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Screening of Different Cultivars of Rapeseed-mustard against Mustard Aphid, *Lipaphis erysimi*, Kaltenbach with Respect to Sowing Dates

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Abstract: To find out highly resistant varieties of rapeseed-mustard, sixty-five cultivars (brown sarson-1, Indian mustard-42, gobhi sarson-4, kiran rai-4, taramera-2, toria-5 and yellow sarson-7) were screened against mustard aphid, *Lipaphis erysimi* during winter season of 2005-06 and 2006-07. The findings revealed that aphid commenced their attack 7 Weeks After Sowing (WAS) and reached to a maximum level at 14 WAS on October 25 (timely) sown cultivars. Whereas, on November 10 and 25 seeded cultivars, aphid incidence was initially recorded on 6 WAS and 4 WAS, which reached to a maximum at 13 and 11 WAS, respectively. The timely sown (October 25) cultivars escaped the aphid infestation and exhibited better growth due to stored moisture by plant and also minimum aphid load than late seeded (November, 10 and 25) cultivars. While calculating Mean Aphid Infestation Index (MAII), it remained below 1.00 on Kranti, Maya, MYSL-203, PCR-7 and Pusa Agrani (Indian mustard); Pusa Swarnim (Kiran rai) and NDYS-2, YST-151 (yellow sarson) when cultivars seeded on October 25 and November 10. Therefore, these cultivars could safely be placed under highly resistant category. Among late sown rapeseed-mustard (November 25), no cultivars found as highly resistant, though, cultivars showing high tolerance during timely sowing become moderately resistant on account of their late (November 25) sowing. Interestingly, gobhi sarson and kiran rai showed relatively less damage due to their late flowering and different plant texture than other cultivars.

Key words: Mustard aphid, rapeseed-mustard, screening, sowing dates

INTRODUCTION

Rapeseed-mustard is an important source of edible oil and vegetable for human as well as cakes for animals. These crops play an important role in Indian oil economy due to their suitability for growing under diverse agro-ecological conditions ranging from hills to down, under irrigated to rainfed, early to late sown and also mixed with other crops. The indigenous species of rapeseed-mustard grown in India are: Brown sarson (*Brassica campestris* var. brown sarson), Indian mustard (*Brassica juncea*), gobhi sarson (*Brassica napus*), Kiran rai (*Brassica carinata*), toria (*Brassica rapa* var. toria), taramira (*Eruca sativa*) and yellow sarson (*Brassica rapa* var. yellow sarson). These crops are being cultivated in about 53 countries spreading over the six continents (Europe, Africa, North America, South America, Oceania and Asia) across the globe. In Asia, it is primarily cultivated in China, India and Pakistan (Amer *et al.*, 2010). Asian continent alone contributes 59.1% of the acreage and 48.6% of the world's production. However, India alone contributes about 28.3% acreage

and 19.8% production of the world oilseeds (Yadava and Singh, 1999).

In India, the position of rapeseed-mustard is next to groundnut in both area and production (Ali *et al.*, 2010). It contributes about 23.7 acreage and 26.0% production of total oilseed in India. The yield of rapeseed-mustard was 1159 kg ha⁻¹ against the total oilseeds yield of 955 kg ha⁻¹. The rapeseed-mustard crops are highly vulnerable to attack of insect pests. Bakhietia and Sekhon (1989) have listed more than three dozens of insect pests, associated with various phenological stages of these crops. Among them, mustard aphid, *Lipaphis erysimi* is a widely distributed throughout the world (Razaq *et al.*, 2011). It causes damage directly by sucking phloem from different parts of plant and indirectly as a vector of plant viruses (Ali and Rizvi, 2007). The attack is severe in those regions where the numbers of cloudy days are more during the pest activity period. On heavy infestation, aphids are largely congregated underside of leaves, they curling and yellowing them and plants fail to develop pods, if young pods develop do not produce healthy seeds and also resulting plant to loss their growth (Mamun *et al.*, 2010).

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The yield loss in rapeseed-mustard also varies with their germplasms and agro-ecological practices (Ansari *et al.*, 2007). Therefore, in present investigations, sixty-five cultivars of rapeseed-mustard were screened against mustard aphid with three different sowing dates to find out relatively tolerant varieties.

MATERIALS AND METHODS

Sixty-five promising varieties of rapeseed-mustard (brown sarson-1, Indian mustard-42, gobhi sarson-4, kiran rai-4, taramera-2, toria-5 and yellow sarson-7) were seeded in experimental field of the Department of Plant Protection, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh in a Randomised Block Design (RBD) during rabi (winter) season of year 2005-06 and 2006-07. To ensure good germination, ploughing of the experimental field was done with the help of soil turning plough followed by two cross ploughing with harrow. Farmyard manure at 1.5 t ha⁻¹ and recommended level of fertilizers (60 kg N+40 kg P₂O₅ and 40 kg K₂O) were properly mixed into soil. Each cultivar variety was sown in one row of 4 m in length (replicated thrice) with spacing of 15 and 45 cm plant-to-plant and row-to-row, respectively. Three different sowing dates, October 25 (First sowing), November 10 (Second sowing) and November 25 (Third sowing) were selected for raising the crop. To determine the effect of abiotic factors on *L. erysimi* population, meteorological data was also recorded daily till harvesting of the crop.

All the cultivars, mentioned below, were obtained from National Research Centre on Rapeseed-Mustard (recently know as Directorate of Rapeseed-Mustard Research), Sewar, Bharatpur, Rajasthan, India.

Brown Sarson (<i>Brassica rapa</i> var. Brown sarson)	
1.	BSH-1
Indian mustard (<i>Brassica juncea</i>)	
2.	Alankar
3.	Basanti
4.	Bio-772
5.	BS-2
6.	CS-52
7.	Durgamani
8.	GM-2
9.	GM-111
10.	JM-1
11.	Kranti
12.	Krishna
13.	Maya
14.	MYSL-203
15.	PBR-91
16.	PBR-97
17.	PCR-7
18.	PM-66
19.	PM-67
Indian mustard (<i>Brassica juncea</i>)	
20.	PR-8988

21.	Pusa Agrani
22.	Pusa Bahar
23.	Pusa Bold
24.	Pusa Jagannath
25.	RH-30
26.	RH-718
27.	RH-819
28.	RH-8113
29.	RH-8812
30.	RL-1359
31.	RLM-514
32.	RLM-619
33.	Rohini
34.	Sanjuct Asech
35.	Sarma
36.	Seeta
37.	SEJ-2
38.	TM-2
39.	TM-4
40.	Urvashi
41.	Vardan
42.	Varuna
43.	Vaibhav
Gobhi Sarson (<i>Brassica napus</i>)	
44.	GSL-1
45.	GSL-2
46.	Neelam
47.	Sheetal
Kiran Rai (<i>Brassica carinata</i>)	
48.	JTC-1
49.	PBC-9902
50.	PC-5
51.	Pusa Swarnim
Taramira (<i>Eruca sativa</i>)	
52.	RTM-314
53.	TMLC-2
Toria (<i>Brassica rapa</i> var. toria)	
54.	M-27
55.	PT-30
56.	PT-303
57.	TL-15
58.	TS-38
Yellow Sarson (<i>Brassica rapa</i> var. Yellow sarson)	
59.	B-9
60.	GS-1
61.	Jhumka
62.	NDYS-2
63.	PS-66
64.	Pusa Gold
65.	YST-151

