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Assessment of rapeseed-mustard genotypes against mustard aphid, *Lipaphis erysimi* (Kalt.) under natural infestation conditions

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Abstract
Experimentations were conceded out at the Oilseed Farm of C.S.A Agricultural University, Kalyanpur, Kanpur, UP. During Rabi season of 2015-16 and 2016-17 to evaluate rapeseed-mustard genotypes against *Lipaphis erysimi*. A total of sixty-three genotypes accessions were evaluated based on population buildup of mustard aphid and infestation index. AKM2 / AKMS-14-34 was resistant and had least number of aphid population (21.3-30.7 aphids/ top 10 cm of central shoot/plant). PT-2010-5 was susceptible and had 87.0-195.3 aphids/ top 10 cm of central shoot/plant. Based on Aphid infestation index, four, three, forty and sixteen mustard genotypes were categorized under resistant, moderately resistant, susceptible and highly susceptible categories, respectively. Genotype namely, AKM2 / AKMS-14-34, ACN 83, RTM-314 and NML 42 were identified resistant varieties against *L. erysimi*.

Keywords: Rapeseeds-mustard, mustard aphid (*Lipaphis erysimi* Kalt.), resistance, screening, *Brassica* genotypes

Introduction
Oilseed crops an important place in the agricultural economy of India, of which rapeseed and mustard rank at second place after groundnut in terms of area and production (Ali *et al.*, 2010). *Brassica* crops account for 30 per cent of the total oilseeds production and 13 per cent of the country's gross cropped area. The area of rapeseed-mustard is 36.59 million hectares (mha), production 100-110 lakh tonnes and level of productivity 1269 kg / ha in India. *Lipaphis erysimi* (Kalt.) (Mustard aphid) *Athalia proxima* (Klug). (Mustard sawfly), *Bagrada cruciferarum (*Kirk.) (Painted bug), *Chromatomyia horticola* Goureau (Leaf miner) and *Spilarctia obliqua* Walker (Bihar hairy caterpillar) are the pests of major importance. Among these, *L. erysimi* is one of the most destructive insect (Rai, 1976) [20], which is responsible for causing severe reduction in seed yield and it varied from 15.0 to 73.3% (Anonymous, 1987, 1993 and Rohilla *et al.*, 1990) [1, 4, 21]. The use of insecticides for the control of mustard aphid may not be either economical or ecologically acceptable all the times. Many of unwanted side effects of insecticides such as residue problem, environmental hazards, besides using A.I.I. and population of mustard aphid in screening test, some of the workers used per cent plant damage caused by mustard aphid as a criterion for identifying promising materials against mustard aphid. Only three lines of *B. carinata viz*., DLSC-1and were observed as promising against mustard aphid at Ludhiana (Anonymous, 1991) [2]. Based on A.I.I., population count and per cent plant infestation, five strains *viz*., T-27, T-6342, HC-2, DLSC-2 and RW-2-2 possessed high degree of resistance to mustard aphid at Ludhiana (Anonymous, 1992) [3]. Destruction of natural enemies, insect pollinators and other non-target species, development of resistance in insect to insecticides etc. have put a great limitation in the use of insecticides particularly in *Brassica* oilseed crops. By realizing such problems with the use of insecticides, the management of insect-pests through the use of resistant varieties has become very important as it serves an ideal method of insect-pest control because it is environmentally safe and also does not harm natural enemies as well as other non-target insect species. For evolving a resistant variety, the search for resistant sources through screening of large number of genotypes is the first step. Cultivation of resistant or tolerant varieties is the easiest way to protect mustard crop from insect pests. Varietal screening for aphid resistance and stability of seed yield under aphid-infested and protected environment would help in identifying the tolerant varieties for aphid attack (Dey *et al*., 2005) [15].

