

Screening of *Brassica* Germplasm against Painted Bug, *Bagrada cruciferarum*

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ABSTRACT: The field experiments on “Screening of *Brassica* germplasm against painted bug, *Bagrada cruciferarum*” was conducted at Students’ Instructional Farm of C.S. Azad University of Agriculture & Technology, Kanpur during Rabi 2021-22 and 2022-23. The field experiment was conducted in natural condition and scientific way. The experiment location situated on the geographical coordinates of 26° 28' 0" N, 80° 21' 0" E. Fifty *Brassica* germplasms were evaluated on the basis of the Range of painted bugs population per plant. The population of mustard painted bugs was observed in 50 germplasms taken under screening to see the performance of germplasms based on the level of infestation of mustard painted bugs. Based on painted bugs population, RC-1, RC-4 and RC-27 were found resistance registering (below 1.5 bugs per plant), RC-3, RC-5, RC-13, RC-14, RC-16, RC-17, RC-19, RC-25, RC-30, RC-32, RC-33, RC-34, RC-42, RC-43, RC-45 and RC-48 were found moderately resistance (between 1.5 to 2.1 bugs per plant), whereas, RC-12 and RC-50 were found highly resistance against this pest (above 2.1 bugs per plant).

Keywords: *Bagrada cruciferarum*, germplasm, Mustard, Painted Bug, Resistance and Screening.

INTRODUCTION

Indian mustard, *Brassica juncea* Linn. Commonly referred as sarson or rai (Hindi), mohari (Marathi) and Sasive (Kannada) is one among the important edible oilseed crops grown within the country. Mustard is an integral part of the human diet with oil content ranging from 32-40% and protein content ranging from 15-17% (Dash and Konarand 2019). The word “rape” and “mustard” have been derived from the Latin word “rapum” meaning turnip and European practice of mixing the sweet “must” of old wine with crushed seeds of black mustard, *Brassica nigra* (L.) to form a hot paste, respectively (Hemingway, 1976). Oilseeds have been the backbone of agricultural economy of India since long. Indian mustard (*Brassica juncea* (L.) is the second largest oilseed crop in India after Groundnut. Among rapeseed-mustard, Indian mustard is one of the most important oil seed crops which contribute about 85 per cent of total rapeseed mustard produced in India (Kumar and Chauhan 2005).

From germination to harvest, the mustard crop is plagued by insect pests and diseases. According to Sachan and Purwar (2007), the mustard aphid, *Lipaphis erysimi*; mustard sawfly, *Athalia proxima*; painted bug; *Bagrada cruciferarum*; leaf miner, *Chromatomyia horticola*; and Bihar hairy caterpillar, *Spilarctia obliqua* are among the insect species that assault mustard.

The European Union was the leading producer of rapeseed worldwide with a production volume of 19.5

million metric tons in that year. The global production of rapeseed oil reached 31.8 million metric tons (source: Statista) in 2022/2023. The highest producer of rapeseed mustard were the European Union, China, Canada, India and Japan in 2023. In India, the area under rapeseed & mustard enhanced by 88.58 lakh ha in 2022-23 (Anonymous, 2023). In fiscal year 2022, India produced more than 38 million metric tons of oilseeds (source: Statista). Major rapeseed-mustard producing states are Rajasthan, Haryana, M.P., U.P., West Bengal, Gujarat, Assam and Bihar. Production in Uttar Pradesh is estimated by Solvent Extractor’s Association (SEA) at 16.69 lakh tonnes.

In India, rapeseed-mustard has been discovered to be infested by about 50 different insect species (Sharma and Singh 2010). A significant pest of rapeseed mustard is the painted bug, which is active from the time of seedling emergence (October–November) (Vora *et al.*, 1985) until harvest onset (March–April) (Singh and Malik 1993).

The painted bug is active all year long and infests several crucifer crops in the winter, where it causes significant harm (Singh *et al.*, 1993). The mustard crop was completely destroyed due to pest occurrence during the seedling stage, necessitating re-sowing (Bakhtia and Sekhon 1986; Singh *et al.*, 1993). Both nymphs and adults ingest the cell sap of growing pods and seedling leaves, which causes them to wilt and dry over time. Because bugs are feasting, young plants' leaves get white patches. When attacked severely, seedling-stage

plants may even die and take on a bulked-up appearance. Even on the threshing floor, nymphs and adults ingest cell sap from seeds in the pods. Adult bugs expel a resinous material that ruins the pods. The loss ascribed to painted bug assault at the seedling stage ranged from 26.8 to 70.8 percent. The attack during the pod formation and maturity phases is much more concerning because it reduces yield by 18.50 to 19.62% (Singh *et al.*, 2013).

