in Randomized Complete Block Design. The data revealed that aphid's infestation invariably started in all four varieties during 2nd week of February 2013 (1st observation). The peak population of 2.47 aphid's leaf $^{-1}$ was recorded during 3rd week of March and lowest population of 1.67 aphid's leaf $^{-1}$ was recorded during 2nd week of April. The specie of ladybird beetle (Coccinella septempunctata) was first time appeared on 14th February with mean number of (0.22 ladybird beetle plant $^{-1}$). At the time when aphid's population started to increase, the peak population of C. septempunctata (1.32 ladybird beetle plant^{-1}) was recorded on the 3rd week of March. Among all the Brassica lines, IBGE-I showed comparatively more resistance by recording least number of aphids on it as compared to IBGE-III, IBGE-IV and IBGE-II. IBGE-II showed least resistance against Lipaphis erysimi, which was found to be most susceptible cultivar by recording highest mean number of aphid's population on it. IBGE-I was also found superior in terms of bio-control agents. Maximum number of bio-control agents was recorded on IBGE-I followed by IBGE-III and IBGE-IV. Lowest number of beetles was recorded on IBGE-II.
Keywords: Lipaphis erysimi, Coccinella septempunctata, Brassica lines.

INTRODUCTION

The genus Brassica consists of three species, *Brassica oleracae, rapa* and *napus. oleracea* includes many important vegetables like cauliflower and broccoli. *Rapa* and *napus* are important oil crops grown all over the world. *brassica napus* consists of two subspecies, Swede (subspecies Brassica), and oilseed rape (subspecies oleifera). Oilseed rape is the most important oil crop in Sweden (Svensk, 2008).Mustard oil is edible and used in culinary indo- pak and preparing ointment and soap, making, condiment, green manure and fodder crops. In Indo- Pak subcontinents the most commonly grown *Brassica* oil seed crops occupy significant place regarding the edible oil production because the seeds of *Brassica* contain about 42% oil products. Amongst the cruciferous crops, the rapeseed and mustard is grown on 81% of the total area under oil seed crops (Nazir, 1994).Pakistan is constantly scarce in production of edible oil and meets its requirements through import from other countries which cost an enormous amount of foreign exchange. Its import bill is continuously the second largest after petroleum and constitutes the single largest expenditure on any of the imported food items. During 2009-2010, Pakistan imported 1.246 million tons of edible oil that cost 77.78 billion rupees (MINFA, 2010). Rape and mustard oil seed crops are the most important sources of vegetable oil grown during the winter season. The area and production level of rape and mustard in Pakistan during 2002-03 were about 649x103 acres, 217x103 tons oil seeds and 69x103 tons oil (Anonymous, 2002-2003). Aphid Lipaphis erysimi (Kaltenback) may become so plentiful during winter that it reduces the yield and quality of rapeseed and mustard. The losses in the yield of this crop have been reported to vary from 27 to 96 percent (Bakhetia, 1979)..The growing of resistant varieties and utilization of bio-control agents is one of the most promising methods of pest control (Naqvi, 1975).) Canola crop is attacked by a number of pests; among these aphids are more serious. Three species of aphids, i.e., cabbage aphid (*Brevicoryne brassicae* L.), turnip aphid (*Lipaphis erysimi* Kalt.) and green peach aphid (*Myzus persicae* Sulz.) are more abundant and widely distributed (Rehman *et al*., 1987) The aphidophagous ladybird beetle *Coccinella septempunctata* L., is one of the most effective predator of the mustard aphid, *Lipaphis erysimi* (Kalt.) which is a key pest of the rapeseed and mustard. The beetle occupies quite an incredible place among the naturally occurring bio-control agents of mustard aphid (Mathur, 1983).The ladybird beetles (lady bugs) are well-known group of small (0.8- 10 mm long), oval, convex, and often- bright coloured insects belonging to 475 North American species in 57 genera. Most ladybird beetles are predacious, as both larvae and adults feed chiefly on aphids. They are frequently quite common, particularly on vegetation where aphids are numerous. The larvae of beetle are elongated, somewhat flattened, and covered with small rounded bloated spines. They are usually marked or banded with bright colours. These larvae are often found in aphids colonies (Triplehorn and

Johnson, 2005).The larvae and adults of ladybird beetles, are not only a potential predators of aphids (plant lice), but they also feeds on several other pests such as soft-scale, mealy bugs, spider mites and eggs of the Colorado potato beetle as well as European corn borer, while a few feeds on plant and pollen mildews. These predatory beetles can be used in biological control of insect pests. For most agricultural systems, the augmentative releases and conservation techniques for ladybird beetle are significantly emphasized to exploit their uses in biological control (Rizvi *et al.,* 1994.

