Environment and Ecology 41 (2) :839—842, April—June 2023
ISSN 0970-0420

Genotypic Variability in Brinjal for Growth and Biochemical Traits Related to Bacterial Wilt Resistance

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Received 15 November 2022, Accepted 16 January 2023, Published on 24 April 2023

ABSTRACT

Fifteen diverse brinjal genotypes were examined for different growth and biochemical traits related to bacterial wilt in brinjal to study the genetic variability. Analysis of variance showed that all the traits under study varied significantly. It suggested ample variation among the genotypes for different characters which may be used for selection of elite genotypes which can be used in breeding program for developing disease resistant varieties. High genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were recorded for total phenolic content of leaf at 45 Days after transplanting, tannin content of leaf at 45 Days after transplanting and disease incidence at 40 days after inoculation. High heritability and high genetic advance were reported for total phenolic content of leaf at 45 Days after transplanting, tannin content of leaf at 45 Days after transplanting and disease incidence at 40 days after inoculation, and thereby selection may be efficient based on these traits.

Keywords Eggplant, Bacterial wilt, GCV, PCV, Heritability.

INTRODUCTION

Brinjal (*Solanum melongena* L.) is an important vegetable crop of the solanaceous group. This crop is the most important vegetable crop of Bihar, extremely variable in India being native to the country, and it has extensively spread around the world (Khan and Singh 2014). Brinjal is also known as the poor man's vegetable because of its high production potential and consumer availability. It is one of the cheapest sources of vitamins and minerals. Brinjal is grown for its immature, unripe fruits, which are cooked and used in curries. It is a major subtropical and tropical solanaceous crop, very important in the warm areas of the Far East, widely grown in India, Bangladesh, Pakistan, China and Philippines. Globally, this crop is grown in an area of about 1.88 million hectares, producing about 56.62 million tonnes and in India it covers an area of about 0.736 million hectares with a

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production of 12.77 million tonnes (FAOSTAT 2020). In India, brinjal has been cultivated for centuries, West Bengal, Orissa, Bihar, Gujarat, Maharashtra, Jharkhand, Karnataka, Uttar Pradesh, and Andhra Pradesh being the major brinjal producing states. It is the most important vegetable in Bihar, with an area of approximately 58.22 thousand hectares, production of 1241.71 thousand metric tonnes and productivity of 21.33 metric tonnes/ha (Anonymous 2018).

Several insect-pests and devastating diseases have hampered the successful cultivation of the brinjal crop. Bacterial wilt is the major limiting factor among the diseases. This has been the most common and serious bacterial disease in the world's tropical, subtropical, and temperate regions (Hayward 1991). *Ralstonia solanacearum*, formerly known as *Pseudomonas solanacearum*, a soil borne bacterium, causes bacterial wilt in brinjal. *Ralstonia solanacearum* can survive in the soil for up to ten years without the presence of a host plant. The pathogen has harmed crop productivity in over eighty countries around the world, resulting in annual losses of over one billion USD (Hong *et al*. 2012), and yield reduction has been found to be in the range of 11.67% to 96.67% (Bainsla *et al*. 2016), while in humid and congenial climatic condition upto 100% loss has been recorded. Being one of the most devastating diseases in India, it affects large portions of Karnataka, Kerala, Odisha, Maharashtra, Madhya Pradesh, and West Bengal, causing economic output losses of up to 86.14% (Rao *et al*. 1976).

Brinjal genotypes vary for their reaction to the disease, and various growth and biochemical traits need to be identified for setting selection criteria for developing resistant variety. Variability in the base population available forms the basis of any breeding program. Therefore, the present investigation with fifteen diverse brinjal genotypes was executed during 2021-22 at Bihar Agricultural University, Sabour (Bhagalpur) with the objective to study the genetic variability for growth and biochemical traits related to bacterial wilt resistance.

MATERIALS AND METHODS

Fifteen brinjal genotypes differing in fruit color, shape and size, maintained at Bihar Agricultural University, Sabour, Bhagalpur, were used in the present study. These genotypes were raised in sterile soil+vermicompost+cocopeat mix in ratio 1:1:1 in portrays and transplanted to pots after 30 days. The experiment was laid out in Randomized Block Design with three replications. The seedlings were inoculated with *Ralstonia solanacearum* by axil puncture and leaf clipping methods and disease incidence was noted at every five days interval till 40 days after inoculation. Control plants were also maintained for each genotype. Three growth characters viz., leaf length at 45 days after transplanting (DAT), stem girth at 45 DAT, plant height at 45 DAT were recorded. Two biochemical characters, total phenolic content of leaf at 45 DAT and tannin content of leaf at 45 DAT of the control plants were evaluated to get the inherent content of these biochemical compound present in the genotypes. Disease incidence (%) was recorded by the following formula:

$$\text{Disease Incidence (\%)} = \frac{\text{Number of infected plants due to bacterial wilt disease}}{\text{Total number of plants}} \times 100$$

The analysis of variance was carried out as suggested by Panse and Sukhatme (1967). Phenotypic and Genotypic coefficients of variation were evaluated by the method suggested by Burton and Devane (1953). Heritability broad sense and genetic advance were calculated as per Johnson *et al*. (1955).