The observations of *Lipaphis erysimi* were recorded on 10 cm terminal inflorescence at weekly intervals (starting from initial incidence to disappearance of aphid) on 5 randomly selected plants from each row as per suggestions of Bakhietia and Sandhu (1973). The plants were categorised into 6 grades depending upon aphid population and its symptoms. In order to get the Aphid Infestation Index (AII), the number of plants in each grade was multiplied by the respective grade and then the number of plants drives the figure. The grades were distributed as:

Grade No.	Description
0	Plants are completely free from aphid
1	Plants having 1-15 aphids per inflorescence shoot. There is no symptom of aphid damage
2	Plants having 16-100 aphids per inflorescence. Shoots and plants start curling due to aphid attack
3	Plants having more than 100 aphids per shoot. Aphids infest most of the branches. Leaves start drying. Pods are curled
4	Each and every branch of the plant is fully covered with aphids and some of the branches start drying
5	Plant is completely dry immaturely due to aphid infestation

RESULTS

The pooled analysis of two successive years (2005-06 and 2006-07) on population dynamics of mustard aphid, *Lipaphis erysimi* on 10 cm terminal inflorescence of different cultivars of rapeseed-mustard showed a significant variation (0.00 to 3.33 AII), which altered with respect to sowing dates. Therefore, Aphid Infestation Index (AII) was recorded on different cultivars of rapeseed-mustard on the basis of sowing dates.

First sowing (October 25): On October 25 sown rapeseed-mustard cultivars, aphid initiated attack in the 50 standard week (st wk), which coincided with 8 Week After Sowing (WAS). The aphid infestation on different cultivars of rapeseed-mustard increased progressively from 0.00 to 0.67, 0.00 to 1.33, 0.33 to 1.83, 0.67 to 2.00 and 1.00 to 2.50 on 51st (9 WAS), 52nd (10 WAS), 1st (11 WAS), 2nd (12 WAS) and 3rd (13 WAS) standard week, respectively. However, it recorded maximum of 1.67 to 3.00 on 14 week after sowing (4th st wk). Thereafter, the aphid infestation index (AII) decreased from 2.67 to 1.33, 2.17 to 0.67, 1.67 to 0.00, 1.00 to 0.00 and 0.67 to 0.00 on 5th (15 WAS), 6th (16 WAS), 7th (17 WAS), 8th (18 WAS) and 9th (19 WAS) standard week, respectively (Table 1). The infestation on toria and yellow sarson cultivars was, however, found nil in the third week (8th st wk) of February due to early crop maturity (Table 1).

While comparing Mean Aphid Infestation Index (MAII) on different cultivars, it was recorded minimum in Indian mustard (*Brassica juncea*) on Kranti (0.97), Maya (0.94), MYSL-203 (0.97), PCR-7 (0.94) and Pusa Agrani (0.90); in Kiran rai (*Brassica carinata*) on Pusa Swarnim (0.85) and in yellow sarson (*Brassica rapa* var. yellow sarson) on NDYS-2 (0.88) and YST-151 (0.80). These cultivars showed MAII below 1 and therefore placed in highly resistant category. The cultivar BSH-1 (brown sarson); Alankar, Krishna, Pusa Bahar, Pusa Bold and Vardan (Indian mustard); GSL-1 (gobhi sarson); PT-30 (toria) and B-9, PS-66

(yellow sarson) exhibited mean aphid infestation index one and could safely placed in moderately resistant category (Table 1). Similarly, varieties rapeseed-mustard (Indian mustard: GM-111, PR-8988, RH-8812, RL-1359, RLM-514, RLM-619, Rohini, Sanjuct Asech, Sarma, Seeta, SEJ-2, TM-2, TM-4, Varuna, Vaibhav; gobhi sarson: GSL-2, Neelam, Sheetal; Kiran rai: JTC-1, PBC-9902, PC-5; Taramira: RTM-314, TMLC-2; Toria: PT-303, TL-15, TS-38; and Yellow sarson: GS-1, Jhumka, Pusa Gold) received mean aphid infestation index between 1.01 to 1.50 and also denoted as moderately susceptible cultivars (Table 1). Other cultivars attained highest value (>1.50) of mean aphid infestation index and also recorded as highly susceptible varieties of rapeseed-mustard; these cultivars included Indian mustard (Basanti, Bio-772, BS-2, CS-52, Durgamani, GM-2, JM-1, PBR-91, PBR-97, PM-66, PM-67, Pusa Jagannath, RH-30, RH-718, RH-819, RH-8113, Urvashi) and toria (M-27).

Second Sowing (November 10): The cultivars of rapeseed-mustard seeded during November 10, initially received aphid infestation on 51st st wk (8 WAS) showing AII of 0.00-0.67 followed by 0.00-1.00, 0.33-1.67, 0.67-2.00, 1.00-2.67 and 1.67-2.67 on 52st (9 WAS), 1st (10 WAS), 2nd (11 WAS), 3rd (12 WAS) and 4th (13 WAS) standard week, respectively. However, maximum AII was observed as 1.67 to 3.00 during (5th st wk/14 WAS) last week of January. Thereafter, infestation (AII) decreased from 2.67-1.00, 2.67-0.33, 1.67-0.00, 1.00-0.33, 0.67-0.00 on 6th (15 WAS), 7th (16 WAS), 8th (17 WAS), 9th (18 WAS) and 10th (20 WAS) standard week, respectively (Table 2). On account of early maturity of toria and yellow sarson, the infestation remained nil on 26 February (Table 2).