Material and Methods

Experiments were conducted at Oil SEED Farm Kalyanpur C.S. Azad University of Agriculture and technology, Kanpur (U. P.) during *Rabi season* 2014-15 and 2015-16. Seeds of sixty-three *Brassica* genotypes were sown the germplasm sown in 6 x 6 m^2. There were three plants per germplasm and each plant was treated as one replication and the sixty-three genotypes organized different treatments. for this experiment Row to row and plant to plant spacing's were maintained 30 cm and 10 cm apart, respectively. Seeds of susceptible check, BSH-1 were also sown in paired rows after every 10 test genotypes and also all along test genotypes as border rows. The winged mustard aphids collected from naturally infested plants (outside the semi-artificial condition) were released on the twigs of each selected plant @ 5 aphids per plant at peak vegetative stage of the mustard plant during last week of January of both years. Top 10 cm of the central shoot of each plant was tapped gently ten times with a 15 cm stick of pencil thickness and aphids were collected on a sheet and counted by visual observation (Chattopadhyay *et al*., 2005) [14] at a fortnightly interval from the date of release. In addition to the aphid population, scoring of aphid Infestation was made before harvesting by adopting slightly modified methodology given by Pradhan *et al*. (1960) [18], Bakhetia and Sandhu (1973) [10] and Prasad and Phadke (1980) [19] as given below:

Table 1: Categorization of genotypes based on population of mustard aphid.

Groups	Scoring	Grades of resistance / susceptibility	Symbol
I	1.0-2.0	Resistant	R
II	2.1-3.0	Moderately resistant	Mr
III	3.1-4.0	susceptible	S
IV	4.1-5.0	Highly susceptible	HS

Results and Discussion

Mean data of two seasons (2014-15 & 2015-16) on population of mustard aphid as well as infestation scoring under semi-natural condition are given in Table 2. Number of aphids increased irrespective of genotypes from the date of inoculation to first fortnight and during second fortnight of February. The aphid population varied from 21.3 to 87.0 and 30.7 to 195.3 during first and second dates of observation, respectively. The infestation underway at flowering stage and extended its topmost during pod formation stage, with decline later. Out of sixty-six germplasm, the least number of aphids (21.3 aphids/top 10 cm of central shoot/plant) was observed in AKM2 / AKMS-14-34 followed by ACN 83 (24.7 aphids / plant), NML 42 (28.3), and RTM-314 (29.3) whereas 87.0 aphids/top 10 cm of central shoot/plant was in genotype PT-2010-5 showing extreme number of aphids on 12.02.2015 during 2014-15. None of the germplasm was found completely free from aphids. According to infestation index, four genotypes were resistant, three moderately resistant, forty susceptible and sixteen highly susceptible. About 70% genotypes were found susceptible against mustard aphid. Similar trends of scoring for aphid population had been reported by Bakhetia and Sandhu (1973) [10], Amer *et al.* (2009) [7] and Ahmad *et al*. (2013) [9]. Jatoi *et al*. (2002) [16] reported that 21.70 to 38.86 and 21.80 to 43.30 aphids/ plant were present at flowering and during seed formation stage on the varieties declared as tolerant. The peak infestation was observed at the pod formation stage which is in line with those of Anwar and Shafique (1999) [23] and Mamun *et al.* (2010) [17]. Approximately 91% tested germplasm accessions showed below average growth with curling and yellowing of leaves on all branches. Flowering and pod setting were almost poor with fewer grains of reduced size. Four accessions, *viz*., AKM2 / AKMS – 14-34, ACN 83, RTM-314 and NML 42 could be declared as resistant.

Table 2. Showing of mustard germplasm against *Lipaphis erysimi* (pooled, 2014-15 & 2015-16) Population of *Lipaphis erysimi* (top 10 cm of central shoot)

