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# Variability, heritability and genetic advance for fruit yield, quality and pest and disease incidence in eggplant

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Eggplant [*Solanum melongena* (L.)] is a major vegetable crop grown in temperate (during warm season) and tropical regions. Eggplant contains the alkaloid solanine in roots and leaves, and there are medicinal uses for eggplant. Fruit are rich in Ca, Mg, P and contain fatty acids (Dhankhar and Singh, 1984). As population increases there is a need for increased production and productivity of eggplant. There are specific genotypes suited for specific locality based on color, shape, taste preferences. It is not possible to have one common cultivar to suit different localities and preferences. It is necessary to improve yield potential of available types through hybridization, to develop good hybrids or varieties. The success of any crop improvement program depends on the nature and magnitude of the genetic variability existing in breeding material. Effectiveness of selection directly depends on the amount of heritability and genetic advance in relation to the average for the character. The study was undertaken to access the variability in eggplant hybrids and their parents.

Forty hybrids and 14 parents were evaluated in a Randomized Complete Block Design with three replications. The experiment took place from October, 2010 to February, 2011. Thirty day-old seedlings from the nursery beds were transplanted on ridges adopting a spacing of 60 × 60 cm. Thirty plants were maintained for each hybrid and parent in each replication of hybrids and parents. Recommended cultural practices were followed (TNAU, 2005). Observations were recorded from five randomly selected plants in each replication. The data were analyzed by the methods of Panse and Sukhatme (1967) using mean values at random plots in each replication from all genotypes to determine significance of genotypic effects. Genotypic and phenotypic coefficients of variation were calculated using the formulae of Burton (1952). Broad sense heritability was calculated as per Lush (1940) and genetic advance estimated by the method of Johnson *et al*. (1955). Categorization of genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) and genetic advance (GA) were done per Sivasubramanian and Menon (1973) and heritability categorized as by Robinson *et al*. (1949).

The parents and hybrids exhibited significant differences for all the characters indicating the existence of genetic variability for growth and yield attributes (Table 1). Variability is the most important characteristic of any population. Estimation of variability is an important prerequisite for realizing response to selection as progress in breeding depends on its amount, nature and magnitude.The genetic proportion of this variability measured in terms of GCV alone represents the heritable component of total variability. The higher the GCV the greater the chance for exploitation of that particular character. Genetic variability in terms of GCV alone is not sufficient for determination of amount of heritable variability. In addition, estimation of heritability and genetic advance as percent of average performance is also needed to assess the extent of genetic gain expected from effective selection. Heritability in the broad sense includes both additive and epistatic gene effects, it will be reliable only when it is accompanied with high genetic advance (Burton, 1952; Johnson *et al.*, 1955).

A relatively high estimate of genotypic and phenotypic coefficient of variation (GCV of more than 20%) occurred for fruit length, calyx length, number of fruit per plant, little leaf incidence, total phenol content and fruit yield per plant. It could be inferred that the selection for improvement of these characters would be effective. This is in accordance with the findings of Prabakaran (2010) for fruit length. Baswana et al. (2002) and Pathania et al. (2002) reported similar responses for

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numbers of fruit per plant. For fruit yield per plant similar results were reported by Singh and Kumar (2005) and Prabakaran (2010) for total phenol content.

Moderate phenotypic and genotypic coefficients of variation (10-19%) were observed for plant height, number of branches per plant, fruit pedicel length, fruit circumference, average fruit weight, shoot borer and fruit borer infestation and ascorbic acid content. There is the opportunity for improving these characters in the desirable direction through selection. This agrees with findings of Vadivel and Babu (1993) for fruit circumference and Prabakaran (2010) for ascorbic acid content. Low estimates of phenotypic and genotypic coefficient of variation were observed for the parameter days to first flowering. A similar results were reported by Sharma and Swaroop (2000) and Prabakaran (2010). In this study, the coefficient of phenotypic and genotypic variation, with respect of all characters did not differ much in magnitude indicating that the characters are not affected by environmental factors, and the selection may be based on phenotypic values.

Genotypic coefficient of variation does not indicate the presence of total heritable variation. Further, it may not be feasible to determine the amount of heritable variation, and the relative degree to which a character is transmitted from parent to offspring, by the estimate of heritability. The heritability estimate, in the broad sense does not serve as the true indicator of genetic potential of the genotype, since the scope is restricted by their interaction with the environment. It is advisable to consider the predicted genetic advance as percent of mean in addition to heritability estimate as a reliable tool in selection (Johnson *et al.*, 1955). Both heritability and genetic advance as percent of average performance was determined to obtain a clear picture of the potential for improvement in various characters through selection.

