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Lack of Plant Resistance in Raya, *Brassica juncea* (L.) Varieties Against Two Aphid Species in Southern Punjab

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Abstract.- Cabbage aphid (*Brevicoryne brassicae* L.) and mustard aphid (*Lipaphis erysimi* (Kalt.)) are important pests of brassicas in Pakistan. We evaluated available varieties of Raya, *Brassica juncea* (L.) for comparative resistance against cabbage and mustard aphid at Multan and Bahawalpur during crop years 2002-2003 and 2003-2004. Varieties BARD-1, BRS-3, PIIR-1, UCD-6/10, P63R5, UCD-44/4, UCD-636, P-37 and RC-280 were planted during 2002-2003. Two more varieties, *i.e*. 95101/163 and 95102/51 were also included in trials during 2003-2004. To determine the degree of resistance, the densities of aphids of both the species were recorded from the top 10cm of the inflorescence by gently beating it 10 times on a white plastic sheet. For this purpose six plants were selected randomly from each treatment. Observations were recorded weekly from the initiation of aphid attack till maturity of the crop. The densities of *B. brassicae* were significantly different across the tested varieties during 2002-2003 on four sampling dates out of seven at Multan and that of *L. erysimi* were non-significant during same year at this location on all sampling dates. Population of *B. brassicae* and *L. erysimi* was also non-significantly different during 2002-2003 at Bahawalpur and 2003-2004 at Multan and Bahawalpur. Based on the results no variety could be declared resistant to cabbage aphid or mustard aphid.

Key words: Indian mustard, cabbage aphid, mustard aphid, population density, resistance.

INTRODUCTION

Oilseed brassicas, the traditional oilseed crops in Pakistan belonging to family Cruciferae are the second most important source of edible oil after cottonseed contributing about 21% of the national edible oil production (Kahair *et al.*, 2003). Pakistan hardly meets only 31% of domestic edible oil needs with the remaining 69% being met through imports (Anonymous, 2006). Cabbage aphid (*Brevicoryne brassicae* L.) and mustard aphid (*Lipaphis erysimi* (Kalt.)) are significant and destructive pests of brassicas in Pakistan. Aphids suck sap resulting in stunted growth, distortion, wilting and yellowing of plants. They thus cause 70-80% of recorded yield losses, and 6% reduction in oil content of the seeds (Rohilla *et al*., 1987; Singh *et al*., 1987; Basavaraju *et al.*, 1995).

The development of resistant plant varieties to various insect pests constitutes an important component of pest management strategies as this method is cost effective, safe and compatible with other pest control methods (Yue and Liu, 2000). The quantification of insect population densities across different varieties of any crop during the growing season is a good indicator of the response of varieties to attack by the insects in question. Such studies provide a sound basis for categorizing the varieties relative to one another along a susceptible to resistant continuum.

Literature reports from India present contrasting results regarding the resistance or susceptibility of *B. juncea* to aphids (Bakhetia, 1990; Sehkon and Ahman, 1992). No results have been published regarding the incidence of aphids on *B. juncea* in the Multan and Bahawalpur districts of Southern Punjab, or on any resistance the varieties may have. The objectives of the present research were to quantify the relative densities of cabbage and mustard aphids on Raya, *Brassica juncea* (L.) and thus screen for promising varieties of Raya that may be resistant against these aphids at Multan and Bahawalpur.

MATERIALS AND METHODS

The experiments were conducted at the Agriculture Farm, University College of Agriculture, Bahauddin Zakariya University, Multan and Regional Agricultural Research Institute, Bahawalpur during the crop seasons 2002-03 and

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Table I.- Number of *B. brassicae* per top 10 cm inflorescence of *B. juncea* at Multan during 2003.