Table 1. Analysis of variance for disease parameters and morphological and biochemical traits under study in 15 brinjal genotypes.

Characters	Replication	Treatment	Error
Leaf length at 45 DAT	0.20	8.12 **	0.83
Stem diameter at 45 DAT	0.58	1.36 **	0.18
Plant height at 45 DAT	0.02	7.71 **	0.64
Leaf total Phenolic content at 45 DAT	25.34	2228.88 **	23.78
Leaf tannin content at 45 DAT	0.02	1.10 **	0.04
Disease incidence (%) at 40 dai	125.16	1277.00 **	102.19

* and ** depicts significance at 5% and 1% levels of significance respectively.

Table 2. Variability components for different traits related to bacterial wilt resistance in 15 brinjal genotypes.

Characters	Range	Overall mean	GCV	PCV	Heritability (broad sense) (%)	Genetic advance	Genetic advance value % means
Plant height at 45 DAT (cm)	10.7-16.8	12.39	12.39	13.97	78.75	2.81	22.66
Leaf length at 45 DAT (cm)	8.6-14.8	10.35	15.07	17.45	74.58	2.77	26.81
Stem diameter at 45 DAT (mm)	2.18-4.22	3.13	19.98	24.24	67.94	1.06	33.92
Total phenolic content at 45 DAT (mg/g GAE DW basis)	40.44-146.29	78.36	34.60	35.15	96.87	54.97	70.15
Tannin content at 45 DAT (mg/g TAE DW basis)	0.88-3.19	1.89	31.64	33.21	90.80	1.17	62.11
Disease incidence at 40 dai (%)	3.00-87.39	21.48	65.72	73.28	80.43	30.93	121.40

RESULTS AND DISCUSSION

The analysis of variance (ANOVA) has been depicted in Table 1. The mean sum of squares for treatment for every trait under study were highly significant. This suggested that there is ample variation among the genotypes for different traits under study which may be used for selection of elite genotypes which can be used in breeding programme. Bidaramali *et al*. (2020), Kumari *et al*. (2017), Fidrianny *et al.* (2017), Nayanathara *et al*. (2016), Kandoliya *et al*. (2020), also reported high variability indicating ample opportunity for selection among diverse genotypes.

Plant height at 45 DAT ranged between 10.7 to 16.8 cm, stem diameter at 45 DAT between 2.18 to 4.22 mm, leaf length at 45 DAT between 8.6 to 14.8 cm among the growth traits. Among the biochemical parameters, total phenolic content of leaf at 45 DAT ranged between 40.44 to 146.49 mg/g GAE DW basis, and tannin content of leaf at 45 DAT ranged between 0.88 to 3.19 mg/g GAE DW basis. At 40 days after inoculation of the pathogen, disease incidence (%) varied between 3.00% (BRBL-07) to 87.39% (VR-2).

The various variability components, viz., genotypic coefficient of variance (GCV), phenotypic coefficient of variance (PCV), heritability (broad sense), predicted genetic advance and genetic advance as percent of mean were calculated and has been summarised in Table 2. GCV and PCV were high for total tannin content of leaf at 45 DAT (31.64 and 33.21 respectively). as well as total phenol content of leaf at 45 DAT (34.60 and 35.15 respectively). High GCV and PCV for phenol content have been earlier reported by Rani *et al*. (2017) and Sharma *et al*. (2022). GCV was moderate for plant height at 45 DAT (12.39), leaf length at 45 DAT (15.07) and in stem girth at 45 DAT (19.98), while PCV was high for stem girth at 45DAT (24.24), moderate for leaf length at 45 DAT (17.45) and plant height at 45 DAT(13.97). Moderate GCV and PCV have been earlier reported for plant height in brinjal by Kumari *et al*. (2017) and Singh *et al.* (2014), which corroborated to our findings.

Heritability was high for all traits under study suggesting that efficient selection could be based on them. High heritability coupled with high genetic advance as percent of mean was observed for plant height, stem diameter, leaf length, leaf tannin content and total phenol content of leaf at 45 DAT as well as for disease incidence percent at 40 days after inoculation. Therefore, selection based on these traits would be efficient. Similar trend for plant height was previously reported by Kumari *et al*. (2017). Singh *et al*. (2014) reported high heritability for disease

incidence and plant height, but moderate genetic advance as percent of mean for these traits. Sharma *et al*. (2022) and Rani *et al*. (2017) reported high heritability coupled with genetic advance for phenol content, which was in accordance with our findings.

The study thus revealed high variability among the genotypes and that the traits like phenol and tannin content particularly, could be effective base for selection for resistant genotypes.

ACKNOWLEDGMENT

The authors are thankful to the Bihar Agricultural University, Sabour, Bhagalpur, Bihar for providing the laboratory and experimental research facility and the project grant SNP/CI/Kh/2016-12 for financial support. The authors are also thankful to ICAR-RCER, Ranchi, IIVR, Varanasi, IARI, New Delhi, GBPUAT, Pantnagar, KAU, Kerala and IIHR, Bengaluru for providing brinjal germplasm used in this study.

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