MATERIALS AND METHODS

The experiment was conducted at the Students' Instructional Farm of C.S. Azad University of Agriculture & Technology, Kanpur (U.P.) during Rabi seasons 2021-22 and 2022-23 to study the screening of mustard germplasm/varieties against painted bugs. Each germplasm was accommodated in two rows. The length of each line was 3.0 m and the row-to-row and plant-to-plant distances were kept at 45 cm and 15 cm, respectively. The source of Indian mustard germplasm was Department of Genetics & Plant Breeding. Experiment was laid out in a Randomized Block Design (R.B.D.). The recommended mustard germplasm/varieties were screened for relative susceptibility against painted bug. The observation of number of Painted bug was recorded on five randomly selected plants from each germplasm per plot and counted the total adult population per plant for computation. The first count of painted bug population was taken at 40 DAS, 60 DAS and 80 DAS respectively, Rabi season. The population of painted bug was counted visually.



Fig. 1. Adult of Painted Bug during meeting time.

RESULTS AND DISCUSSION

Screening of fiftygermplasm of mustard was done against painted bugs during both year 2021-22 and 2022-23.

The data presented in Table 2&3 revealed that none of the germplasm of mustard was found completely free from the attack of painted bug. The infestation of painted bugs started two weeks after sowing of mustard crop in all the germplasm of mustard screened and remained up to December. Thereafter, painted bug population disappeared on all the germplasm of mustard during vegetative stage of the mustard crop. The population of painted bug reappeared from January and gradually increased up to March the both year 2021-22 and 2022-23.

The differences in number of painted bugs occurred on different germplasm at 40th days after sowing were statistically significant and the population ranged from 0.46 to 1.26 and 0.46 to 1.20 painted bugs per plant in

Rabi Season 2021-22 and 2022-23 respectively. In Rabi Season 2021-22 the minimum number of painted bug i.e. 0.46 per plant was recorded on germplasm RC-13 and it was at par with RC-2 (0.73), RC-5 (0.53), RC-12 (0.67), RC-23 (0.67), RC-27 (0.67), RC-29 (0.73), RC-31 (0.73), RC-32 (0.73), RC-33 (0.73), RC-35 (0.73) and RC-40 (0.53) respectively. The maximum number of adults of painted bugs was recorded on germplasm RC-42 i.e. 1.26 per plant and was at par with RC-3 (1.13), RC-4 (1.13), RC-7 (1.00), RC-9 (1.13), RC-11 (1.00), RC-14 (1.06), RC-16 (1.00), RC-18 (1.06), RC-19 (1.00), RC-21 (1.20), RC-24 (1.13), RC-34 (1.06), RC-39 (1.06), RC-41 (1.13), RC-43 (1.06), RC-45 (1.13), RC-46 (1.00), RC-47 (1.26), RC-48 (1.00) and RC-49 (1.13) respectively (Table 2). In Rabi Season 2022-23 the minimum number of painted bugs i.e. 0.46 per plant was recorded on germplasm RC-13 and it was at par with RC-2 (0.73), RC-3 (0.67), RC-8 (0.73), RC-9 (0.67), RC-11 (0.73), RC-19 (0.67), RC-23 (0.67), RC-34 (0.73), RC-36 (0.73), RC-40 (0.67) and RC-48 (0.67) respectively. The maximum number of adults of painted bugs was recorded on germplasm RC-14 i.e. 1.20 per plant and was at par with RC-4 (1.00), RC-7 (1.06), RC-18 (1.13), RC-20 (1.00), RC-24 (1.06), RC-27 (1.00), RC-28 (1.00), RC-29 (1.00), RC-31 (1.00), RC-33 (1.00), RC-38 (1.00), RC-42 (1.00), RC-43 (1.06) and RC-49 (1.20) respectively (Table 3). The remaining entries occupied intermediate positions.

On the 60th day after sowing the population of painted bugs were ranged from 0.80 to 1.86 and 1.13 to 1.93 per plant in Rabi Season 2021-22 and 2022-23 respectively. In Rabi Season 2021-22 the minimum numbers of painted bugs were recorded on germplasm RC-4 (0.80 per plant) and it was at par with RC-26 (0.86), RC-42 (0.80) and RC-46 (0.933). The maximum number of adults were recorded on RC-24 (1.86 per plant) and it was at par with RC-9 (1.06), RC-10 (1.67), RC-11 (1.67), RC-17 (1.67), RC-31 (1.60), RC-35 (1.06) and RC-49 (1.80) respectively (Table 2). In Rabi Season 2022-23 the minimum number of painted bug i.e. 1.13 per plant was recorded on germplasm RC-1 and it was at par with RC-2 (1.26), RC-7 (1.40), RC-8 (1.46), RC-22 (1.46), RC-23 (1.46), RC-28 (1.26), RC-33 (1.26), RC-37 (1.20), RC-8 (1.46), RC-39 (1.40), RC-42 (1.46) and RC-49 (1.40) respectively. The maximum number of adults of painted bugs was recorded on germplasm RC-47 i.e. 1.93 per plant and was at par with RC-4 (1.60), RC-15 (1.76), RC-16 (1.67), RC-31 (1.83), RC-32 (1.67), RC-35 (1.73) and RC-50 (1.86) respectively (Table 3). The remaining germplasm occupied intermediate positions.

