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Evaluation of brinjal (*Solanum melongena* L.) germplasm for yield and bacterial wilt (*Ralstonia solanacearum*) disease resistance

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Abstract

Bacterial wilt caused by *Ralstonia solanacearum*, one of the important disease affecting brinjal and yield loss ranges from 11.67 to 96.67%. The conventional disease control strategies are not effective, hence use of resistance varieties and hybrids is the only way to control the disease. The experimental materials consisted of seven germplasm viz., CARI-1, Surya, WCGR, IIHR-3, S-75, Rampur Local and IIHR-586. The experiments were conducted in bacterial wilt sick plot with artificial inoculation of *R. solanacearum* culture. The highest variance was observed for fruit weight and lowest variance was observed on fruit yield per plant. The germplasm Surya was recorded as a better performed germplasm in respect to fruit yield per plant, number of fruits per plant, days to first flowering, number of primary branches per plant and percent disease incidence (bacterial wilt). The other germplasm CARI-1 was found to be immune to bacterial wilt disease with better yield performance.

Keywords: Brinjal, germplasm, yield, bacterial wilt disease incidence

Introduction

Brinjal or eggplant or aubergine (*Solanum melongena* L.) is a warm season solana ceous vegetable crops and it's grown extensively in all over the world for its edible immature fruits. According to Vavilov (1928) India is considered as the primary centre of origin with great diversity. Brinjal contains very good source of vitamins, minerals, antioxidant and amide proteins. The brinjal production severely affected by many diseases, among all bacterial wilt is most devastating disease. Bacterial wilt in brinjal caused by *Ralstonia solanacearum*, it's a soil-borne bacterium belongs to β -proteobacteria class (Yabuuchi *et al.*, 1996) [15]. Based on host differentiate *Ralstonia solanacearum* have been classified into 5 races, among all race 1 and 3 infecting solana ceous crops and race 1 is predominant. In India the disease occur frequently in all parts of the country and yield loss ranging from 11.67 to 96.67% (Bainsla *et al.*, 2016) [2]. The disease control strategies like cultural and chemical methods are not effective. To overcome these problems, the only way is development of resistant varieties with high yield potential. Therefore, the present studies were designed to screen out the potential resistant to bacterial wilt disease and high yielding germplasm in brinjal.

Materials and Methods

The experimental materials consisted of seven germplasm viz., CARI-1, Surya, WCGR, IIHR-3, S-75, Rampur Local and IIHR-586. Randomized block design (RBD) was used in these experiments with 3 replications. The seedlings of all entries were raised in pro-tray nursery and 30 days old seedling were transplanted at spacing of 60 × 60 cm during *Kharif* 2015 in bacterial wilt sick plot with artificial inoculation of *Ralstonia solanacearum* culture by axil puncturing and soil drenching method. The crop was raised and followed recommended good agricultural practices (GAP) for successful crop production.

The eight different yield and yield contributing traits and bacterial wilt disease were recorded on five randomly selected plants in each germplasm with three replications. The eight different yield attributing traits namely fruit yield per plant, number of fruits per plant, plant height, number of primary branches per plant, days to first flowering, fruit length, fruit width and fruit weight. The percentage disease incidence (PDI) was calculated for individual germplasm as

Per Bainsla *et al.* (2016) [2]. The individual germplasm were categorized 0–5 scale (Table 1) based on the PDI value according to Hussain *et al.* (2005). The dead individuals were examined for ooze out test for, in which individuals were died for bacterial wilt or other diseases. The mean data of all the observation were pooled and the Statistical Analysis System Version 9.3 software (SAS, 2012) [10] was used for statistical analysis.

$$\text{PDI} = \frac{\text{Number of wilted plants per germplasm}}{\text{Total number of plants per germplasm}} \times 100$$

Results and Discussion

The ANOVA for yield traits and bacterial wilt disease were given in Table 2. The variance of germplasm was significant for plant height, fruit length, fruit width, fruit weight, number of fruits per plant and bacterial wilt was significant at 1 per cent level of significance. The variance of germplasm was significant at 5 per cent level were observed in days to first flowering, The highest variance was observed for fruit weight and lowest variance was observed on fruit yield per plant. The non-significant variances were observed in number of primary branches per plant and fruit yield per plant at both 1 and 5 percent levels of significance.

The mean performance data of seven parents for eight yield traits and bacterial wilt disease were given in Table 3. The plant height ranged from 49.57 cm (Surya) to 65.97 cm (IIHR–586). The variation in germplasm was recorded in number primary branches per plant ranged from 5.00 (WCGR and S.75) to 7.07 (Rampur Local). Plant height is a significant growth attributing trait by which growth and vigour of plants are measured and number of primary branches per plant is another yield increasing trait in brinjal. Similar results were recorded in brinjal for the plant height by Praneetha and Jaya Lakshmi (2018); Syed *et al.* (2018) [12], and the number of primary branches per plant by Suresh *et al.* (2012) [11]. Among the seven germplasm early flowering was recorded in IIHR–586 (25 days) and late flowering were recorded in WCGR (36.67 days). These results were close to the previous study of Suresh *et al.* (2012) [11] and Syed *et al.* (2018) [12].