The mean aphid infestation index also showed a significant variation (0.77-1.68) with respect to different cultivars (Table 2). It was recorded minimum (below 1) in Indian mustard (*Brassica juncea*) on Kranti (0.96), Maya (0.89), MYSL-203 (0.94), PCR-7 (0.96) and Pusa Agrani (0.92); in Kiran rai (*Brassica carinata*) on Pusa Swarnim (0.83) and in yellow sarson (*Brassica rapa* var. yellow sarson) on NDYS-2 (0.90) and YST-151 (0.77). These cultivars showed maximum resistance against mustard aphid and therefore placed in highly resistant category. Similarly, cultivars BSH-1 (brown sarson); Alankar, Krishna, Pusa Bahar, Pusa Bold and Vardan (Indian mustard); GSL-1 (gobhi sarson); PT-30 (toria) and B-9, PS-66 (yellow sarson) demonstrated MAII one and sited as moderately resistant (Table 2). The other cultivars (Indian mustard: GM-111, PR-8988, RH-8812, RL-1359, RLM-514, RLM-619, Rohini, Sanjuct Asech, Sarma, Seeta,

Table 1: Screening of rapessed-mustard cultivars against mustard *Lipaphis erysimi* during first sowing (October 25)

Cultivars	11 Dec. 50 (st wk)	18 Dec. 51 (st wk)	25 Dec. 52 (st wk)	1 Jan. 1 (st wk)	8 Jan. 2 (st wk)	15 Jan. 3 (st wk)	22 Jan. 4 (st wk)	29 Jan. 5 (st wk)	5 Feb. 6 (st wk)	12 Feb. 7 (st wk)	19 Feb. 8 (st wk)	26 Feb. 9 (st wk)	Mean _{AI}
Brown sarson (<i>Brassica campestris</i> var. brown sarson)													
BSH-1	0.00	0.33	0.67	1.00	1.33	1.84	2.00	2.33	1.50	0.67	0.33	0.00	1.00
Indian mustard (<i>Brassica juncea</i>)													
Alankar	0.00	0.33	0.33	1.00	1.33	1.67	2.33	2.17	1.50	0.67	0.33	0.33	1.00
Basanti	0.33	0.67	1.00	1.67	2.00	2.33	2.67	2.33	2.00	1.67	1.00	0.67	1.53
Bio-772	0.17	0.67	1.33	1.67	2.00	2.67	2.67	2.33	1.67	1.33	1.00	0.67	1.51
BS-2	0.33	1.00	1.33	1.67	1.67	2.33	2.67	2.33	2.00	1.67	0.67	0.67	1.53
CS-52	0.17	1.33	1.50	1.67	2.00	2.67	3.00	2.00	2.00	1.67	1.00	0.33	1.61
Durgamani	0.33	1.00	1.67	2.00	2.33	2.67	2.67	2.00	1.67	1.00	0.67	0.33	1.53
GM-2	0.67	1.00	1.50	1.67	2.00	2.33	2.67	2.00	2.00	1.67	1.00	0.33	1.57
GM-111	0.00	0.17	0.67	1.34	1.67	2.00	2.33	2.17	1.67	1.67	0.67	0.33	1.22
JM-1	0.17	1.00	1.67	2.00	2.33	2.33	2.67	2.33	1.67	1.33	0.50	0.17	1.51
Kranti	0.00	0.00	0.67	1.33	1.67	2.34	2.33	1.33	1.00	0.67	0.33	0.00	0.97
Krishna	0.00	0.33	0.67	1.00	1.67	2.00	2.33	1.84	1.17	0.67	0.33	0.00	1.00
Maya	0.00	0.00	0.33	0.67	1.67	2.00	2.33	2.00	1.33	0.67	0.33	0.00	0.94
MYSL-203	0.00	0.00	0.33	0.67	1.34	2.00	2.34	2.33	1.67	0.67	0.33	0.00	0.97
PBR-91	0.17	1.00	1.67	2.00	2.33	2.33	2.67	2.33	1.67	1.33	1.00	0.33	1.57
PBR-97	0.67	1.00	1.50	1.67	2.00	2.33	2.67	2.00	1.67	1.33	1.00	0.67	1.54
PCR-7	0.00	0.33	0.67	1.00	1.33	1.84	2.33	1.67	1.17	0.67	0.33	0.00	0.94
PM-66	0.33	1.00	1.33	1.67	2.33	2.50	2.84	2.33	2.00	1.00	0.67	0.33	1.53
PM-67	0.33	0.67	1.83	2.00	2.33	2.67	2.33	2.00	1.67	1.33	0.67	0.33	1.51
PR-8988	0.00	0.33	0.67	1.00	2.33	2.67	2.17	1.67	1.33	0.67	0.33	0.00	1.10
Pusa agrani	0.33	0.67	1.00	1.33	1.67	2.00	1.67	1.17	0.67	0.33	0.00	0.00	0.90
Pusa bahar	0.00	0.33	0.67	1.00	1.33	2.00	2.33	2.00	1.33	0.67	0.33	0.00	1.00
Pusa bold	0.00	0.33	0.67	0.67	1.00	1.67	2.67	2.33	1.67	0.67	0.33	0.00	1.00
Pusa jagannath	0.17	1.00	1.33	2.00	2.33	2.33	2.67	2.67	2.00	1.34	0.33	0.17	1.53
RH-30	0.33	0.67	1.00	1.67	2.33	2.50	2.67	2.33	1.67	1.33	1.00	0.67	1.51
RH-718	0.33	1.00	1.33	1.84	2.50	2.67	3.00	2.33	1.67	1.17	0.67	0.33	1.57
RH-819	0.67	1.00	1.33	1.67	2.00	2.34	2.84	2.33	2.00	1.50	0.67	0.33	1.56
RH-8113	0.33	1.00	1.50	1.67	2.00	2.50	2.84	2.67	2.00	1.50	0.67	0.33	1.58
RH-8812	0.00	0.33	0.67	1.33	2.00	2.17	2.67	2.33	1.67	0.67	0.00	0.00	1.15
RL-1359	0.00	0.33	0.67	1.33	2.00	2.34	2.33	2.17	1.50	0.67	0.00	0.00	1.11
RLM-514	0.00	0.33	0.67	1.67	2.00	2.33	2.84	2.33	1.67	0.84	0.17	0.00	1.24
RLM-619	0.00	0.00	0.33	1.00	1.67	2.00	2.50	2.33	1.67	0.84	0.17	0.00	1.04
Rohini	0.00	0.33	1.00	1.50	2.33	2.67	3.00	2.33	1.50	1.00	0.67	0.17	1.37
Sanjuct asech	0.00	0.33	0.67	1.34	2.33	2.67	3.00	2.67	2.17	1.00	0.33	0.00	1.38
Sarma	0.00	0.00	0.33	0.67	1.33	2.00	2.33	2.67	2.17	1.33	0.67	0.17	1.14
Seeta	0.00	0.33	0.67	1.00	1.67	2.17	2.67	2.33	2.00	1.17	0.67	0.17	1.24
SEJ-2	0.17	0.50	0.84	1.17	1.67	2.17	2.50	2.00	1.67	0.84	0.33	0.00	1.15
TM-2	0.00	0.33	0.67	1.33	2.00	2.33	2.67	2.00	1.67	1.34	0.67	0.17	1.26
TM-4	0.00	0.33	0.67	1.00	1.67	2.00	2.33	2.00	1.67	1.33	0.67	0.33	1.17
Urvashi	0.33	1.00	1.33	1.67	2.00	2.33	2.50	2.33	2.00	1.33	1.00	0.33	1.51
Vardan	0.00	0.33	0.67	1.00	1.67	2.00	2.67	1.67	1.00	0.67	0.33	0.00	1.00
Varuna	0.00	0.00	0.33	1.33	1.84	2.17	2.50	2.17	1.67	1.33	0.50	0.17	1.17
Vaibhav	0.00	0.17	0.50	1.34	2.17	2.50	2.67	2.00	1.67	0.67	0.33	0.00	1.17
Gobhi sarson (<i>Brassica napus</i>)													
GSL-1	0.00	0.33	0.33	0.67	1.84	2.00	2.33	2.00	1.34	0.84	0.33	0.00	1.00
GSL-2	0.00	0.17	0.50	1.33	1.67	2.17	2.50	1.84	1.67	1.00	0.33	0.00	1.10
Neelam	0.00	0.00	0.33	1.00	1.67	2.33	2.67	2.17	1.50	1.17	0.67	0.17	1.14
Sheetal	0.00	0.33	0.67	1.50	2.00	2.50	2.84	2.17	1.67	1.00	0.33	0.00	1.25
Kiran rai (<i>Brassica carinata</i>)													
JTC-1	0.00	0.33	0.67	1.00	1.67	2.00	2.33	2.00	1.67	0.67	0.33	0.00	1.06
PBC-9902	0.00	0.17	0.50	1.00	1.84	2.33	2.67	2.33	1.84	1.00	0.67	0.33	1.22
PC-5	0.00	0.33	0.67	1.00	1.67	2.17	2.67	2.33	1.67	1.00	0.33	0.00	1.15
Pusa swarnim	0.00	0.00	0.33	0.67	1.17	1.84	2.17	1.67	1.33	0.67	0.33	0.00	0.85
Taramira (<i>Eruca sativa</i>)													
RTM-314	0.17	0.50	0.84	1.17	1.84	2.33	2.67	2.50	2.17	1.50	0.67	0.33	1.39
TMLC-2	0.00	0.33	0.50	0.84	1.34	2.00	2.33	2.17	1.50	1.00	0.50	0.00	1.04
Toria (<i>Brassica rapa</i> var. toria)													
M-27	0.33	0.67	1.00	1.67	2.17	2.84	2.50	2.17	1.33	0.50	-	-	1.52
PT-30	0.00	0.33	0.67	1.00	1.67	2.00	1.67	1.33	1.00	0.33	-	-	1.00
PT-303	0.00	0.33	0.67	2.00	2.33	2.84	2.50	2.17	1.50	0.50	-	-	1.48
TL-15	0.00	0.33	1.33	1.84	2.33	2.67	2.33	1.67	0.67	0.33	-	-	1.35
TS-38	0.17	0.67	1.17	1.67	2.00	2.50	2.34	1.67	1.00	0.33	-	-	1.35

