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Plant Protection

Evaluation of Host Plant Resitance in Rajmash (*Phaseolus vulgaris* L.) Genotypes for Leaf miner (*Chromatomyia horticola* Gaur.) and Pod Borers

P.S. Singh* and S.K. Singh

Department of Entomology and Agricultural Zoology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, India

***Corresponding author:** pss_ento@yahoo.co.in

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Abstract

Different genotypes of Rajmash were sown at Agricultural Research Farm of Banaras Hindu University during *Rabi* season of 2013-14 and 2014-15 for the evaluation of resistance to leaf miner and pod borers. During 2013-14 genotype 405 showed comparative resistance reaction to leaf miner damage (33.52%), whereas genotypes HUR 15 (51.74 %) and 180 (51.10 %) showed susceptible reaction with higher leaf miner damage. Maximum pod damage was recorded in genotype VL63 (11.00 %) and minimum in HUR 203 (1.93 %). Genotype M8 produced higher yields as compared to other genotypes (13.88 q ha^{-1}), while genotype 180 (5.86 q ha^{-1}) produced minimum yield. During 2014-15, genotype 405 (26.16 %) showed less leaf miner damage and genotype HUR 15 (45.12 %) was more infested by leaf miner. Genotype VL63 (11.67 %) showed maximum pod damage and genotype 405 (3.94 %) showed less damage.Maximum yield obtained from genotype 214 (13.36 q ha^{-1}) and minimum from genotypes HUR15 and HUR 146 (6.48 q ha^{-1}).

Highlights

- Genotype 405 emerged as a potential resistant genotype of Rajmash (*Phaseolus vulgaris* L.) against leaf miner under Indo-Gangetic plains whereas HUR 15 showed susceptible reaction.
- Rajmash (*Phaseolus vulgaris* L.) genotype VL63 was susceptible to damaged by pod borers and genotypes HUR 203 and 405 identified as resistance genotypes for pod borers.

Keywords: *Phaseolus vulgaris*, *chromatomyia horticola*, pod borer, screening

Rajmash or dry common bean (*Phaseolus vulgaris* L.) is potential pulse crop in India and is grown in a number of states for grains as well as for vegetable. It is high in starch, protein and dietary fiber and is an excellent source of iron, potassium, selenium, molybdenum, thiamine, vitamin B_6 and folic acid. Green beans have been reported to contain 23% protein and 60-63% carbohydrate (Nwokolo and Smartt, 1996). Therefore, it is regarded as highly nutritious pulse. It is cooked and canned as refried beans or whole with water, salt and sometimes sugar. The use of high yielding varieties and improved cultivation practices, pest problem might also changes.Approximately 10-20% of produce is lost due to damage caused by insects and it may be much higher during epidemics. Several workers *viz.*, Anand (1978); Nayer *et al.* (1979); Shah and Garg (1985) and Sachan and Garg (1992) have reported the insect pests of rajmash from different parts of India. In developing countries like India, mostly synthetic insecticides are used for the control of these insect pests. But the use of these synthetic insecticides has lead to the development of insecticidal resistant strains in insects, resurgence of pest species, direct toxicity to the applicator, destruction of parasites, predators and other beneficial organisms, accumulation of pesticide residues in the agricultural commodities, and poisoned food, water, air and soil (Forrester *et al.* 1993). Development of cultivars with resistance to major pest complexes would be an efficient, sustainable and cost effective means of providing the best bet to successfully manage pest menace (Lateef,

Table 1. Performance of Rajmash (*Phaseolus vulgaris* L.) genotypes against leaf miner and pod borers during 2013-14

Entries	Leaf miner Damage (%)		Pod Damage (%)		Seed Damage (%)		Yield (q/ha)
6592	40.23	**39.37**	4.70	**12.52**	8.05	**16.48**	9.87
214	46.24	**42.84**	8.50	**16.95**	13.09	**21.21**	8.94
405	33.52	**35.38**	3.77	**11.19**	10.54	**18.95**	9.87
228	36.70	**37.29**	6.53	**14.81**	13.02	**21.15**	12.27
194A	37.22	**37.60**	5.57	**13.65**	12.16	**20.41**	10.49
346	49.88	**44.93**	8.00	**16.43**	16.32	**23.83**	8.63
336	37.03	**37.48**	8.80	**17.26**	9.49	**17.94**	11.65
HUR 146	49.31	**44.60**	5.37	**13.39**	10.80	**19.19**	9.87
96	38.61	**38.41**	10.40	**18.81**	12.81	**20.97**	12.58
180	51.10	**45.63**	4.72	**12.55**	8.13	**16.57**	5.86
229	47.00	**43.28**	5.33	**13.35**	7.10	**15.46**	12.58
HUR 202	48.42	**44.09**	4.80	**12.66**	8.54	**16.99**	10.80
HUR 501	50.16	**45.09**	6.20	**14.42**	8.92	**17.38**	8.95
VL63	42.38	**40.62**	11.00	**19.37**	14.71	**22.56**	10.41
PDR 14	42.71	**40.81**	6.97	**15.30**	9.86	**18.30**	7.71
M 8	38.46	**38.33**	6.33	**14.58**	10.02	**18.46**	13.88
HUR 701	46.05	**42.74**	3.66	**11.02**	11.15	**19.51**	9.56
HUR 203	44.03	**41.57**	1.93	**7.99**	5.87	**14.02**	8.33
HUR 137	41.30	**39.99**	5.13	**13.10**	9.82	**18.26**	10.41
HUR 15	51.74	**46.00**	8.47	**16.92**	13.11	**21.22**	8.33
CD @ 5%		**5.71**		**2.61**		**NS**	**3.33**

