Original Research Article

Genetic Analysis in F4 Generation of Bhendi [Abelmoschus esculentus (L.) Moench] for Growth and Yield

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ABSTRACT

The material for the present study consisted of 30 F4 families of bhendi, to assess the genetic components for growth and yield at Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, UT of Puducherry, India. The mean values and ranges recorded for various traits under study revealed significant variation. The maximum range of variability was observed for fruit yield plant-1 (148.0 to 377.31 g), followed by plant height at final harvest (76.56 to 160.40 cm). The phenotypic coefficient of variation was found higher than genotypic coefficient of variation for all the traits. The highest value of genotypic coefficient of variation was observed for fruit yield plant-1 (20.48 per cent) and number of fruits plant-1 (20.204 per cent). The maximum value for phenotypic coefficient of variation was recorded for fruit yield plant-1 (29.824 per cent), followed by number of fruits plant-1 (28.952 per cent) and plant height at final harvest (27.202 per cent). The heritability in broad sense was found to range from 0.503 per cent (first flowering node) to 48.699 per cent (number of fruits plant-1). Number of fruits plant-1, fruit yield plant-1, plant height at final harvest, fruit length, plant height at flowering, days to first flowering and fruit girth recorded moderate heritability and rest of the characters recorded low heritability. None of the characters studied recorded high or moderate magnitude of genetic advance as per cent of mean.

Keywords
Bhendi, F4 Families, Genetic Advance, Heritability and Variability

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Introduction

The World Health Organization recommends daily intake of more than 400 g of vegetables person1 (Kamatchi Kala and Nagajothi, 2019). The fresh fruits of okra [Abelmoschus esculentus (L.) Moench], a member of the hibiscus family Malvaceae originating from Africa is found rich in protein and thus assists in building muscle tissues and enzymes capable of controlling the hormones. It’s soluble fibre helps in lowering serum cholesterol, reducing heart diseases and cancer, especially colorectal cancer (Aminu et al., 2016). As okra plays an important role among other annual crops in the economy of nations, further consideration should be given in choosing varieties of higher yield. An
ideotype of bhendi should be high yielding, early maturing, having shorter internodes, producing fruits of uniform size, shape, colour and ridges, coupled with complemental nutritive value. The variability existing among the genotypes offers excellent scope for genetic improvement through selection (Mishra et al., 2015). Hence, the major aim of any breeder is to evolve a superior variety simply through selection from among the available genotypes.

Yield and yield components are polygenic in nature and are subjected to different amount of non-heritable variation (Lush, 1940). In any selection programme, emphasis on yield and its component characters lies solely on their heritability and genetic advance (Reddy et al., 2012). The knowledge on variability and heritability is of prime importance and greater practical utility in exercising selection. Hence, an attempt was made in the present investigation to estimate the extent of variability, heritability and genetic advance of F$_4$ families of bhendi.

**Materials and Methods**

The field experiment was conducted at Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, UT of Puducherry, India. The material for the present study consisted of 30 F$_4$ families of bhendi selected based on the earlier studies performed in F$_3$ generation. The experiment was laid out in a Randomized Block Design and was replicated twice. The mean data of selected plants in each replication for each F$_4$ families were subjected to analysis of variance (Panse and Sukhatme, 1957). Phenotypic and genotypic coefficient of variations was calculated based on the method advocated by Burton (1952).

Heritability in the broad sense was estimated by the method described by Lush (1940) and expressed in per cent. Genetic advance as per cent mean was estimated by the method suggested by Johnson et al., (1955).

**Results and Discussion**

The estimates on mean, range, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability ($h^2$) and genetic advance as per cent of mean for the F$_4$ families is presented in Table 1. The range of values revealed the existence of significant variation for all the traits under study. In the present study, maximum range of variability was observed for fruit yield plant$^{-1}$ (148.0 to 377.31 g) followed by plant height at final harvest (76.56 to 160.40 cm).

The magnitude of phenotypic coefficients of variation (PCV) was higher than the corresponding genotypic coefficients of variation (GCV) for all the twelve characters under study, indicating that the apparent variation was not only due to genotype but also due to the favorable influence of environment and hence selection for these traits sometimes may be misleading. This environmental effect could be due to heterogeneity in soil fertility status and other unpredictable factors as reported earlier by Ahamed et al., (2015) and Archana et al., (2015).