Varieties	Sampling dates						
	24th February	2nd March	5th March	8th March	11th March	14th March	17th March
BARD-1	8.70ns	23.66ab	26.25abcd	16.92cd	23.29ns	22.23ns	20.88abc
BRS-3	4.92	9.54c	12.50d	6.79d	14.91	11.50	7.37cd
P11R-1	9.87	13.71bc	23.00bcd	16.46cd	25.75	23.71	22.00ab
UCD-6/10	14.83	19.38bc	21.96bcd	18.63cd	18.42	16.71	16.5bcd
P63R5	20.33	30.33a	40.58a	35.04ab	23.00	17.79	12.25bcd
UCD-44/4	11.54	18.71abc	23.88bcd	20.08bcd	22.17	20.00	18.13abcd
UCD636	18.75	25.63ab	35.92ab	37.33a	22.33	26.54	30.63a
P-37	19.92	19.91abc	29.04abc	24.88abc	24.12	25.58	22.75ab
RC-280	19.04	29.04a	26.08abcd	18.96bcd	11.17	11.71	12.91bcd

Means in columns followed by the same letters are not significantly different (LSD; P=0.05); ns= non-significant.

Table II.- Number of *L. erysimi* per top 10cm inflorescence of *B. juncea* at Multan during 2003.

Varieties	Sampling dates						
	24th February	2nd March	5th March	8th March	11th March	14th March	17th March
BARD-1	4.71	5.96	3.17	2.58	8.96	8.38	7.75
BRS-3	5.75	1.79	1.25	0.92	7.29	5.46	4.75
P11R-1	5.75	4.17	2.88	2.25	9.63	6.04	2.63
UCD-6/10	7.67	5.21	6.54	3.48	4.67	5.00	4.92
P63R5	4.13	1.83	4.96	3.17	8.29	5.21	4.25
UCD-44/4	7.59	5.46	2.80	2.71	5.04	5.21	5.37
UCD636	2.63	2.96	3.99	2.29	10.29	7.79	6.88
P-37	2.04	5.17	2.12	2.38	5.25	5.08	5.00
RC-280	4.71	2.92	3.84	3.92	8.04	6.79	5.46

Means in columns are not significantly different at P=0.05.

Table III.- Number of *B. brassicae* per top 10cm inflorescence of *B. juncea* at Bahawalpur during 2003.

Varieties	Sampling dates					
	8th February	15th February	22nd February	1st March	8th March	15th March
BARD-1	16.26	11.65	11.14	24.26	17.63	5.38
BRS-3	8.75	7.68	12.91	14.77	9.83	5.21
P11R1	7.37	15.19	7.55	24.06	8.83	5.62
UCD-6/10	9.03	12.69	10.52	24.09	12.32	5.42
P63R5	1.46	13.79	16.02	28.25	13.19	5.13
UCD-44/4	8.99	15.12	15.63	27.97	14.10	4.21
UCD-636	5.79	12.30	8.38	35.88	15.13	9.54
P-37	5.96	11.58	14.55	31.90	10.69	9.69
RC-280	8.12	8.26	14.03	29.42	14.05	6.71

Means in columns are not significantly different at P=0.05.

2003-04. The trials were laid out in a Randomized Complete Block Design in four and three replicates during the 2002-03 and 2003-04 cropping seasons, respectively. Raya varieties (Tables I-VIII) were planted on October 16, 2002 and November 5, 2003 at Multan and on October 25, 2002 and November 6, 2003 at Bahawalpur. Each plot consisted of four rows. Each row was 4.5 m long. Row to row and plant to plant distance was 44 and 10 cm, respectively. The distance between replications was

1.8 meters. All the agronomic practices were carried out according to the normal recommendations. No insecticide was sprayed on any crop during either year at both locations.

Table IV.- Number of *L. erysimi* per top 10cm inflorescence of *B. juncea* at Bahawalpur during 2003.

Varieties	Sampling dates	
	8th March	15th March
BARD-1	2.34	3.21
BRS-3	1.04	2.67
PIIR-I	1.25	3.17
UCD-6/10	0.96	4.46
P63R5	1.00	3.00
UCD-44/4	1.75	3.18
UCD-636	1.96	3.04
P-37	2.17	3.67
RC-280	1.67	2.92

Means in columns are not significantly different at P=0.05.