Table 1: Continued

Cultivars	11 Dec. 50 (st wk)	18 Dec. 51 (st wk)	25 Dec. 52 (st wk)	1 Jan. 1 (st wk)	8 Jan. 2 (st wk)	15 Jan. 3 (st wk)	22 Jan. 4 (st wk)	29 Jan. 5 (st wk)	5 Feb. 6 (st wk)	12 Feb. 7 (st wk)	19 Feb. 8 (st wk)	26 Feb. 9 (st wk)	Mean>All
Yellow sarson (<i>Brassica rapa</i> var. Yellow sarson)													
B-9	0.00	0.00	0.33	0.67	1.00	2.33	2.00	2.33	1.00	0.33	-	-	1.00
GS-1	0.00	0.33	0.67	1.50	1.84	2.67	2.33	2.00	1.33	0.50	-	-	1.32
Jhumka	0.00	0.00	0.33	0.84	1.84	2.67	2.50	1.67	1.00	0.50	-	-	1.13
NDYS-2	0.00	0.00	0.33	0.67	1.67	2.00	1.84	1.34	0.67	0.33	-	-	0.88
PS-66	0.00	0.00	0.33	1.00	1.67	2.00	2.00	1.67	1.00	0.33	-	-	1.00
Pusa gold	0.00	0.17	0.50	1.00	2.00	2.84	2.33	2.33	1.33	0.33	-	-	1.28
YST-151	0.00	0.00	0.33	0.67	1.00	2.00	1.67	1.67	0.67	0.00	-	-	0.80

Given values are the means of two successive cropping years (2005-06 and 2006-07)

Table 2: Screening of rapessed-mustard cultivars against mustard *Lipaphis erysimi* during first sowing (November 10)

