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Screening of Brinjal Genotypes for Shoot and Fruit Borer (*Leucinodes orbonalis* G.) under Valley Condition of Garhwal Hills

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ABSTRACT

The present research was conducted to screen eleven promising genotypes of Brinjal (Long Black Pooja, Long Green, Pant Rituraj, Pant Samrat, Pusa Purple Long, Pusa Uttam, Rajendra–1, Round–1, Srinagar Local, Telangana Local with one checkcultivar Pusa Purple Round) against brinjalshoot and fruit borer and observe their growth, yield, and quality attributes with a comparative level of tolerance under valley condition of Garhwal Hill. The minimum shoot borer infestation<4 % and <15% was observed from the genotypes Pusa Purple Long and Long Green respectively and maximum yield 14.25 and 13.31 kg/plot were also recorded in Pusa Purple Long and Long Green respectively. Thus, it can be concluded that the genotype Pusa Purple Long and Long Green were better performers over check Pusa Purple Round. Therefore, these two genotypes i.e., Pusa Purple Long and Long Green indicated significant tolerance against shoot and fruit borer among tested genotypes and can be recommended to enhance the production of Brinjal undervalley condition of Garhwal Hills.

Keywords Brinjal, Genotypes, Shoot & Fruit Borer, and Tolerance.

INTRODUCTION

Scientifically brinjal is known as (*Solanum melongena* L.) which belongs to the family Solanaceae, with diploid chromosome number 2n=2x=24. It is mostly grown in tropical to sub-tropical regions of the world. The different biological and climatic factors are accountable for decreasing the yield of eggplant in India. According to Nayar *et al.*(1995) brinjal is infested by more than 50 various insect pest species all over the world. Among the pests, shoot and fruit borer (*Leucinodes orbonalis* Guenee) which belongs to Pyralidae family and order Lepidoptera is a key pest of brinjal which reduces the crop yield at all growth stages, up to 60-70% and inflicts the huge loss in production (Singh *et al.* 2017).The pestis monophagous, practically feeding on eggplant; but it is also feeding on different plants belonging to family Solanaceae. Its distribution is mostly higher in those areas having hot and humid climate conditions.The high humidity with reasonable temperature promotes the fruit and

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shoot borer to enhance their population (Shukla and Khatri 2010 and Bhushan *et al.* 2011).

There is a need for a selection of genotypes that perform well under the attack of shoot and fruit borer. Apart from the pest control and good management of cultural practices, the development of new varieties and evaluation of the available brinjal varieties are the sustainable strategies to improve the production and productivity of brinjal.Therefore, keeping in view the above mention facts, the present investigation was conducted to find out the infestation level of the shoot and fruit borer among different brinjal genotypes under valley condition and to find out the tolerant genotype against the shoot and fruit borer with quality yield and hence deriving best genotype of brinjal which is suitable for cultivation in particular climatic conditions.

MATERIALS AND METHODS

The experiment was conducted at Horticultural Research Center, Chauras Campus, Department of Horticulture, HNB. Garhwal University, Srinagar (Garhwal), Uttarakhand with eleven genotypes viz., Brinjal Long Black Pooja, Long Green, Pant Rituraj, Pant Samrat, Pusa Purple Long, Pusa Uttam, Rajendra-1, Round-1, Srinagar Local, Telangana Local and Pusa Purple Round (Check cultivar) were evaluated in RCBD (Randomized Complete Block Design) with 3 replications during the Summer season of 2018 from month March to July.The treated seeds with captan 10g/kg were sown under protected conditions in raised seedbeds during the end of January month and transplanted during the middle March month at a spacing of 60 cm × 60 cm. The full dose of FYM @ 25 tonnes/ha was applied during the last ploughing and the recommended dose of nitrogen, phosphorus, and potassium @ 100:75:50 was applied in the form of urea, SSP and MOP respectively. The whole amount of P and K and half dose of N were used before transplanting and the remaining half dose of N was given 30 DAT as a top dressing. All the cultural practices were carried out under scientific management. During the investigation, various growth parameters and quantitative traits related to yield were recorded. Five plants from each treatment were randomly selected and tagged for recording the observations.The quality analysis (Ascorbic Acid content and Ash content) was estimated as per the procedure given by Ranganna (2015). The percent of shoot borer and fruit borer infestation was recorded from five selected plants per plot and percentage was calculated. The levels of resistance were graded based on infestation following the scale of Subbaratnam and Butani (1981).The statistical analysis was carried out for each observed character under the study using MS-Excel and OPSTAT.