The heritability value was high for all characters, indicating that the major part of the variability was due to genotypic causes. High heritability also indicated that there were more additive genes for these characters. The results agree with the findings of Prabakaran (2010). In the present investigation, high heritability coupled with high genetic advance occurred for fruit length, fruit pedicel length, fruit circumference, calyx length, number of fruit per plant, average fruit weight, shoot borer infestation, fruit borer infestation, little leaf incidence, ascorbic acid content, total phenol content and fruit yield per plant, indicating that selection among the genotypes can bring about significant improvement in the fruit yield and its component characters. This result agrees with the findings of Pathania *et al.* (2002). Further, high heritability coupled with high expected genetic advance indicated the involvement of additive genetic variance, therefore selection may be effective for improvement of these traits. Similar findings were reported by Thangamani (2003) and Chung-won Bok *et al.* (2003).

The trait related to ascorbic acid content had high heritability and high genetic advance, which confirms the predominance of additive gene action. Plant height and number of branches per plant produced a moderate amount of heritability and genetic advance indicating the presence of non-additive gene action for these traits, and improvement of these traits by simple selection was not possible. Days to first flowering had high heritability and low genetic advance indicating the role of non-additive gene action that includes dominance and epistasis. Burton (1952) stated that GCV together with

**Table 1.** Variability parameters for different characters in brinjal.

| Character | PCV[a] | Range | Mean | GCV | ECV | $h^2$ | GA as % of mean |
|---|---|---|---|---|---|---|---|
| Plant height (cm) | 13.93 | 66.9-110.2 | 91.97 | 10.21 | 9.47 | 53.74 | 15.42 |
| Days to first flowering | 5.70 | 74.8-87.98 | 80.30 | 5.18 | 2.49 | 81.46 | 9.64 |
| Number of branches per plant | 14.05 | 15.29-24.2 | 20.21 | 10.03 | 9.83 | 51.01 | 14.76 |
| Fruit length (cm) | 21.02 | 4.36-8.17 | 6.43 | 20.61 | 4.14 | 96.11 | 41.63 |
| Fruit pedicel length (cm) | 16.07 | 3.36-5.37 | 4.40 | 15.71 | 3.36 | 95.62 | 31.66 |
| Fruit circumference (cm) | 14.84 | 9.55-13.09 | 11.57 | 14.19 | 4.49 | 90.88 | 27.86 |
| Calyx length (cm) | 34.37 | 2.34-5.54 | 3.67 | 33.68 | 6.87 | 96.00 | 67.98 |
| Number of fruit per plant | 22.52 | 19.55-3.29 | 26.54 | 21.88 | 5.33 | 94.39 | 43.79 |
| Average fruit weight (g) | 15.93 | 34.94-7.01 | 50.38 | 15.51 | 3.65 | 94.74 | 31.10 |
| Shoot borer infestation (%) | 16.84 | 17.89-4.69 | 28.49 | 16.47 | 3.48 | 95.73 | 33.21 |
| Fruit borer infestation (%) | 12.41 | 37.59-8.86 | 41.89 | 11.86 | 3.64 | 91.36 | 23.36 |
| Little leaf incidence (%) | 26.57 | 17.69-4.44 | 26.49 | 26.32 | 3.65 | 98.10 | 53.71 |
| Ascorbic acid content (mg/100 g) | 15.13 | 9.63-13.18 | 11.38 | 14.83 | 2.99 | 96.07 | 29.95 |
| Total phenols content (mg/100 g) | 23.21 | 29.46-77.51 | 61.07 | 23.05 | 2.67 | 98.67 | 47.18 |
| Fruit yield per plant (kg) | 26.61 | 0.93-1.85 | 1.43 | 25.84 | 6.37 | 94.26 | 51.68 |

[a] PCV = phenotypic coefficient of variation; GVC = genotypic coefficient of variation, $h^2$ = heritability, and GA = genetic advance.

high heritability and genetic advance would give the best picture on the extent of advance expected from selection.

The genetic architecture of fruit yield is based on the balance, or overall net effect, produced by the interaction yield components. There is a good possibility for improving these characters in eggplant by simple phenotypic selection.

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