Bold values are Arc sin transformed values.

1991). Keeping all these facts in view the investigation was carried out to thescreening of certain Rajmash (*Phaseolus vulgaris* L.) genotypes against leaf miner and pod borers.

Materials and Methods

The study was conducted for the evaluation of resistance of 20 Rajmash genotypes against Leaf miner (*Chromatomyia horticola* Gaur.) and pod borers (*Helicoverpa armigera* Hub. and *Etiella zinckenella* Treit.) at Agricultural Research Farm, Banaras Hindu University, Varanasi, Uttar Pradesh. Total 20 genotypes were sown in Randomized Block Design and replicated thrice (3m × 3m plot size). The spacing between rows and plants was kept 30 cm and 15 cm, respectively. The recommended dose of fertilizers 100 kg N, 60 kg P_2O_5 and 20 kg S/ha for Rajmash under normal irrigated conditions were applied. There was no insecticides/ herbicides application on the plants. Routine intercultural operations were done as necessary. The data on per cent leaf damage was recorded by counting the total number of healthy and damaged leaf/plant and averaged. Per cent pod damaged and per cent seed damaged was calculated separately after harvesting the crop at the time of threshing by counting the total number of damaged and healthy pods per plant and from each pod total no. of damaged and healthy seeds were counted to calculate the per cent seed infestation.

The cumulative percent leaf/pod/seed infestation was worked out on the basis of total number of leaf/pod/ seed from all the observation as given below:

$$\text{Percent leaf/pod/seed infestation} = \frac{\text{Total no. of infested leaf/pod/seed}}{\text{Total no. of leaf/pod/seed}} \times 100$$

At the time of maturity grain yield data were also recorded . The data obtained were analyzed statistically to compare the treatment effects (Panse and Sukhatme, 1961).

Results and Discussion

Performance of Rajmash genotypes against Leaf miner during 2013-14 and 2014-15

Average Data of study during 2013-14 revealed that leaf miner damage in different genotypes of Rajmash (*Phaseolus vulgaris* L.) varied from 51.74 to 33.52%. Genotype 405 showed comparative resistance to Leaf miner with 33.52% leaf damage followed by 228 with

Table 2. Performance of Rajmash (*Phaseolus vulgaris* L.) genotypes against leaf miner and pod borer in 2014-15.

Entries	Leaf miner Damage (%)		Pod Damage (%)		Seed Damage (%)		Yield (q/ha)
6592	33.55	**35.40**	7.83	**16.25**	8.49	**16.94**	8.33
214	41.30	**39.99**	8.01	**16.44**	9.67	**18.12**	13.36
405	26.16	**30.76**	3.94	**11.45**	8.94	**17.40**	8.02
228	30.24	**33.36**	4.53	**12.29**	11.20	**19.55**	10.54
194A	38.79	**38.52**	7.21	**15.58**	12.55	**20.75**	8.81
346	36.76	**37.32**	7.20	**15.57**	10.87	**19.25**	7.81
336	30.46	**33.50**	8.12	**16.56**	8.45	**16.90**	10.33
HUR 146	36.43	**37.12**	5.97	**14.15**	5.97	**14.15**	6.48
96	34.52	**35.99**	9.00	**17.46**	7.33	**15.71**	9.81
180	39.01	**38.65**	9.37	**17.82**	9.03	**17.49**	8.95
229	37.32	**37.66**	5.81	**13.95**	5.81	**13.95**	11.10
HUR 202	38.65	**38.44**	5.74	**13.86**	7.07	**15.42**	9.15
HUR 501	33.82	**35.56**	9.62	**18.07**	10.62	**19.02**	8.38
VL63	35.53	**36.59**	11.67	**19.97**	9.34	**17.79**	9.76
PDR 14	38.03	**38.07**	8.71	**17.17**	8.71	**17.17**	7.71
M 8	36.92	**37.42**	6.19	**14.41**	6.19	**14.41**	8.55
HUR 701	39.18	**38.75**	4.62	**12.41**	13.62	**21.66**	8.02
HUR 203	35.66	**36.67**	6.41	**14.66**	5.74	**13.86**	8.12
HUR 137	30.48	**33.51**	7.44	**15.83**	7.44	**15.83**	8.07
HUR 15	45.12	**42.20**	7.43	**15.82**	6.43	**14.69**	6.48
CD @ 5%		**4.30**		**3.32**		**4.23**	**1.81**

Bold values are Arc sin transformed values.