RESULTS AND DISCUSSION

Analysis of variance

The mean sum of square due to treatments revealed that significant differences were found at 5% level for all the character studied viz.,days taken to first seed germination, plant height(cm) at 30, 60 and 90 DAT, number of leaves per plant at 30, 60 and 90 DAT, number of primary branches/plant,number of secondary branches/plant,fruit weight (g), fruit length (cm), fruit diameter (cm), yield/plant (kg), yield/plot (kg), yield/ha (q), total soluble solid (°Brix), ascorbic acid (mg/100g), ash content (%), shoot borer infestation (%) at 30, 60 and 90 DAT and fruit borer infestation (%) after 55, 70, 85, 100 and 113 at harvest. Similar findings were also recorded by Bhushan (2016) and Arti *et al.* (2018).

Growth parameters

The data related to different cultivars on various growth parameters is presented in Table 1. From the data it was observed that, different cultivar significantly differ from each other. The minimum (12.76 days) days taken to first seed germination was recorded in Pant Samrat. On the other hand, the maximum (17.50 days) was found in Telangana Local. A similar result was reported by Chaudhary and Sharma (2000) in brinjal. The maximum (37.97 cm) plant height at 30 DAT was recorded in Pant Samrat, whereas the minimum (24.95 cm) was recorded in Round-1. A similar result also reported by Narendra Panwar *et al.* (2013) in brinjal. The maximum (78.60 cm) plant height at 60 DAT was found in Pant Rituraj, while the minimum (67.80 cm) plant height was found in Round-1. Present findings are in close conformity

Table 1. Mean performance of brinjal genotypes for growth and yield parameters.

Genotypes	Days taken to first seed germination (days)	Plant height (cm) at 30 DAT	Plant height (cm) at 60 DAT	Plant height (cm) at 90 DAT	Number of leaves at 30 DAT	Number of leaves at 60 DAT	Number of leaves at 90 DAT	Number of primary branches/ plants	Number of secondary branches/ plants	Fruit weight (g)	Fruit diame-ter (cm)	Fruit length (cm)	Yield per plant (kg)
Brinjal long Black pooja	15.45	29.81	69.07	76.13	14.33	50.87	56.07	5.40	9.00	102.35	3.61	12.76	0.63
Long green	14.14	29.58	69.33	84.13	9.93	47.87	75.93	7.33	16.13	88.01	3.53	10.72	1.11
Pant rituraj	15.18	30.93	78.60	85.27	12.33	62.80	76.53	6.13	11.80	113.11	7.35	8.43	0.75
Pant samrat	12.76	37.97	69.13	75.13	16.13	55.80	62.04	5.60	9.47	96.28	3.61	11.21	0.68
Pusa purple long	14.52	29.23	73.53	87.11	14.80	82.41	92.27	7.50	14.60	146.77	4.34	18.35	1.19
Pusa uttam	17.72	26.36	70.00	77.13	14.47	73.00	78.45	6.54	13.13	162.13	8.54	11.51	0.83
Rajendra-1	13.60	27.09	76.67	83.27	13.53	76.07	87.73	6.44	11.60	109.64	6.81	7.85	0.72
Round-1	16.36	24.95	67.80	74.60	14.27	79.73	85.33	5.83	13.07	77.95	5.63	6.63	0.72
Srinagar local	13.54	28.83	76.52	81.60	12.47	77.80	86.47	6.00	13.20	68.27	5.23	7.31	0.68
Telangana Local	17.58	34.48	73.22	79.73	24.13	67.24	73.11	6.27	12.60	103.82	4.21	12.21	0.83
Pusa purple Round (check cultivar)	13.04	35.91	69.20	75.47	15.27	51.27	66.11	6.73	13.40	184.82	9.08	12.40	1.09
SEm (±)	**0.80**	**2.31**	**2.02**	**1.68**	**1.09**	**4.39**	**3.10**	**0.35**	**0.46**	**0.86**	**0.73**	**0.72**	**0.07**
CD 5%	**2.36**	**6.66**	**5.96**	**4.95**	**3.21**	**12.94**	**9.15**	**1.02**	**1.36**	**2.53**	**2.14**	**2.12**	**0.22**