Cultivars	18 Dec. 51 (st wk)	25 Dec. 52 (st wk)	1 Jan. 1 (st wk)	8 Jan. 2 (st wk)	15 Jan. 3 (st wk)	22 Jan. 4 (st wk)	29 Jan. 5 (st wk)	5 Feb. 6 (st wk)	12 Feb. 7 (st wk)	19 Feb. 8 (st wk)	26 Feb. 9 (st wk)	5 Mar. 10 (st wk)	Mean>All
Brown sarson (<i>Brassica campestris</i> var. brown sarson)													
BSH-1	0.00	0.33	0.67	1.00	1.50	1.67	2.00	2.33	1.33	0.84	0.33	0.00	1.00
Indian mustard (<i>Brassica juncea</i>)													
Alankar	0.00	0.33	0.67	1.00	1.67	2.00	2.33	2.00	1.00	0.67	0.33	0.00	1.00
Basanti	0.33	1.00	1.67	2.00	2.33	2.33	2.67	2.33	1.67	1.00	0.67	0.33	1.53
Bio-772	0.17	0.67	1.33	1.67	2.00	2.33	2.33	2.67	2.00	1.67	1.00	0.33	1.51
BS-2	0.67	1.00	1.33	1.67	2.00	2.33	2.50	2.67	2.00	1.67	0.67	0.33	1.57
CS-52	0.17	0.67	1.00	1.67	2.00	2.33	2.67	2.33	2.00	1.67	1.00	0.67	1.51
Durgamani	0.33	1.00	1.67	2.00	2.33	2.67	2.84	2.33	1.67	1.33	0.67	0.33	1.60
GM-2	0.67	1.00	1.33	1.67	2.00	2.33	2.67	2.33	1.67	1.67	0.67	0.33	1.53
GM-111	0.00	0.33	0.67	1.34	1.67	2.00	2.33	2.33	1.67	1.67	0.67	0.33	1.25
JM-1	0.33	0.67	1.33	2.00	2.33	2.67	2.67	2.33	2.00	1.00	0.67	0.33	1.53
Kranti	0.00	0.00	0.67	1.50	1.67	2.00	2.00	1.67	1.00	0.67	0.33	0.00	0.96
Krishna	0.00	0.33	0.67	1.00	1.67	2.00	2.33	1.84	1.17	0.67	0.33	0.00	1.00
Maya	0.00	0.00	0.33	0.67	1.00	1.67	2.33	2.00	1.67	0.67	0.33	0.00	0.89
MYSL-203	0.00	0.00	0.33	0.67	1.33	1.67	2.33	2.33	1.67	0.67	0.33	0.00	0.94
PBR-91	0.67	1.00	1.33	1.67	2.00	2.33	2.67	2.33	1.67	1.33	1.00	0.67	1.56
PBR-97	0.33	1.00	1.17	1.33	1.67	2.33	2.67	2.33	2.00	1.67	1.00	0.67	1.51
PCR-7	0.00	0.33	0.67	1.00	1.33	2.00	2.33	1.67	1.17	0.67	0.33	0.00	0.96
PM-66	0.67	1.00	1.33	1.67	2.33	2.67	2.84	2.33	1.67	1.00	0.67	0.00	1.51
PM-67	0.33	0.67	1.00	1.67	2.33	2.67	2.67	2.00	1.67	1.33	1.33	0.67	1.53
PR-8988	0.00	0.33	0.67	1.33	2.33	2.67	2.17	1.33	1.33	1.00	0.67	0.33	1.18
Pusa agrani	0.33	0.67	1.00	1.33	1.67	2.00	2.00	1.00	0.67	0.33	0.00	0.00	0.92
Pusa bahar	0.00	0.33	0.67	1.00	1.67	2.00	2.33	1.67	1.33	0.67	0.33	0.00	1.00
Pusa bold	0.00	0.33	0.67	1.00	1.33	2.00	2.67	2.00	1.00	0.67	0.33	0.00	1.00
Pusa jagannath	0.17	0.67	1.33	1.67	2.00	2.33	2.67	2.67	1.67	1.33	1.00	0.67	1.51
RH-30	0.33	0.67	1.00	1.67	2.33	2.67	2.67	2.33	1.67	1.33	1.00	0.67	1.53
RH-718	0.33	0.67	1.00	1.84	2.50	2.67	3.00	2.33	1.67	1.17	0.67	0.33	1.51
RH-819	0.33	0.67	1.00	1.67	2.33	2.34	3.00	2.67	2.00	1.50	0.67	0.33	1.54
RH-8113	0.67	1.00	1.67	2.00	2.33	2.50	2.84	2.67	2.00	1.50	0.67	0.33	1.68
RH-8812	0.00	0.33	0.67	1.67	2.00	2.33	2.67	2.33	1.67	0.67	0.33	0.00	1.22
RL-1359	0.00	0.33	0.67	1.33	2.00	2.34	2.33	2.17	1.67	1.00	0.33	0.00	1.18
RLM-514	0.00	0.33	0.67	1.67	2.00	2.33	2.84	2.67	1.67	0.84	0.33	0.00	1.28
RLM-619	0.00	0.00	0.33	1.00	1.67	2.33	2.50	2.33	1.67	1.00	0.33	0.00	1.10
Rohini	0.00	0.33	1.00	1.50	2.33	2.67	3.00	2.33	1.50	1.67	0.67	0.33	1.44
Sanjuct asech	0.00	0.33	0.67	1.34	2.33	2.67	3.00	2.67	2.17	1.33	0.33	0.00	1.40
Sarma	0.00	0.00	0.33	0.67	1.33	2.00	2.33	2.67	2.17	1.67	1.00	0.17	1.19
Seeta	0.00	0.33	0.67	1.00	1.67	2.17	2.67	2.33	2.00	1.67	0.67	0.17	1.28
SEJ-2	0.17	0.50	0.84	1.17	1.67	2.17	2.50	2.00	1.67	1.00	0.67	0.00	1.20
TM-2	0.00	0.33	0.67	1.33	2.00	2.33	2.67	2.33	2.00	1.34	0.67	0.17	1.32
TM-4	0.00	0.33	0.67	1.00	1.67	2.00	2.33	2.67	1.67	1.33	1.00	0.33	1.25
Urvashi	0.33	0.50	1.33	1.67	2.00	2.33	2.67	2.33	2.00	1.67	1.00	0.33	1.51
Vardan	0.00	0.33	0.67	1.33	1.67	2.00	2.33	1.67	1.00	0.67	0.33	0.00	1.00
Varuna	0.00	0.00	0.33	1.33	2.00	2.17	2.50	2.33	1.67	1.33	0.50	0.17	1.19
Vaibhav	0.00	0.17	0.50	1.34	2.33	2.50	2.67	2.00	1.67	1.00	0.33	0.00	1.21
Gobhi sarson (<i>Brassica napus</i>)													
GSL-1	0.00	0.32	0.50	1.00	1.67	2.00	2.33	1.67	1.33	0.84	0.33	0.00	1.00
GSL-2	0.00	0.17	0.67	1.67	2.00	2.17	2.50	1.84	1.67	1.00	0.33	0.00	1.17
Neelam	0.00	0.33	0.67	1.00	1.67	2.33	2.67	2.17	1.50	1.17	0.67	0.17	1.19
Sheetal	0.00	0.33	0.67	1.67	2.00	2.50	2.84	2.17	1.67	1.33	0.33	0.00	1.29
Kiran rai (<i>Brassica carinata</i>)													

Table 2: Continued

Cultivars	18 Dec. 51 (st wk)	25 Dec. 52 (st wk)	1 Jan. 1 (st wk)	8 Jan. 2 (st wk)	15 Jan. 3 (st wk)	22 Jan. 4 (st wk)	29 Jan. 5 (st wk)	5 Feb. 6 (st wk)	12 Feb. 7 (st wk)	19 Feb. 8 (st wk)	26 Feb. 9 (st wk)	5 Mar. 10 (st wk)	MeanAll
JTC-1	0.00	0.33	1.00	1.33	1.67	2.00	2.33	2.00	1.67	1.00	0.33	0.00	1.14
PBC-9902	0.00	0.17	0.50	1.00	2.00	2.33	2.67	2.33	1.84	1.33	0.67	0.33	1.26
PC-5	0.00	0.33	0.67	1.33	1.67	2.17	2.67	2.33	1.67	1.00	0.33	0.33	1.21
Pusa Swarnim	0.00	0.00	0.33	0.67	1.00	1.84	2.17	1.67	1.33	0.67	0.33	0.00	0.83
Taramira (<i>Eruca sativa</i>)													
RTM-314	0.17	0.50	0.84	1.22	1.84	2.33	2.67	2.67	2.17	1.50	0.67	0.33	1.41
TMLC-2	0.00	0.33	0.50	0.84	1.34	2.00	2.33	2.33	2.67	1.00	0.50	0.00	1.15
Toria (<i>Brassica rapa</i> var. toria)													
M-27	0.00	0.50	0.84	1.67	2.33	2.67	2.84	2.67	1.17	0.50	-	-	1.52
PT-30	0.00	0.33	0.67	1.00	1.67	2.33	1.67	1.33	0.67	0.33	-	-	1.00
PT-303	0.33	0.67	1.67	2.00	2.33	2.67	2.84	2.17	1.67	0.67	-	-	1.70
TL-15	0.00	0.33	1.33	2.00	2.67	2.67	2.33	1.67	0.67	0.33	-	-	1.40
TS-38	0.17	0.67	1.17	2.00	2.33	2.67	2.50	1.67	1.00	0.33	-	-	1.45
Yellow sarson (<i>Brassica rapa</i> var. yellow sarson)													
B-9	0.00	0.00	0.33	0.67	1.33	2.00	2.67	2.00	0.67	0.33	-	-	1.00
GS-1	0.00	0.33	0.67	1.50	1.84	2.67	2.50	2.33	1.33	0.50	-	-	1.37
Jhumka	0.00	0.00	0.33	0.84	1.84	2.67	2.67	1.67	1.00	0.67	-	-	1.17
NDYS-2	0.00	0.00	0.33	0.67	1.67	2.00	2.33	1.00	0.67	0.33	-	-	0.90
PS-66	0.00	0.00	0.33	0.67	1.67	2.00	2.00	1.67	1.00	0.67	-	-	1.00
Pusa gold	0.00	0.17	0.50	1.33	2.00	2.33	2.84	2.33	1.33	0.33	-	-	1.32
YST-151	0.00	0.00	0.33	0.67	1.00	1.67	2.00	1.67	0.33	0.00	-	-	0.77