36.70% leaf damage. Genotypes HUR 15 and 180 showed higher leaf damage compared to other genotypes with 51.74 and 51.10%, respectively (Table 1) and (Figure 1).

On above parameter of data during the 2014-15 indicated that leaf miner damage ranged from 45.12 to 26.16%. Genotype 405 showed resistance against leaf miner with 26.16% leaf damage followed by 228 with 30.24% leaf damage.

Genotype HUR 15 was more infested by leaf miner with 45.12% leaf damage followed by genotype 214 with 41.30% leaf damage (Table 2) and (Figure 2). The present study is in agreement with the findings of Anonymous (2014) and Anonymous (2015). Singh (2013) had also evaluated Rajmash genotypes for resistance against major insect pests.

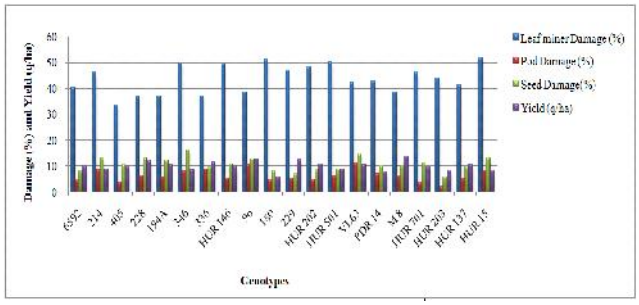

Fig. 1. Performance of Rajmash genotypes against leaf miner and pod borers during 2013-14

Performance of Rajmash (*Phaseolus vulgaris* L.) genotypes against pod borers during 2013-14 and 2014-15

The damage caused by pod borers in the harvested pods during 2013-14 revealed that the percent pod damage varied significantly. Maximum pod damage recorded in genotype VL63 with 11.00% pod damage followed by genotype 96 with 10.40% pod damage. Genotypes HUR 203 and 405 was relatively least susceptible to pod borer damage with 1.93 and 3.77% pod damage, respectively. During 2013-14 seed damage was differ non-significantly with maximum seed damage in genotype 346 with 16.32% seed damage. Genotype HUR 203 showed relatively least damage with 5.87% seed damage (Table 1).

The damage in the harvested pods during 2014-15 showed that genotype VL63 showed a maximum of 11.67 per cent pod damage followed by HUR 501 with 9.62 per cent pod damage and minimum pod damage was recorded in genotypes 405 and 228 with 3.94 and 4.53% pod damage, respectively. Seed damage in various entries also differed significantly during 2014-15. Maximum seed damage was recorded in genotype HUR 701 with 13.62% seed damage while genotype HUR 146 revealed minimum 5.97 62% seed damage (Table 2). The similar findings also reported by Anonymous (2014) and Anonymous (2015). Singh (2013) have also evaluated Rajmash genotypes for resistance against major insect pests.

Effect of Leaf miner and Pod borers damage on yield of genotypes of Rajmash during 2013-14 and 2014-15

All genotypes were harvested, threshed separately and yield per plot was converted in to hectare basis. Data of yield during 2013-14 revealed that maximum yield was recorded 13.88 q ha^{-1} from genotype M8 and minimum yield recorded in genotype 180 with 5.86 q ha^{-1}.

Yield performance of Rajmash genotypes during 2014-15 revealed that genotype 214 produced maximum 13.36 q ha^{-1} yield and genotype HUR 15 and HUR 146 produced 6.48 q ha^{-1} yield. The present findings are in agreement with the findings of Anonymous (2014) and Anonymous (2015). Singh (2013) have also evaluated Rajmash genotypes for resistance against major insect pests.

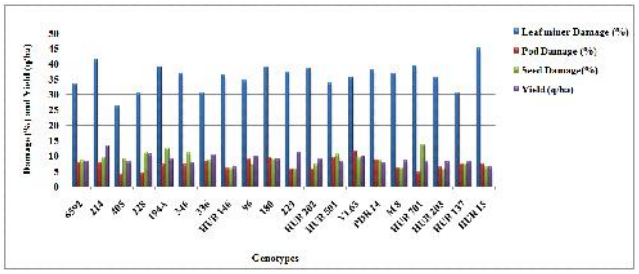

Fig. 2. Performance of Rajmash genotypes against leaf miner and pod borers during 2014-15

Conclusion

Based on the present study of Rajmash, it may be concluded that of all 20 genotypes tested, genotype 405 showed marginal resistance to leaf miner whereas HUR 15, genotype 180 and 214 were highly susceptible. However the pod borer damage was significantly less in HUR 2013 and 405 and the damage was significantly high in genotype VL 63 and genotype 96. This information a screening Rajmash genotypes for resistance against insect pests may be utilized for breeding programmes while evaluating and developing resistance genotypes in insect pests prone areas.

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