However, there was a close correspondence between the estimates of phenotypic and genotypic coefficients of variation for majority of the characters under study indicating the fact that the environmental influence on the expression of the traits was very low. However, the magnitudinal difference between the estimates of GCV and PCV were highest for number of primary branches plant$^{-1}$ at final harvest (11.007), followed by number of fruits plant$^{-1}$ (8.748). The PCV and GCV values were classified as low (less than 10 per cent), moderate (10 - 20 per cent) and high (more than 20 per cent) as suggested by Sivasubramanian and Menon (1973).
**Table 1** Mean, range, variability, heritability and genetic advance as per cent of mean for growth and yield traits in F₄ families of bhendi

| Traits                                           | Mean  | Range   | Variability (per cent) | Heritability (h²) (per cent) | Genetic advance as per cent of mean |
|--------------------------------------------------|-------|---------|------------------------|-------------------------------|-------------------------------------|
|                                                  | Min.  | Max.    | PCV                   | GCV                           |                                     |
| Days to first flowering                          | 35.61 | 34.44   | 37.44                  | 2.780                         | 1.737                               | 39.040                             | 1.411                             |
| First flowering node                             | 4.01  | 3.89    | 4.11                   | 2.272                         | 0.161                               | 0.503                              | 0.018                             |
| Inter nodal length (cm)                          | 6.36  | 5.53    | 7.37                   | 11.796                        | 5.124                               | 18.871                             | 2.654                             |
| Plant height at flowering (cm)                   | 31.91 | 27.38   | 40.66                  | 14.084                        | 8.945                               | 40.340                             | 1.654                             |
| Plant height at final harvest (cm)               | 104.10| 76.56   | 160.40                 | 27.202                        | 17.532                              | 41.542                             | 0.530                             |
| Days to first harvest                            | 41.87 | 41.00   | 43.89                  | 2.837                         | 1.532                               | 29.170                             | 0.775                             |
| Number of primary branches plant⁻¹ at final harvest | 3.40  | 2.33    | 4.00                   | 18.126                        | 7.119                               | 15.427                             | 3.671                             |
| Fruit length (cm)                                | 12.97 | 11.47   | 14.94                  | 10.161                        | 6.507                               | 41.005                             | 4.170                             |
| Fruit girth (cm)                                 | 6.09  | 5.72    | 6.68                   | 6.206                         | 3.507                               | 31.944                             | 6.110                             |
| Individual fruit weight (g)                      | 17.12 | 13.54   | 21.33                  | 15.237                        | 8.113                               | 28.355                             | 1.817                             |
| Number of fruits plant⁻¹                         | 18.11 | 12.00   | 27.44                  | 28.952                        | 20.204                              | 48.699                             | 3.866                             |
| Fruit yield plant⁻¹(g)                           | 240.34| 148.00  | 377.31                 | 29.824                        | 20.484                              | 47.176                             | 0.278                             |
The highest value of genotypic coefficient of variation (more than 20 per cent) was registered for fruit yield plant\(^{-1}\) (20.484 per cent) and number of fruits plant\(^{-1}\) (20.204 per cent). Higher the genotypic coefficient of variation, more are the chances of improvement in those characters.

The highest value of phenotypic coefficient of variation was recorded for fruit yield plant\(^{-1}\) (29.824 per cent), followed by number of fruits plant\(^{-1}\) (28.952 per cent) and plant height at final harvest (27.202 per cent). High magnitude (more than 20 per cent) of genotypic and phenotypic coefficients of variation were also reported by Dhall et al., (2003) for number of fruits plant\(^{-1}\) and Gandhi et al., (2001), Bendale et al., (2003), Mehta et al., (2006) and Singh et al., (2006) for fruit yield plant\(^{-1}\).

The heritability values were classified as low (less than 30 per cent), moderate (30-60 per cent) and high (more than 60.00 per cent) as suggested by Johnson et al., (1955). The heritability in broad sense was found to be range from 0.503 per cent (first flowering node) to 48.69 per cent (number of fruits plant\(^{-1}\)). Number of fruits plant\(^{-1}\) (48.66 per cent), fruit yield plant\(^{-1}\) (47.176 per cent), plant height at final harvest (41.54 per cent), fruit length (41.005 per cent), plant height at flowering (40.34 per cent), days to first flowering (39.04 per cent) and fruit girth (31.94 per cent) recorded moderate heritability and rest of the characters recorded low heritability. These results were found to be in consonance with the results of Reddy et al., (2012). The estimates of genetic advance as per cent of mean was classified as low (less than 10 per cent), moderate (10-20 per cent) and high (more than 20 per cent) as suggested by Johnson et al., (1955). The genetic advance as per cent of mean (GAM) i.e., genetic gain was ranged from 0.018 per cent (first flowering node) to 6.110 per cent (fruit girth).

None of the characters recorded high and moderate magnitude of genetic advance as per cent of mean.

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