Given values are the means of two successive cropping years (2005-06 and 2006-07)

SEJ-2, TM-2, TM-4, Varuna, Vaibhav; gobhi sarson: GSL-2, Neelam, Sheetal; Kiranrai: JTC-1, PBC-9902, PC-5; Taramira: RTM-314, TMLC-2; Toria: PT-303, TL-15, TS-38 and Yellow sarson: GS-1, Jhumka, Pusa Gold) exhibited MAII between 1.01-1.50 and indicated as moderately susceptible cultivars (Table 2). The cultivars of rapeseed-mustard obtained highest MAII (>1.50) were: Indian mustard (Basanti, Bio-772, BS-2, CS-52, Durgamani, GM-2, JM-1, PBR-91, PBR-97, PM-66, PM-67, Pusa Jagannath, RH-30, RH-718, RH-819, RH-8113, Urvashi), and toria (M-27) and also placed in highly susceptible category (Table 2).

Third sowing (November 25): During third sowing, the rapeseed-mustard cultivars were sown on November 25 in the experimental field. Initially, attack of *L. erysimi* on different cultivars was witnessed during last week of December (52nd st wk as well as 7 WAS). The infestation of aphid (AII) increased gradually from 0.00 to 0.67, 0.33 to 1.50, 0.33 to 2.00, 1.00 to 2.67, 1.33 to 3.00, 2.00 to 3.17 and 2.00 to 3.34 on 52nd (7 WAS), 1st (8 WAS), 2nd (9 WAS), 3rd (10 WAS), 4th (11 WAS), 5th (12 WAS) and 6th (13 WAS) standard week, respectively (Table 3). Subsequently, Aphid Infestation Index (AII) decreased from 3.17 to 1.00, 2.67 to 0.33, 1.67 to 0.00 and 0.84 to 0.00 during 7th (14 WAS), 8th (15 WAS), 9th (16 WAS) and 10th (17 WAS) standard week, respectively (Table 3). Likewise, other sowing dates, the infestation on toria and yellow sarson was observed nil on 05 March due to early maturity of crops (Table 3).

The Mean Aphid Infestation Index (MAII) showed a considerable variation (1.00 to 2.14) on different cultivars. During late (November 25) seeded cultivars, none cultivars showed MAII below 1, however, minimum MAII (1.00) was recorded in Indian mustard (*Brassica juncea*) on Kranti, Maya, MYSL-203, PCR-7 and Pusa Agrani; in Kiran rai (*Brassica carinata*) on Pusa Swarnim and in yellow sarson (*Brassica rapa* var. yellow sarson) on NDYS-2 and YST-151. These cultivars sited under resistant category. The cultivars such as BSH-1 (brown sarson); Alankar, Krishna, Pusa Bahar, Pusa Bold and Vardan (Indian mustard); GSL-1 (gobhi sarson); PT-30 (toria) and B-9, PS-66 (yellow sarson) showed MAII between 1.00 to 1.50 and placed in moderately susceptible category (Table 3). Other cultivars (Indian mustard: Basanti, Bio-772, BS-2, CS-52, Durgamani, GM-2, GM-111, JM-1, PBR-91, PBR-97, PM-66, PM-67, PR-8988, Pusa Jagannath, RH-30, RH-718, RH-819, RH-8113, RH-8812, RL-1359, RLM-514, RLM-619, Rohini, Sanjuct Asech, Sarma, Seeta, SEJ-2, TM-2, TM-4, Varuna, Vaibhav, Urvashi; gobhi sarson: GSL-2, Neelam, Sheetal; Kiran rai: JTC-1, PBC-9902, PC-5; Taramira: RTM-314, TMLC-2; Toria: M-27, PT-303, TL-15, TS-38 and Yellow sarson: GS-1, Jhumka, Pusa Gold) attained maximum (beyond 1.50) MAII and recognized as highly susceptible varieties (Table 3).

During the course of investigations, the range of maximum and minimum temperature and percent relative humidity, wind velocity, sunshine, evaporation and rainfall with respect to different sowing dates and pest activity period was recorded (Table 4).

Table 3: Screening of rapessed-mustard cultivars against mustard *Lipaphis erysimi* during first sowing (November 25)