The fruit length, fruit girth and fruit weight are essential parameters, this traits are indirectly contributes towards the total yield in brinjal. Mean performance indicated that the highest fruit length was recorded in IIHR–3 and S.75 (26.50

cm) and lowest were recorded in Surya (11.83 cm). These results were similar to the earlier findings of Gogoi *et al.* (2018) [4]. The observation on fruit width, highest was observed in CARI–1 (24.00 cm) while, the lowest fruit length was in IIHR–3 (8.00 cm). These results were similar to earlier report of Praneetha and Jaya Lakshmi who reported significant variation among the cultivars of brinjal for fruit width trait. The fruit weight was recorded highest in parent CARI–1 (207.33 g) while, lowest in parent IIHR–3 (53.00 g). These results were close to the earlier study of Bhavana and Singh (2016) [2-3] Tripathi *et al.* (2017) [13]. The number of fruits per plant was recorded highest in Surya (14.17) and lowest were recorded in IIHR–586 (3.63). These results were similar to the earlier findings of Bhavana and Singh (2016) [2-3]. The fruit yield per plant varied from 0.90 kg (WCGR) to 1.87 kg (Surya). These results were close to the earlier study of Suresh *et al.* (2012) [11]; Syed *et al.* (2018) [12].

The CARI–1 germplasm was recorded as highly resistance (immune) to bacterial wilt disease with no wilting symptoms of plants. These results were similar to the earlier finding of Bainsla *et al.*, (2016) [2] and Khapte *et al.*, (2018). Surya, WCGR, IIHR–3, and S–75 germplasm were observed as resistance to bacterial wilt disease with the wilting percentage of 5.00 (12.92), 3.33 (10.37), 8.33 (16.73) and 6.67 (14.90) respectively. Similar observation was also made by Peter *et al.*, (1993) [6], Gopalakrishnan *et al.*, (2005) [5], Gopalakrishnan *et al.*, (2014), Arun kumar *et al.*, (2016) [1-2]. The germplasm Rampur Local and IIHR–586 were recorded as highly susceptible to bacterial wilt disease with the wilt percentage of 85.83 (67.88) and 85.00 (67.58) respectively. Similar results were obtained by Khapte *et al.*, (2018).

Conclusion

In the present investigation based on mean performance, the germplasm Surya was adjudged as the best performing germplasm among all. Hence, this germplasm recorded a better performance for fruit yield per plant, number of fruits per plant, days to first flowering, number of primary branches per plant and bacterial wilt disease resistance. The other germplasm CARI–1 was observed as immune to bacterial wilt disease with better yield performance. Therefore, these germplasms could be better utilized for further crop improvement programme in brinjal for yield traits and bacterial wilt resistance.

Table 1: Disease scale for the percent disease incidence

Disease response	Percent disease incidence
Highly resistant (HR)	Plants did not show any wilt symptom
Resistant (R)	1-20% plants wilted
Moderately resistant (MR)	21-40% plants wilted
Moderately susceptible (MS)	41-60% plants wilted
Susceptible (S)	61-80% plants wilted
Highly susceptible (HS)	More than 80% plants wilted

Table 2: Anova for yield traits and bacterial wilt disease

Source	Df	Ph	Npbpp	Dff	Fl	Fw	Fwt	Nfpp	Fypp	Bw
Replications	2	7.68	0.07	14.33	32.33*	6.23	4.90	37.66	0.74	6.91
Germplasm	6	132.03*	2.28	47.30**	93.42*	117.13*	11270.38*	39.43*	0.35	2386.65*
Error	12	9.13	1.50	5.11	3.83	2.68	117.24	14.28	0.30	10.19

Significance at *0.01 Significance at **0.05

Table 3: The performance of germplasm for yield traits and bacterial wilt disease

S. No	Germplasm	Ph	Npbpp	Dff	Fl	Fw	Fwt	Nfpp	Fypp	Bw
1.	CARI-1	63.30	6.87	28.00	19.67	24.00	207.33	6.11	1.16	0.00 (0.00)
2.	Surya	49.57	6.80	26.00	11.83	15.00	63.33	14.17	1.87	5.00 (12.92)
3.	WCGR	50.23	5.00	36.67	15.67	21.67	167.00	5.43	0.90	3.33 (10.37)
4.	IIHR-3	58.60	6.53	29.00	26.50	8.00	53.00	11.23	1.17	8.33 (16.73)
5.	S.75	51.67	5.00	27.33	26.50	10.83	100.67	8.97	1.69	6.67 (14.90)
6.	Rampur Local	60.47	7.07	25.67	24.50	10.17	93.00	9.10	1.41	85.83 (67.88)
7.	IIHR-586	65.97	6.13	25.00	21.17	19.67	183.33	3.63	1.14	85.00 (67.58)
	SE	2.47	1.00	1.85	1.60	1.34	8.84	3.09	0.45	2.03
	CD	5.37	2.18	4.02	3.48	2.91	19.26	6.72	0.98	4.42
	CV%	5.29	19.74	8.01	9.40	10.49	8.74	45.11	41.40	9.14

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