On the 80th day after sowing the population of painted bugs were ranged from 0.93 to 2.53 and 1.40 to 2.26 per plant in Rabi Season 2021-22 and 2022-23 respectively. In Rabi Season 2021-22 the minimum numbers of painted bugs were recorded on germplasm RC-7 (0.93 per plant) and it was at par with RC-1 (1.13), RC-3 (1.86), RC-4 (1.33), RC-5 (1.93), RC-39 (1.46) and RC-45 (1.60) respectively. The maximum number of adults were recorded on RC-21 (2.53 per plant) and it was at par with RC-2 (2.26), RC-12 (2.13), RC-26 (2.00), RC-35 (2.20), RC-40 (2.20), RC-44

(2.06) and RC-50 (2.20) respectively (Table 2). In Rabi Season 2022-23 the minimum number of painted bug i.e. 1.40 per plant was recorded on germplasm RC-4 and it was at par with RC-1 (1.46), RC-2 (1.73), RC-3 (1.67), RC-6 (1.53), RC-33 (1.67), RC-40 (1.60) and RC-46 (1.53) respectively. The maximum number of adults were recorded on RC-50 (2.26 per plant) and it was at par with RC-8 (2.00), RC-11 (2.06), RC-12 (2.06), RC-23 (2.00), RC-29 (2.00), RC-38 (2.13) and RC-49 (2.20) respectively (Table 3). The remaining

germplasm occupied intermediate positions. Sharma *et al.* (2019). Ten varieties of mustard were screened for their relative susceptibility against *Brassica cruciferarum* indicated that three varieties viz., RGN-145, RGN-303 and RGN-73 were found less susceptible, whereas, three varieties NRCBH-101, Vasundhra and Laxmi were found highly susceptible. The remaining varieties RGN-236, RGN-229, RGN-48 and Pusa bold were found moderately susceptible against painted bug.

Table 1: Categorization of germplasm based on the population of painted bugs.

Sr. No.	Range of painted bug population per plant	Category of varieties	Name of the germplasm
1.	Below 1.5	Resistance	RC-1, RC-4, RC-27
2.	1.5- 2.1	Moderate resistance	RC-3, RC-5, RC-13, RC-14, RC-16, RC-17, RC-19, RC-25, RC-30, RC-32, RC-33, RC-34, RC-42, RC-43, RC-45, RC-48
3.	Above 2.1	Highly resistance	RC-12, RC-50

Table 2: Screening of mustard germplasm against painted bug, *Bagrada cruciferarum* during 2021-22.

Sr. No.	Name of the germplasm	No. of painted bug / Plant		
		40 DAS	60 DAS	80 DAS*
1.	RC-1	0.8	1.00	1.13
2.	RC-2	0.73	1.53	2.26
3.	RC-3	1.13	1.13	1.86
4.	RC-4	1.13	0.8	1.33
5.	RC-5	0.53	1.53	1.93
6.	RC-6	0.93	1.33	1.93
7.	RC-7	1.00	1.33	0.93
8.	RC-8	0.93	1.4	1.93
9.	RC-9	1.13	1.06	1.86
10.	RC-10	0.66	1.66	1.46
11.	RC-11	1.00	1.13	1.33
12.	RC-12	0.66	1.66	2.13
13.	RC-13	0.46	1.33	1.8
14.	RC-14	1.06	1.33	1.8
15.	RC-15	0.8	1.53	1.86
16.	RC-16	1.00	1.33	1.86
17.	RC-17	0.93	1.66	1.8
18.	RC-18	1.06	1.4	1.8
19.	RC-19	1.00	1.00	1.66
20.	RC-20	0.73	1.26	1.8
21.	RC-21	1.2	1.53	2.53
22.	RC-22	0.86	1.13	2.06
23.	RC-23	0.66	1.33	1.53
24.	RC-24	1.13	1.86	1.33
25.	RC-25	0.93	1.26	1.86
26.	RC-26	0.93	0.86	2.00
27.	RC-27	0.66	1.53	1.33
28.	RC-28	0.86	1.2	1.6
29.	RC-29	0.73	1.46	1.8
30.	RC-30	0.86	1.46	1.86
31.	RC-31	0.73	1.6	1.8
32.	RC-32	0.73	1.06	1.66
33.	RC-33	0.73	1.2	1.66
34.	RC-34	1.06	1.33	1.66
35.	RC-35	0.73	1.06	2.2
36.	RC-36	0.8	1.86	1.53
37.	RC-37	0.8	1.33	1.4
38.	RC-38	0.86	1.53	1.86
39.	RC-39	1.06	1.46	1.46
40.	RC-40	0.53	1.13	2.2
41.	RC-41	1.13	1.46	1.66
42.	RC-42	1.26	0.8	1.8
43.	RC-43	1.06	1.53	1.86
44.	RC-44	0.8	1.4	2.06
45.	RC-45	1.13	1.26	1.6
46.	RC-46	1.00	0.93	1.73
47.	RC-47	1.26	1.4	1.46
48.	RC-48	1.00	1.2	1.66