with the findings of Bhushan (2016) and Ali *et al.* (2017). The maximum (87.11 cm) plant height at 90 DAT was recorded in Pusa Purple Long, whereas the minimum (74.60 cm) was recorded in Round-1. Similar findings were also observed by Bilal *et al*. (2017), Arti *et. al*. (2018) and Bhushan *et al.* (2018) in brinjal.

The maximum (24.13) number of leaves at 30 DAT was recorded in Telangana Local, while minimum (9.93) number of leaves per plant was recorded in Long Green. The maximum (82.41) number of leaves at 60 DAT was recorded in Pusa Purple Long, while minimum (47.87) number of leaves per plant was recorded in Long Green.The maximum (92.27) number of leaves at 90 DAT was recorded in Pusa Purple Long, while minimum (56.07) number of leaves per plant was recorded in Brinjal Long Black Pooja. Similar findings were reported by Ramesh *et al*. (2015) and Bhushan (2016) in brinjal.The maximum (7.5) number of primary branches per plant was recorded in Pusa Purple Long, while a minimum (5.40) number of primary branches per plant was found in Brinjal Long Black Pooja. The maximum (16.13) number of secondary branches per plant was recorded in Long Green, while minimum (9.47) number of secondary branches per plant was found in Brinjal Long Black Pooja. Ali *et al.* (2017), and Banerjee *et al.* (2018a) made similar result in brinjal.

Yield parameters

The main focus of cultivating a crop is to have the maximum yield per unit area for better returns. Moreover, high fruit yield is the ultimate goal of any breeding program; hence it requires the highest consideration. The data related to yield parameter is presented in Table 2. The maximum (184.82 g) fruit weight was found in genotype Pusa Purple Round, while the minimum (68.27 g) fruit weight was found in Srinagar Local. Similar findings have been also reported by Bhushan (2016), Banerjee *et al.* (2018a), and Banerjee *et al.* (2018b) in brinjal.The maximum (9.08 cm) fruit diameter was recorded in check cultivar Pusa Purple Round. On the other hand, the minimum (3.53 cm) fruit diameter was found in Long Green. Bhushan (2016), Banerjee *et al.* (2018a), and Banerjee *et al*. (2018b) also recorded a similar finding in brinjal.The maximum (18.35 cm) fruit length was observed in Pusa Purple Long, while the minimum (6.63 cm) fruit length was found in Round-1. Similar findings have also been reported by Banerjee *et al.*

Table 2. Mean performance of brinjal genotypes for yield, quality, and pest screening parameter.