Aphid densities on the different varieties under study were counted by taking samples from the inner two rows of each plot. From each row three plants were randomly selected. The top 10 cm of the flower shoot of each of the six plants were sampled, by gently beating ten times, with a 30 cm long stick onto a white paper sheet (30 x 35 cm) held under the shoot, as described by Singh *et al.* (1989) and Chattopadhyay *et al.* (2005). The cabbage aphids and turnip aphids collected on each white paper sheet were counted separately. The mean density of each aphid species per top 10 cm inflorescence was calculated for each sampling date. The data were subjected to Analysis of Variance (ANOVA) by using MSTATC computer software (MSU, 1982) and means were separated by calculating Least Significant Difference test at P= 0.05.

RESULTS AND DISCUSSION

Population densities of *B. brassicae* were not significantly different across the tested varieties on 24th February and 11th March, but were so on 2nd, 5th, 8th and 17th March during 2003 at Multan. The lowest population densities were observed on variety BRS-3 on all the sampling dates except on 11th March (Table I). The population densities of *L. erysimi* were not significantly different among tested varieties during 2003 on all the sampling dates at Multan (Table II). Population densities of *B. brassicae* and *L. erysimi* were not significantly different across the tested varieties on all the sampling dates during 2003 at Bahawalpur and during 2004 on all the sampling dates at Multan and Bahawalpur (Tables III – VIII). Population densities of *B. brassicae* were greater than those of *L. erysimi* during both years of study at both the locations. Peak populations of both the species of aphids were observed during the 1st or 2nd week of March (Tables I – III).

Population densities of *B. brassicae* and/or *L. erysimi* were different on *B. juncea* varieties as reported by earlier workers (Brar and Sandhu, 1978; Prasad, 1983; Phadke and Prasad, 1987; Rohilla *et al*., 1990; Amjad and Peters, 1992; Hameed and Khattak, 1993; Hou *et al*., 1995; Bhadauria *et al*., 1995; Ram *et al.*, 1995; Rana and Khokhar, 1998; Lal *et al*., 1999; Malik and Deen, 1999). They observed different population densities or survival rate of aphids on tested varieties. Varieties were declared resistant or susceptible on the basis of population densities or survival rate of aphids. Results of present study partly agree with these workers as we observed that the densities of *B. brassicae* were significantly different across the tested varieties during 2002-2003 on four sampling dates out of seven at Multan. Condition of crop culture with specific conditions and biotype favours the insect pest at different locations (Chattopadhyay *et al.*, 2005). All the studies by previous workers were conducted on different varieties from our study and under different climatic conditions. Difference in varieties tested, climatic conditions and biotypes of aphids might be the reason for different results from previous workers.

Population of *L. erysimi* was non-significantly different during 2002-2003 at Multan. Population of *B. brassicae* and *L. erysimi* also was non-significantly different during 2002-2003 at Bahawalpur and 2003-2004 at Multan and Bahawalpur. Prasad and Phadke (1984) and Kumar and Sharma (1999) also found non significant difference in *B. brassicae* population among different varieties of *B. juncea* in India.

Table V.- Number of *B. brassicae* per top 10cm inflorescence of *B. juncea* at Multan during 2004.

Varieties	Sampling dates							
	4th Feb.	11th Feb.	18th Feb.	25th Feb.	3rd March	10th March	17th March	24th March
BARD-1	1.7	3.8	5.0	6.4	17.3	25.7	2.3	3.4
BRS-3	1.2	2.9	9.2	11.3	24.7	22.5	2.3	1.7
P11R-1	0.5	1.5	6.0	8.7	15.8	28.9	2.2	3.5
UCD-6/10	0.8	2.4	3.5	12.0	16.3	19.4	2.7	4.8
P63R5	0.7	1.3	8.8	9.7	15.2	19.6	1.3	1.9
UCD-44/4	0.3	0.0	6.1	8.1	19.5	21.9	3.3	2.9
UCD636	0.4	2.0	2.9	7.7	25.4	25.4	2.6	2.8
P-37	0.5	3.3	4.6	7.9	19.8	23.7	2.6	3.1
RC-280	0.0	4.6	3.0	12.4	4.2	21.1	2.4	2.5
95101/163	1.5	0.9	3.7	10.4	18.2	18.0	2.5	4.7
95102/51	0.2	1.9	10.2	12.7	21.0	18.7	5.3	3.8

Means in columns are not significantly different at P=0.05.