Germplasm	At the time of flowering	At the time of pod setting	Infestation Counting
PT-2010-5	87.0 (9.35)	195.3 (13.99)	5.0
BAUT 08-5	83.3 (9.16)	167.7 (12.97)	5.0
RMT 10-11	75.0 (8.69)	158.0 (12.59)	4.7
RAUDT – 10-23	78.7 (8.90)	167.0 (12.94)	4.7
Varuna	71.3 (8.48)	155.3 (12.48)	4.7
Benoy	78.0 (8.86)	145.3 (12.08)	4.7
Pusa Mustard-28	78.3 (8.88)	161.0 (12.71)	4.7
TS 46	80.7 (9.01)	165.3 (12.88)	4.7
TL-15	78.7 (8.90)	168.0 (12.98)	4.7
CS-1100-12-2-3	81.0 (9.03)	165.0 (12.86)	4.7
YSH-0401	77.3 (8.82)	172.3 (13.15)	4.7
RTM-2002	67.7 (8.26)	145.0 (12.06)	4.3
MCP-22	72.7 (8.55)	149.7 (12.25)	4.3
GSC-101	54.3 (7.40)	110.0 (10.51)	4.3
PRO 5222	65.0 (8.09)	145.7 (12.09)	4.3
YSKM 14-2	73.3 (8.59)	158.0 (12.59)	4.3
RGN-73	57.0 (7.58)	125.3 (11.22)	4.0
PRL-2012-13	64.0 (8.03)	125.3 (11.22)	4.0
NUDB – 26-11	71.7 (8.50)	138.7 (11.80)	4.0
RHO 919	63.3 (7.99)	141.7 (11.92)	4.0
RSPN 29	50.0 (7.11)	98.7 (9.96)	4.0
PHR 800	81.0 (9.03)	173.7 (13.20)	4.0
TM 266	45.0 (6.75)	102.0 (10.12)	3.7
Pitambari	50.0 (7.11)	101.0 (10.07)	3.7
PYS 2013-3	46.7 (6.87)	94.3 (9.74)	3.7
RH 406	47.7 (6.94)	91.0 (9.57)	3.7

RH 1019	52.0 (7.25)	103.0 (10.17)	3.7
LES 50	54.0 (7.38)	125.3 (11.22)	3.7
PR 2012-15	55.0 (7.45)	108.3 (10.43)	3.7
PT 2011-7	62.7 (7.95)	133.7 (11.58)	3.7
LES-51	84.0 (9.19)	153.3 (12.40)	3.7
PT 303	56.7 (7.56)	111.3 (10.58)	3.7
TH 1102	72.7 (8.55)	140.3 (11.87)	3.7
RTM 1351	44.3 (6.70)	97.3 (9.89)	3.3
DRMRIJ 1403	63.0 (7.97)	128.0 (11.34)	3.3
TMB-2032	58.7 (7.69)	126.3 (11.26)	3.3
TMB-2031	67.0 (8.22)	135.0 (11.64)	3.3
Rohani	62.0 (7.91)	117.0 (10.84)	3.3
RH 1019	58.3 (7.67)	111.3 (10.58)	3.3
RTM 1212	64.3 (8.05)	124.7 (11.19)	3.3
RTM 1415	59.3 (7.74)	121.7 (11.05)	3.3
RTM 1355	51.7 (7.22)	101.7 (10.11)	3.3
RMWR 09-5	53.7 (7.36)	109.7 (10.50)	3.3
KMR(L)-14-6	60.3 (7.80)	116.0 (10.79)	3.3
RGN-330	58.0 (7.65)	113.3 (10.67)	3.3
PRL-2012-1	59.7 (7.76)	119.7 (10.96)	3.3
RGN-337	56.7 (7.56)	113.3 (10.67)	3.3
Urvashi	52.0 (7.25)	106.3 (10.34)	3.3
SKM-1208	59.3 (7.74)	119.0 (10.93)	3.3
RMM 101-1	56.7 (7.56)	101.0 (10.07)	3.3
SKBS-3	61.3 (7.86)	119.7 (10.96)	3.3
RH 0555	53.0 (7.31)	104.0 (10.22)	3.3
NPJ-185	63.3 (7.99)	126.7 (11.28)	3.3
PYS 2012-6	61.7 (7.88)	125.0 (11.20)	3.3
JT 90-1	60.0 (7.78)	122.0 (11.07)	3.3
Basmati	52.3 (7.27)	100.3 (10.04)	3.3
Rolli	39.0 (6.28)	83.0 (9.14)	3.0
Vaibhav	42.7 (6.57)	84.0 (9.19)	2.7
KMR(e) 14-1	59.3 (7.74)	78.7 (8.90)	2.3
NML 42	28.3 (5.37)	57.3 (7.60)	2.0
ACN 83	24.7 (5.02)	36.7 (6.10)	1.7
RTM-314	29.3 (5.46)	44.7 (6.72)	1.7
AKM2/AKMS – 14-34	21.3 (4.67)	30.7 (5.58)	1.3
SEm ±	0.32	0.54	-
CD (P = 0.05)	0.91	1.51	-

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