49.	RC-49	1.13	1.8	1.93
50.	RC-50	0.93	1.33	2.2
Mean		0.90	1.33	1.75
S.E.		0.16	0.25	0.28
C.D. 5%		0.44	0.71	0.81

* Peak population of painted bug

Table 3: Screening of mustard germplasm against painted bug, *Bagrada cruciferarum* during 2022-23.

Sr. No.	Name of the germplasm	No. of painted bug / Plant		
		40 DAS	60 DAS	80 DAS*
1.	RC-1	0.80	1.13	1.47
2.	RC-2	0.73	1.27	1.73
3.	RC-3	0.67	1.33	1.67
4.	RC-4	1.00	1.60	1.40
5.	RC-5	0.80	1.13	1.93
6.	RC-6	0.87	1.53	1.53
7.	RC-7	1.07	1.40	1.73
8.	RC-8	0.73	1.47	2.00
9.	RC-9	0.67	1.53	1.53
10.	RC-10	0.93	1.13	1.67
11.	RC-11	0.73	1.60	2.07
12.	RC-12	0.93	1.53	2.07
13.	RC-13	0.47	1.27	1.87
14.	RC-14	1.20	1.33	1.93
15.	RC-15	0.87	1.77	1.53
16.	RC-16	0.93	1.67	1.73
17.	RC-17	0.80	1.33	1.93
18.	RC-18	1.13	1.57	1.53
19.	RC-19	0.67	1.53	1.60
20.	RC-20	1.00	1.40	2.07
21.	RC-21	0.87	1.60	1.63
22.	RC-22	0.93	1.47	1.87
23.	RC-23	0.67	1.47	2.00
24.	RC-24	1.07	1.60	1.73
25.	RC-25	0.93	1.53	1.80
26.	RC-26	0.73	1.53	1.67
27.	RC-27	1.00	1.33	1.47
28.	RC-28	1.00	1.27	1.53
29.	RC-29	1.00	1.33	2.00
30.	RC-30	0.93	1.53	1.80
31.	RC-31	1.07	1.83	2.07
32.	RC-32	0.60	1.67	1.80
33.	RC-33	1.00	1.27	1.67
34.	RC-34	0.73	1.73	1.80
35.	RC-35	0.87	1.73	1.53
36.	RC-36	0.73	1.60	1.80
37.	RC-37	0.87	1.20	2.07
38.	RC-38	1.00	1.47	2.13
39.	RC-39	0.93	1.40	2.07
40.	RC-40	0.67	1.53	1.60
41.	RC-41	0.93	1.67	2.20
42.	RC-42	1.00	1.47	1.80
43.	RC-43	1.07	1.67	1.80
44.	RC-44	0.87	1.33	1.93
45.	RC-45	0.53	1.47	1.80
46.	RC-46	0.87	1.67	1.53
47.	RC-47	0.93	1.93	2.13
48.	RC-48	0.67	1.60	1.73
49.	RC-49	1.20	1.40	2.20
50.	RC-50	0.87	1.87	2.27
Mean		0.87	1.49	1.81
S.E.		0.15	0.20	0.18
C.D. 5%		0.41	0.57	0.49

* Peak population of painted bug

CONCLUSIONS

Fifty *Brassica* germplasm of mustard were screening against mustard painted bugs. Based on painted bugs population, RC-1, RC-4 and RC-27 were found resistance registering (below 1.5 bugs per plant), RC-3, RC-5, RC-13, RC-14, RC-16, RC-17, RC-19, RC-25,

RC-30, RC-32, RC-33, RC-34, RC-42, RC-43, RC-45 and RC-48 were found moderately resistance (between 1.5 to 2.1 bugs per plant), whereas, RC-12 and RC-50 were found highly resistance against this pest (above 2.1 bugs per plant).

FUTURE SCOPE

The promising germplasm identified in this study can be exploited commercially to increase oil quality and quantity with increase in production of oil.

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Conflict of Interest. None.

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