Table VI.- Number of *L. erysimi* per top 10cm inflorescence of *B. juncea* at Multan during 2004.

Varieties	Sampling dates							
	4th Feb.	11th Feb.	18th Feb.	25th Feb.	3rd March	10th March	17th March	24th March
BARD-1	0.6	1.9	9.4	8.1	12.0	10.2	0.4	0.9
BRS-3	0.0	4.4	2.7	13.6	12.3	11.6	0.2	0.5
P11R-1	0.1	0.8	4.0	8.2	12.8	10.8	0.3	1.0
UCD-6/10	2.9	1.0	5.6	7.5	10.6	9.5	1.1	0.8
P63R5	0.4	2.9	1.7	17.3	13.3	15.0	0.3	0.7
UCD-44/4	1.1	1.7	2.1	7.4	10.3	16.3	0.4	1.9
UCD636	2.7	3.4	5.6	17.7	12.8	16.0	0.7	0.3
P-37	0.3	2.1	3.2	9.0	10.4	8.0	1.0	0.9
RC-280	0.7	2.5	3.7	8.5	13.8	12.3	0.9	0.9
95101/163	0.3	1.5	1.9	8.7	11.7	18.6	0.7	1.1
95102/51	0.5	0.5	1.4	16.2	17.4	13.3	0.5	1.4

Means in columns are not significantly different at P=0.05.

Table VII.- Number of *B. brassicae* per top 10cm inflorescence of *B. juncea* at Bahawalpur during 2004.

Varieties	Sampling dates					
	15th February	22nd February	29th February	7th March	14th March	21st March
BARD-1	0.4	8.5	24.4	20.4	23.6	2.5
BRS-3	0.9	9.7	21.4	34.3	24.9	2.0
P11R-1	0.5	2.8	15.7	22.3	20.4	2.1
UCD-6/10	0.8	5.8	18.2	2.2	15.7	2.3
P63R5	0.5	6.4	23.0	22.2	20.8	1.9
UCD-44/4	1.3	6.0	21.0	33.3	29.0	2.8
UCD636	0.0	15.4	25.6	25.2	25.4	2.0
P-37	2.0	5.9	18.4	17.7	20.8	1.5
RC-280	0.3	10.4	22.0	23.0	19.2	2.7
95101/163	1.2	8.5	12.4	25.8	20.9	3.9
95102/51	0.2	5.8	14.2	21.3	19.4	2.2

Means in columns are not significantly different at P=0.05.

Table VIII.- Number of *L. erysimi* per top 10cm inflorescence of *B. juncea* at Bahawalpur during 2004.

Varieties	Sampling dates					
	15th February	22nd February	29th February	7th March	14th March	21st March
BARD-1	1.4	4.6	4.3	16.8	11.9	6.2
BRS-3	0.7	7.5	15.1	8.0	5.8	0.4
P11R-1	1.4	3.9	4.1	15.0	5.8	1.0
UCD-6/10	1.1	3.9	6.9	11.4	9.0	0.0
P63R5	0.4	1.7	7.9	17.7	13.8	0.8
UCD-44/4	1.0	1.9	3.8	11.5	3.4	0.0
UCD636	0.8	3.4	5.8	21.9	6.9	0.4
P-37	0.6	4.1	6.6	18.8	6.5	0.4
RC-280	1.7	9.8	7.8	13.3	9.1	1.0
95101/163	0.4	2.9	15.3	11.6	4.9	0.8
95102/51	0.9	2.9	8.4	13.8	7.1	0.8

Means in columns are not significantly different at P=0.05.

The economic threshold level (ETL) in Rajasthan state of India is 23-25 aphids per plant (Anonymous, 1999). The total population of both species (highest recorded in every cropping season) in our study was approximately close to ETL employed in India. Therefore, no variety can be declared resistant. As varieties lack plant resistance therefore, application of insecticides is necessary for aphid control on *B. juncea*.

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