MATERIALS AND METHODS

An experiment was conducted to determine the population trends of Brassica aphid, *Lipaphis erysimi* (Kalt.) and its associated bio-control agents, in different Brassica lines viz. IBGE-I, IBGE-II, IBGE-III and IBGE-IV at the New Developmental Farm, The University of Agriculture Peshawar, during cropping season (2012-2013).

Parameters

1. Population density/ trend of Brassica aphid, *Lipaphis erysimi* leaf^{-1}.
2. Population density/ trend of Ladybird beetle plant^{-1}.
3. Identification of Ladybird beetle.

Seed sowing

Seeds of all Brassica lines were sown at the New Developmental Farm, near the institute of Biotechnology and Genetic Engineering, The University of Agriculture Peshawar on 29th October 2012. The seeds were sown in rows by using hand hoe. Each variety was replicated four times in the same field in small blocks, of area 5×3 m^2. Each block has 15 rows of plants with a distance of 33.02 cm. There were total 16 blocks, while each variety carries four blocks.

Population trend of *Lipaphis erysimi.*

In order to study the population trend of *L. erysimi,* in four different Brassica lines including IBGE-I, IBGE-II, IBGE-III and IBGE-IV were sown in different blocks. All these Brassica lines were replicated four times. Numbers of aphids were counted on three leaves, top, middle and lower region of 10 randomly selected plants in each block avoiding the border rows of each block. Data were collected at weekly intervals from 2nd week of February to the 2nd week of April.

Population trend of Ladybird beetles

In order to study the population trend of Ladybird beetles in four different Brassica lines including IBGE-I, IBGE-II, IBGE-III and IBGE-IV were sown in different blocks. All these Brassica lines were replicated four times. The numbers of ladybird beetles were counted on 10 randomly selected plants in each block avoiding the border rows of each block. Data were collected at weekly intervals from 2nd week of February to the 2nd week of April.

Identification of Bio-control agent

The specimen, which was found in the field, were collected and identified in the lab of Plant Protection Department, The University of Agriculture Peshawar.Seven-spotted Ladybird beetle (*Coccinella septempunctata*).

Analysis of Data

Data were analyzed by Statistix 8.1 computer package, using Randomized Complete Block Design.

RESULTS

Population density of aphid, *L. erysimi* (Kalt.) in different Brassica lines

The analysis of variance (Table-1), for the effect of Brassica lines and different time intervals (weeks) on the population of Canola aphid, *L. erysimi*, showed significantly large F values (P<0.05) for the brassica lines and time interval (weeks).

Table-1 shows the effect of interaction of Brassica lines and time intervals (weeks) on the mean population of Canola aphid, *L. erysimi.*

Mean value of the data indicate that, initially the mean aphid's population was low, which was (0.25 aphids leaf^{-1}) on 2nd week of February but with passage of time the aphid's population increased and peak population of (2.47 aphids leaf^{-1}) was recorded on 3rd week of March. After that the population started to decline and low mean population of (1.67 aphids leaf^{-1}) was recorded on 2nd week of April.

Among brassica lines, maximum aphids population of (2.05 aphids leaf^{-1}) was recorded in the IBGE-II, followed by IBGE-IV (1.75 aphids leaf^{-1}), IBGE-III (1.48 aphids leaf^{-1}) and the lowest mean population of (1.16 aphids leaf^{-1}) was recorded in IBGE-I.

The interaction of Brassica lines and time intervals (weeks), show that in almost all varieties initially the population was low, but with the passage of time the aphid's population increased and Peak population of (3.1 aphids leaf^{-1}) was recorded in IBGE-II on (3rd week of March). Also in all other lines peak population of aphids was recorded on 3rd week of March. After that the population started to decline, and lowest population of (1.1 aphids leaf^{-1}) was recorded in IBGE-I on the 2nd week of April. Significant response was recorded for the

interaction of Brassica lines and time intervals (weeks).

Population density of Ladybird beetle in different Brassica lines

The analysis of variance (Table-2), for the effect of Brassica lines and different time intervals (weeks) on the population of Ladybird beetle, *Coccinella septempunctata*, showed significantly large F values (P> 0.05) for the brassica lines and time interval (weeks).

Table-2 shows the effect of interaction of Brassica lines and time intervals (weeks) on the mean population of Ladybird beetle, *Coccinella septempunctata.*

Mean value of data indicate that, initially the mean ladybird beetles population was low, which was (0.22 llb plant $^{-1}$) on the 2nd week of February but with the passage of time the beetles population increased and peak population of (1.56 llb plant $^{-1}$) was recorded during 3rd week of March , after that the decline was started.