Cultivars	25 Dec. 52 (st wk)	1 Jan. 1 (st wk)	8 Jan. 2 (st wk)	15 Jan. 3 (st wk)	22 Jan. 4 (st wk)	29 Jan. 5 (st wk)	5 Feb. 6 (st wk)	12 Feb. 7 (st wk)	19 Feb. 8 (st wk)	26 Feb. 9 (st wk)	5 Mar. 10 (st wk)	Mean All
Brown sarson (<i>Brassica campestris</i> var. brown sarson)												
BSH-1	0.17	0.33	0.67	1.00	1.67	2.33	2.84	2.00	1.00	0.67	0.33	1.18
Indian mustard (<i>Brassica juncea</i>)												
Alankar	0.00	0.33	1.00	1.33	1.67	2.00	2.67	2.00	1.33	0.67	0.17	1.20
Basanti	0.33	0.84	1.50	2.00	2.50	2.67	3.00	2.84	2.33	1.50	0.67	1.83
Bio-772	0.17	1.17	1.67	2.00	2.50	2.84	3.00	2.67	2.17	1.50	0.67	1.85
BS-2	0.33	1.00	1.67	2.50	2.84	2.84	3.17	2.17	1.67	1.00	0.33	1.77
CS-52	0.33	1.17	1.84	2.33	2.84	2.84	3.17	3.17	2.50	1.67	0.67	2.05
Durgamani	0.33	1.17	1.84	2.33	2.67	2.84	3.00	2.84	2.33	1.50	0.67	1.96
GM-2	0.33	1.17	1.83	2.50	3.00	3.17	3.34	3.17	2.67	1.67	0.67	2.14
GM-111	0.00	0.84	1.84	2.17	2.34	2.67	2.84	2.50	1.84	1.17	0.34	1.68
JM-1	0.17	1.00	1.84	2.17	2.67	2.67	3.00	2.50	1.84	1.34	0.34	1.77
Kranti	0.00	0.33	1.00	1.33	1.67	2.00	2.33	1.33	0.67	0.33	0.00	1.00
Krishna	0.00	0.67	1.00	1.33	1.67	2.33	2.67	1.33	1.00	0.67	0.33	1.18
Maya	0.00	0.17	0.33	1.00	1.33	2.00	2.67	2.00	1.00	0.33	0.17	1.00
MYSL-203	0.00	0.33	0.67	1.33	1.67	2.00	2.33	1.67	0.67	0.33	0.00	1.00
PBR-91	0.00	0.84	1.84	2.00	2.17	2.67	3.00	2.84	2.17	1.17	0.50	1.74
PBR-97	0.17	0.84	1.84	2.17	2.50	2.84	3.00	2.50	1.84	1.17	0.50	1.76
PCR-7	0.00	0.67	1.00	1.33	1.67	2.00	2.33	1.00	0.67	0.33	0.00	1.00
PM-66	0.50	1.50	2.00	2.34	2.50	3.00	3.00	2.67	1.50	0.67	0.00	1.79
PM-67	0.00	0.84	1.67	2.33	2.67	3.00	3.34	3.00	2.33	1.50	0.67	1.94
PR-8988	0.00	0.84	1.67	2.34	2.00	2.50	2.84	2.33	1.67	0.67	0.00	1.53
Pusa agrani	0.00	0.67	1.00	1.33	1.67	2.00	2.33	1.00	0.67	0.33	0.00	1.00
Pusa bahar	0.33	0.67	1.00	1.33	1.67	2.00	3.00	1.67	1.00	0.33	0.17	1.20
Pusa bold	0.00	0.33	0.67	1.00	2.00	2.33	3.00	1.67	1.00	0.67	0.33	1.18
Pusa jagannath	0.00	1.50	2.00	2.67	3.00	3.00	3.17	2.83	2.00	1.17	0.50	1.99
RH-30	0.50	1.17	1.84	2.17	2.50	3.00	3.17	2.84	2.17	1.67	0.84	1.99
RH-718	0.00	1.00	2.00	2.34	2.50	3.00	3.17	2.67	1.84	1.50	0.33	1.85
RH-819	0.00	0.67	1.67	2.17	2.33	2.84	3.00	2.67	2.17	1.67	0.33	1.77
RH-8113	0.00	0.67	1.67	2.17	2.50	2.84	3.00	2.67	2.17	1.67	0.67	1.82
RH-8812	0.00	0.84	1.67	2.17	2.34	2.67	2.84	2.33	1.67	0.67	0.00	1.56
RL-1359	0.33	0.67	1.50	2.00	2.33	2.50	2.84	2.17	1.67	0.67	0.00	1.52
RLM-514	0.00	0.84	1.84	2.00	2.33	2.67	3.00	2.00	1.67	0.67	0.00	1.55
RLM-619	0.33	0.67	1.34	2.00	2.33	2.50	2.84	2.34	1.84	0.67	0.00	1.53
Rohini	0.17	1.00	1.84	2.33	2.50	2.84	3.00	2.17	1.67	0.84	0.50	1.71
Sanjuct asech	0.00	0.84	1.84	2.17	2.50	3.00	3.00	2.50	2.00	0.84	0.17	1.71
Sarna	0.33	0.50	1.50	2.17	2.50	2.67	3.00	2.17	1.50	0.67	0.00	1.55
Seeta	0.17	0.67	1.33	1.84	2.34	2.67	3.00	2.34	1.84	0.67	0.00	1.53
SEJ-2	0.33	0.67	1.17	2.00	2.00	2.67	3.00	2.34	1.67	0.67	0.00	1.50
TM-2	0.00	0.67	1.17	2.00	2.17	2.67	3.00	2.33	1.67	0.67	0.33	1.52
TM-4	0.00	0.67	1.50	2.34	2.17	2.84	3.00	2.17	1.67	0.67	0.00	1.55
Urvashi	0.17	1.34	1.84	2.33	2.67	3.00	3.17	3.00	2.34	1.17	0.50	1.96
Vardan	0.00	0.33	0.67	1.33	2.00	2.33	2.67	1.67	1.00	0.67	0.33	1.18
Varuna	0.00	0.50	1.50	2.00	2.17	2.50	3.00	2.34	1.84	0.50	0.33	1.52
Vaibhav	0.00	0.50	1.67	2.17	2.17	2.67	3.00	2.50	2.17	1.34	0.33	1.68
Gobhi sarson (<i>Brassica napus</i>)												
GSL-1	0.00	0.33	1.33	1.67	1.84	2.33	2.00	1.67	1.33	0.67	0.00	1.20
GSL-2	0.33	0.67	1.67	2.00	2.33	2.67	2.67	2.00	1.67	0.50	0.00	1.50
Neelam	0.67	1.00	1.50	1.67	2.00	2.50	2.67	2.33	1.33	0.67	0.33	1.52
Sheetal	0.33	1.00	1.67	2.00	2.17	2.33	2.50	2.00	1.67	0.67	0.33	1.52
Kiran rai (<i>Brassica carinata</i>)												
JTC-1	0.33	0.67	1.67	2.00	2.33	2.67	2.50	2.00	1.33	0.67	0.33	1.50
PBC-9902	0.67	1.33	1.67	2.00	2.00	2.33	2.67	2.33	1.17	0.67	0.17	1.55
PC-5	0.33	1.00	1.33	1.67	2.33	2.33	2.67	2.00	1.67	1.00	0.33	1.51
Pusa swarnim	0.00	0.33	0.84	1.17	1.33	2.00	2.33	1.67	0.84	0.50	0.00	1.00
Taramira (<i>Eruca sativa</i>)												
RTM-314	0.17	1.00	1.33	1.67	2.33	2.70	2.84	2.33	1.67	0.84	0.33	1.56
TMLC-2	0.33	0.67	1.33	1.67	2.00	2.33	2.67	2.33	1.67	1.33	0.33	1.51
Toria (<i>Brassica rapa</i> var. toria)												
M-27	0.17	1.00	1.84	2.17	2.50	2.67	3.00	2.17	1.67	0.67	-	1.78
PT-30	0.33	0.67	1.00	1.33	2.00	2.67	2.00	1.00	0.67	0.33	-	1.20
PT-303	0.33	0.67	1.34	2.00	2.17	2.67	2.84	2.17	1.17	0.33	-	1.57
TL-15	0.34	1.50	1.34	1.84	2.50	2.50	2.67	1.67	1.00	0.34	-	1.57
TS-38	0.33	1.00	1.33	1.67	2.00	2.50	2.67	2.00	1.00	0.67	-	1.52
Yellow sarson (<i>Brassica rapa</i> var. yellow sarson)												
B-9	0.00	0.33	1.00	1.67	2.00	2.33	2.67	1.00	0.67	0.33	-	1.20