Genotypes	Yield per plot (kg)	Yield per hectare (q)	Total soluble solid (°Brix)	Ascorbic acid (mg/ 100g)	Ash content (%)	Shoot infestation (%) at 30 DAT	Shoot infestation (%) at 60 DAT	Shoot infestation (%) at 90 DAT	Fruit borer infestation (%) after 55 at harvest	Fruit borer infestation (%) after 70 at harvest	Fruit borer infestation (%) after 85 at harvest	Fruit borer infestation (%) after 100 at harvest	Fruit borer infestation (%) after 113 at harvest
Brinjal Long Black Pooja	7.54	174.61	3.40	3.27	10.67	2.87	1.57	2.69	16.77	19.87	19.12	25.67	12.13
Long Green	13.31	308.02	3.64	2.68	11.58	1.04	2.66	1.92	14.29	12.68	18.79	19.38	10.07
Pant Rituraj	8.94	207.02	3.48	3.97	9.81	3.75	1.89	2.87	24.48	20.82	12.46	26.74	9.85
Pant Samrat	8.20	189.74	3.72	3.40	13.33	0.91	1.41	0.71	10.49	20.11	21.89	14.12	16.81
Pusa Purple Long	14.25	329.78	4.56	4.10	11.68	0.69	3.43	0.83	10.73	27.07	13.13	10.29	10.11
Pusa Uttam	10.00	231.40	3.51	3.23	11.13	1.08	2.86	1.78	13.16	18.72	19.04	16.72	13.14
Rajendra-1	8.58	198.61	2.99	3.17	13.16	2.16	3.01	2.20	16.51	26.32	18.04	16.89	14.93
Round-1	8.66	200.46	4.35	4.04	11.39	1.93	2.73	2.32	14.52	23.67	18.71	15.12	14.31
Srinagar Local	8.12	188.04	3.69	3.60	10.55	2.08	2.11	1.87	16.21	19.87	19.82	16.73	15.02
Telangana Local	9.99	231.25	2.47	3.03	10.47	1.99	2.33	1.47	15.76	21.47	18.61	15.73	13.12
Pusa Purple Round (Check cultivar)	13.07	302.62	3.81	4.47	10.26	1.14	2.85	1.76	14.12	20.42	16.71	15.02	10.74
SEm (±)	**0.89**	**20.51**	**0.25**	**0.12**	**0.68**	**0.10**	**0.28**	**0.32**	**1.06**	**1.02**	**0.86**	**0.81**	**0.58**
CD 5%	**2.61**	**60.51**	**0.73**	**0.35**	**1.85**	**0.28**	**0.83**	**0.93**	**3.12**	**3.0**	**2.52**	**2.39**	**1.72**

(2018a), Banerjee *et al.* (2018b) and Bhushan *et al.* (2018) in brinjal.

The maximum (1.19 kg/plant) yield per plant was recorded in Pusa Purple Long, but statistically at par with Long Green (1.11 kg/plant) and Pusa Purple Round (1.09 kg/plant). On the other hand, the minimum (0.63 kg/plant) yield per plant was found in Brinjal Long Black Pooja. The maximum (14.25 kg/plot) yield per plot was recorded in Pusa Purple Long, but statistically at par with Long Green (308.02 q) and Pusa Purple Round (302.62 q), while the minimum (7.54 kg/plot) yield per plot was found in Brinjal Long Black Pooja. The maximum (329.78 q/ha) yield per hectare was recorded in Pusa Purple Long, On the other hand, a minimum (17.46 q/ha) yield per hectare was found in Brinjal Long Black Pooja. Ali *et al*. (2017) and Banerjee *et al.* (2018a) also reported similar results in brinjal.

Quality parameters

The fruit quality of different cultivars was analyzed in terms of total soluble solids (TSS), ascorbic acid and ash content and presented in Table 2. The maximum (4.56 °Brix) total soluble solid was recorded in Pusa Purple Long, while the minimum (2.47 °Brix) total soluble solid was found in Telangana Local. A similar finding was reported by Arti *et al.* (2018) in brinjal.The maximum (4.47mg/100g) ascorbic acid was found in check cultivar Pusa Purple Round, while the minimum (2.68mg/100g) ascorbic acid was observed in Long Green. Similar findings have also been reported by Arti *et al.* (2018) and Bhushan *et al.* (2018) in brinjal.The minimum (9.81 %) ash content was recorded in Pant Rituraj, whereas the maximum (13.33 %) ash content was recorded in Pant Samrat. This result is near the findings of Panda and Das (1975) and Elanchezhyan *et al*. (2009) who observed less ash content which is susceptible to shoot and fruit borer.