Among brassica lines, maximum beetles population of (1.15 llb plant $^{-1}$) was recorded in the IBGE-I, followed by IBGE-III (0.89 llb plant^{-1}), IBGE-IV (0.76 llb plant $^{-1}$) and the lowest mean population of (0.56 llb plant $^{-1}$) was recorded in IBGE-II. Significant response was recorded for the interaction of Brassica lines and time intervals (weeks).

Table1. Effect of the interaction of the Brassica lines and time intervals (weeks) on the mean number of Canola aphids leaf $^{-1}$ of Brassica plant at the New Developmental Farm, The University of Agriculture Peshawar during spring 2013

Brassica Lines	Time interval (week)									Total Mean
	14/2/ 2013	21/2/2013	28/2/2013	7/3/ 2013	14/3/2013	21/3/ 2013	28/3/2013	4/4/ 2013	11/4/2013	
IBGE-I	0.21	0.70	0.90	1.20	1.60	1.80	1.60	1.40	1.10	1.16
IBGE-II	0.33	1.10	1.50	2.10	2.70	3.10	2.90	2.60	2.20	2.05
IBGE-III	0.23	0.80	1.10	1.60	1.90	2.30	2.10	1.80	1.50	1.48
IBGE-IV	0.25	0.90	1.30	1.90	2.30	2.70	2.40	2.10	1.90	1.75
Total Mean	0.25	0.87	1.20	1.70	2.12	2.47	2.25	1.97	1.67	

Table2. Effect of the interaction of the Brassica lines and time intervals (weeks) on the mean number of Ladybird beetle plant $^{-1}$ of Brassica plant at the New Developmental Farm, The University of Agriculture Peshawar during spring 2013

Brassica Lines	Time interval (week)									Total Mean
	14/2/ 2013	21/2/2013	28/2/2013	7/3/ 2013	14/3/2013	21/3/ 2013	28/3/2013	4/4/ 2013	11/4/2013	
IBGE-I	0.50	0.90	1.10	1.30	1.41	1.56	1.38	1.25	1.00	1.15
IBGE-II	0.10	0.30	0.40	0.60	0.90	1.10	0.90	0.60	0.20	0.56
IBGE-III	0.10	0.50	0.80	1.00	1.27	1.36	1.23	1.10	0.70	0.89
IBGE-IV	0.20	0.40	0.60	0.90	1.10	1.27	1.10	0.80	0.50	0.76
Total Mean	0.22	0.52	0.72	0.95	1.17	1.32	1.15	0.93	0.60	

DISCUSSION

Aphids are the most serious pest of Brassica spp, and causes maximum yield losses in Brassica so it is very important to study its population trends and thus to control or minimize their losses. Weibull and Melin (2003) reported that canola crop is heavily infested by aphids under favorable environmental conditions and reduced its yield drastically.

Brassica lines, and different time intervals (weeks) on the population of Canola aphid, L.erysimi (Kalt.) showed significantly large F values (P< 0.05) for the Brassica lines and time intervals (weeks).In the first week the mean aphid population was low, but with the passage of time the aphid's population increased and peak population was recorded on 3rd week of March. After that the population started to decline and low population was recorded on 2nd week of April. Similar results were reported by Rana (2006) who stated that the population start multiplying and reached to a peak during the 3rd and 4th week of March.

The brassica line (IBGE-I) showed the best response in reducing the aphid's population. Our results are in

conformity with Verma et al. (2003) who reported that brassica cultivars Banasri Rai and Rohini were considered highly resistant to aphid's infestation as compared to Veruna, Vaibhav, Vardan and UPN-9, which were highly susceptible to aphid's infestation.

In present study the population of ladybird beetles is significantly different for Brassica lines and time interval (weeks). At the beginning the mean ladybird beetles population was lower but with the passage of time, the population increased and maximum population was observed in (3^{rd} week of March), while minimum population was recorded on 2^{nd} week of April. Among the brassica lines, maximum ladybird beetle population was recorded on (IBGE-I), while minimum ladybird beetle population was observed on (IBGE-II). Our results are in conformity with Singh and Sachan (1999) who reported that *C. septempunctata* appeared in variably late in February during the studies of three consecutive years in Brassica crop.

CONCLUSION

L.erysimi (Kalt.) is the predominant species of the Brassica at the New Developmental Farm, The University of Agriculture Peshawar. The peak population of 2.47 aphids leaf^{-1} attained during 3^{rd} week of March and lowest population of 1.67 aphids leaf $^{-1}$ observed during 2^{nd} week of April. *L. erysimi* highly attack the Brassica line, (IBGE-II) because of its susceptible nature, while Brassica line (IBGE-I) showed resistance against its attack. The initial population of Ladybird beetles started in the 2^{nd} week of February attained peak on 3^{rd} week of March and then declined. Ladybird beetle, *Coccinella septempunctata* was the major bio-control agent observed in the study sites, which feeds on *L. erysimi*.

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