Table 3: Continued

Cultivars	25 Dec. 52 (st wk)	1 Jan. 1 (st wk)	8 Jan. 2 (st wk)	15 Jan. 3 (st wk)	22 Jan. 4 (st wk)	29 Jan. 5 (st wk)	5 Feb. 6 (st wk)	12 Feb. 7 (st wk)	19 Feb. 8 (st wk)	26 Feb. 9 (st wk)	5 Mar. 10 (st wk)	Mean All
GS-1	0.33	1.00	1.67	2.17	1.84	2.17	2.84	2.00	1.33	0.67	-	1.60
Jhumka	0.34	0.83	1.50	1.83	1.67	2.50	2.84	1.83	1.17	0.67	-	1.52
NDYS-2	0.00	0.33	0.67	1.00	1.33	2.00	2.33	1.33	0.67	0.33	-	1.00
PS-66	0.17	0.67	1.00	1.22	2.00	2.50	2.33	1.00	0.67	0.33	-	1.19
Pusa gold	0.17	0.84	1.50	1.84	2.17	2.33	2.67	1.84	1.33	0.67	-	1.53
YST-151	0.17	0.33	0.67	1.33	1.84	2.00	2.33	1.00	0.33	0.00	-	1.00

Given values are the means of two successive cropping years (2005-06 and 2006-07)

Table 4: Maximum and minimum temperature and percent relative humidity, wind velocity, sunshine, evaporation and rainfall with respect to different sowing dates and pest activity period

Meteorological parameters	First sowing (October 25)	Second sowing (November 10)	Third sowing (November 25)
Maximum temperature	16.71-26.06	16.71-27.97	16.71-27.97
Minimum temperature	40.80-13.50	4.80-15.01	40.80-15.01
Maximum relative humidity	78.76-95.33	78.29-95.33	78.29-95.33
Minimum relative humidity	43.40-58.18	42.51-58.18	42.51-58.18
Wind velocity	00.55-4.30	0.55-4.30	00.55-4.30
Sunshine	10.25-6.15	1.25-6.20	10.35-6.20
Evaporation	10.65-4.05	1.65-4.70	10.65-4.70
Rainfall	00.00-31.60	0.00-31.60	00.00-31.60

DISCUSSION

In the present study, mustard aphid, *Lipaphis erysimi* commenced its attack in the third week of December on October 25 sown cultivars and reached to a maximum in the last week of January. Whereas, on November 10 and November 25 sown cultivars, the aphid attack was initially recorded on third and last week of December, however, attaining maximum population in first and second week of February, respectively. The study made by Aslam *et al.* (2005) and Saljoqi *et al.* (2011) showed complete corroboration with present findings, they also recorded maximum aphid infestation in the month of February. On the other hand, cultivars sown on October 25 escaped the infestation due to asynchronization of vulnerable crop stages and aphid multiplication period. In contrast, the late seeded cultivars (November, 10 and 25) showed heavy infestation, covered all plant organs including leaves, stem, apical shoots and developing pods during last week of January. Many workers have reported similar findings and suggested that early or timely sown crop escaped aphid infestation compared to the late sown crop (Prasad and Singh, 1999; Karmakar, 2003; Chattopadhyay *et al.*, 2005; Rai and Mishra, 2007; Razaq *et al.*, 2011). However, the climatic conditions were found as important determining factors for aphid multiplication. In the present study, the cultivars sown on October 25 experienced high temperature (24.7 to 29.1°C) and low relative humidity (43.7 to 51.6%) at vegetative stage and low temperature (6.1 to 11.1°C) and high relative

humidity (78.9 to 93.5%) at siliqua formation. Hence, it could be attributed that the cultivars escaped serious attack of aphid and favors the development of healthy crops. Contrary to this, late sown cultivars (November 10 and 25) received low temperature range (10.0 to 18.6°C) and high relative humidity (57.5 to 87.3%) at vegetative as well as siliqua formation stages, which would have favored aphid multiplication. Similar reports on the climatic factors on aphid multiplication are available (Srivastava *et al.*, 1995; Prasad, 2003; Chattopadhyay *et al.*, 2005; Ansari *et al.*, 2007).

When rapeseed-mustard cultivars seeded on October 25 and November 10, Kranti, Maya, MYSL-203, PCR-7 and Pusa Agrani (Indian mustard); Pusa Swarnim (Kiran rai) and NDYS-2, YST-151 (yellow sarson) showed high tolerance against *L. erysimi* (MAII < 1.00). Whereas, these cultivars sown on November 25 synchronized with aphid multiplication and become moderately resistant (MAII 1.00). On the other hand, cultivars BSH-1 (brown sarson); Alankar, Krishna, Pusa Bahar, Pusa Bold and Vardan (Indian mustard); GSL-1 (gobhi sarson); PT-30 (toria) and B-9, PS-66 (yellow sarson) exhibited mean aphid infestation index one, with respect to first (October 25) and second (November 10) sowing dates and placed in moderately resistant category. Whenever, these cultivars seeded late (November 25) become more vulnerable to aphid attack (1.00 to 1.50) and comes under moderately susceptible category. Similar results were also observed by Aslam *et al.* (2005) and Saljoqi *et al.* (2011), they observed no varieties completely free by the attack of aphid in the month of February. Therefore, present findings revealed that the cultivars showed timely showed maximum self defense as compared to late (Amer *et al.*, 2009; Aslam *et al.*, 2009; Ahuja *et al.*, 2010; Saljoqi *et al.*, 2011). The variation in MAII on cultivars is likely to have been caused by seasonal variations in aphid pressure and plant growth factors. The cultivars identified as promising in these trials confirm the earlier findings of Manzar *et al.* (1998), Jatoi *et al.* (2002), Roy and Baral (2003), Naqvi *et al.* (2004), Rana (2005) and Mamun *et al.* (2010). Among the late seeded cultivars (November 25), kiran rai and gobhi sarson showed less damage owing to different plant texture and late flowering, whereas remaining cultivars were found heavily infested with aphid.

In conclusion, *Lipaphis erysimi* population can be reduced considerably on rapeseed-mustard crops by manipulating sowing dates. The timely sown cultivars (October 25) could avoid aphid multiplication to a great extent as compared to late sown cultivars (November 10 and 25). Therefore, the farmers are strongly advised to seeding rapeseed-mustard timely (October last week) and also use any of the tested cultivar viz., Kranti, Maya, MYSL-203, PCR-7 and Pusa Agrani (Indian mustard); Pusa Swarnim (Kiran rai) and NDYS-2, YST-151 (yellow sarson).

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