Screening parameters

The data presented in Table 3 shows the variation for shoot borer incidence for different cultivar used

Table 3. Shoot borer infestation (%) of brinjal genotypes.

Grade	Genotypes	Shoot borer infestation (%)
Tolerant	Long Green, Pant Samrat, Pusa Purple Long, PusaUttam, Telangana Local, Pusa Purple Round	<2
Moderately tolerant	Brinjal Long Black Pooja, Pant Rituraj, Rajendra–1, Round–1, Srinagar Local	2.1-3.0
Susceptible	NIL-	3.1-5.0
Highly susceptible	-NIL-	>5.0

Table 4. Fruit borer infestation (%) of brinjal genotypes.

Grade	Genotypes	Shoot borer infestation (%)
Tolerant	Long Green, Pusa Purple Long, Pusa Purple Round	<15
Moderately tolerant	Brinjal Long Black Pooja, Pant Rituraj, Pant Samrat, PusaUttam, Rajendra – 1, Round – 1, Srinagar Local, Telangana Local	16 – 25
Susceptible	-NIL-	26 – 40
Highly susceptible	- NIL-	>40

during the investigation. According to mean performance, six genotypes (Long Green, Pant Samrat, Pusa Purple Long, Pusa Uttam, Telangana Local, and Pusa Purple Round) was found tolerant and five genotypes (Brinjal Long Black Pooja, Pant Rituraj, Rajendra –1, Round– 1 and Srinagar Local) was moderately tolerant. The differences in shoot borer infestation in different genotypes may be due to the variation in stems thickness, the high number of branches, leaf areas, spines, roughens of leaves, cuticle lignification, size of hypodermis, the arrangement of the vascular bundle and small size of path area which might have major causes for less infestation and vice versa in case of higher infestation (Ali 1994 and Hossain *et al.* 2002). A similar result was reported by Bhushan (2016), Singh *et al*. (2016), Rishi *et al.* (2018) and Umamahesh *et al.* (2018) in brinjal.

The data presented in Table 4 indicated that, the fruit borer incidence was found tolerant in three genotypes (Long Green, Pusa Purple Long and Pusa Purple Round) and eight genotypes viz., Brinjal Long Black Pooja, Pant Rituraj, Pant Samrat, Pusa Uttam, Rajendra–1, Round–1, Srinagar Local and Telangana Local were recorded moderately tolerant. Out of 10 genotypes, Pusa Purple Long (-7.40 %) showed superior over check cultivar. Different rang of shoot borer infestation in different brinjal genotypes were divided in to tolerant, moderately tolerant, susceptible and highly susceptible. In the present study, the possible reasons for tolerates in 'Pusa Purple Long and Long Green' variety might be due to the serpentine shaped fruit with fewer seeds. The capacity of tolerant nature of the above varieties might be due to toughness of the skin and flesh, firm to semi-firm shoot, and average to thick pubescence (Raut and Sonone 1980). The moderately tolerant reaction was due to the softness of the shoot, loose seed arrangement, globular shape fruits, soft rind, and sparse pubescence. A similar result was reported by Rishi *et al.* (2018) and Umamahesh *et al.* (2018) in brinjal and Safna *et al.* (2018) were also of the same opinion in tomato.

CONCLUSION

Based on obtained findings from the present research work it may be concluded that the genotype Pusa Purple Long found to be superior over check cultivar (Pusa Purple Round) for yield and yield-related characters with resistance against shoot and fruit borer infestation. Also, the genotype Long Green shows resistance against shoot and borer infestation over check cultivar. Hence, these two genotypes i.e., Pusa Purple Long and Long Green could be recommended to enhance the production of brinjal with less susceptibility of the shoot and fruit borer infestation under valley condition of Garhwal Hills.

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