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# GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE FOR SOME OF THE SEEDLING PARAMETERS IN SORGHUM GERMPLASM

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## Abstract

Sixty three genotypes consisting of sixty germplasm lines and three improved released varieties of kharif sorghum were evaluated for five seedling parameters. The study revealed that the characters vigour index length showed moderate GCV and PCV values indicating thereby good amount of variation in these characters. For all the seedling parameters the higher magnitude of PCV as compared to GCV indicated the greater effect of environment on these characters. High heritability estimate in broad sense along with medium expected genetic advance over mean was observed for vigour index length indicating that this character would respond positively to selection. Moderate values of heritability along with low value of expected genetic advance were observed for the characters like shoot length and vigour index mass indicating that these characters were governed by non additive component of variation, which is non-fixable so heterosis breeding can be fruitfully exploited for improving these characters.

***Key words :*** GCV, genetic advance heritability, PCV, sorghum.

## Introduction

Variability in any crop is essential for effective selection. Germplasm means sum total of the hereditary material or genes present in species. They are sources of many valuable genes, including those for adaptation. So, there is need to conserve and study the characteristics of germplasm and their further utilization in the breeding programme. The challenge to sorghum improvement will be to concentrate on utilization of desirable traits from such germplasm that may aid in developing the improved lines. The study of seedling parameters including the root shoot characteristics are useful in the crop like sorghum where development of drought tolerant genotypes is one of the major objectives. Therefore, the present study was undertaken to study the genetic parameters such as variance, coefficient of variation, heritability and genetic advance in the kharif sorghum germplasm lines.

## Materials and Methods

Sixty three genotypes consisting of sixty germplasm lines and three improved released varieties of kharif sorghum received from Directorate of Sorghum Research (DSR), Hyderabad were sown at Sorghum Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.), India; during *kharif* 2012-2013. Material was sown in randomized block design. Observations were recorded on the five seedling parameters like shoot length, root length, root shoot ratio, vigour index-length and vigour index-mass. Vigour index length was calculated by using the below formula as suggested by Abdul-Baki and Anderson (1973) and expressed in whole number using the formula- Vigour Index = Germination (%) × (Root length + Shoot length in cm). Vigour index in terms of mass is determined by the multiplication of germination percentage with seedling dry weight on the day of final count (Khare and Bhale, 2000). Observations were recorded on the tenth day of germination test. Analysis of variance was done as per the method suggested by Panse and Sukhatme (1967). Genotypic and phenotypic coefficients of variation were estimated as per formulae given by Burton (1951). Heritability and genetic advance were estimated as per Johnson *et al*. (1955).

## Results and Discussion

The analysis of variance indicated highly significant differences among the genotypes for all the characters

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**Table 1 :** Range, mean and the best genotype for different characters.

| S. no. | Character | Range | Mean | Best genotype |
|---|---|---|---|---|
| 1. | Shoot length (cm) | 8.81-15.45 | 11.54 | E-149 |
| 2. | Root length (cm) | 11.03-20.47 | 15.22 | E-149 |
| 3. | Root shoot ratio | 1.11-1.64 | 1.33 | E-189 |
| 4. | Vigour index length | 1469.23-3071.76 | 2148.37 | E-149 |
| 5. | Vigour index mass | 11.77-16.20 | 13.77 | E-169 |

amenable for improvement. Similar results were observed by Khade (2012). Low GCV and PCV values were found for the characters root length, shoot length, vigour index mass, root shoot ratio, indicating small amount of variation and impediment in improvement through selection. Sumathi *et al*. (2010) in pearl millet reported similar results for characters root length and shoot length. For all the seedling parameters, the higher magnitude of PCV as compared to GCV indicated the greater effect of environment on these characters.

**Table 2 :** Estimation of genetic parameters –GV, PV, GCV, PCV, $h^2$ and EGA.

| S. no. | Character | Genotypic coefficient of variation | Phenotypic coefficient of variation | $h^2$ % | EGA as % over mean |
|---|---|---|---|---|---|
| 1. | Shoot length (cm) | 7.64 | 13.39 | 32.59 | 8.99 |
| 2. | Root length (cm) | 8.62 | 13.31 | 41.90 | 11.49 |
| 3. | Root shoot ratio | 5.39 | 14.71 | 13.43 | 4.07 |
| 4. | Vigour index length | 10.78 | 13.11 | 67.60 | 18.25 |
| 5. | Vigour index mass | 6.40 | 10.02 | 40.75 | 8.41 |

under study. High magnitude of variation in the experimental material was also reflected by wider range for all the characters under study (table 1).

Shoot length ranged from 8.81 cm (E-160) to 15.45 cm (E-149). Root length ranged from 11.03 (E-157) to 20.47 cm (E-149). Root shoot ratio ranged from 1.11 (E-205) to 1.64 (E-189). Vigour index length of seed varied from 1469.23 (E-157) to 3271.76 (E-149). Vigour index mass of seed varied from 11.77 (E-157) to 16.20 (E-169).

The genotypic coefficient of variation, phenotypic coefficient of variation, heritability in broad sense and expected genetic advance per cent over mean for various characters are presented in table 2. The genotypic coefficient of variation (GCV) ranged from 5.39 to 10.78% for different character under study (table 2). The highest order value of genotypic coefficient of variation was observed for vigour index length (10.78%), root length (8.62%), shoot length (7.64%), vigour index mass (6.40%) and root shoot ratio (5.39%).

The phenotypic coefficient of variation (table 2) ranged from 3.36 to 46.97% for various characters under study. The highest order value of phenotypic coefficient of variation was observed for root shoot ratio (14.71%) followed by shoot length (13.39%), root length (13.31%), vigour index length (13.11%) and vigour index mass (10.02%).

Moderate values of PCV and GCV was recorded for vigour index length indicating that this character is

With the genotypic coefficient of variation, it is difficult to determine the relative amounts of heritable and non heritable components of variation present in the population. Estimates of heritability and genetic advance would supplement this parameter. The heritability in broad sense ranged from 13.43 to 67.60% for various characters under study. High heritability estimate in broad sense was observed for vigour index length (67.60%) indicating that this character would respond positively to selection because of high broad sense heritability. High heritability for vigour index length was in conformity with the results of Khade (2012) and Elangovan *et al.* (2013). Medium heritability was observed for the characters root length (41.90%), vigour index mass (40.75%) and shoot length (32.59%). Sumathi *et al*. (2010) in pearl millet reported similar results for characters root length and shoot length. Only one character root shoot ratio (13.43%) showed low heritability. However, Sumathi *et al*. (2010) in pearl millet reported high heritability for root shoot ratio.

Expected genetic advance per cent over mean was estimated for different characters and it was observed that expected genetic advance per cent over mean was in the range of 4.07 to 18.25 per cent. The medium expected genetic advance over mean was found for the characters like vigour index length (18.25%) and root length (11.49%). While shoot length (8.99%), vigour index mass (8.41%) and root shoot ratio (4.07%) showed low expected genetic advance over mean.

In general, high heritability accompanied with

moderate expected genetic advance for the characters suggest that the genes governing these character may have additive effect. It can be mentioned here that characters vigour index length exhibited high heritability values along with moderated values of expected genetic advance. The phenotypic expression of these characters may be governed by the genes acting additively and thereby indicating the importance of these characters for selection. Moderate values of heritability along with low value of expected genetic advance were observed for the characters like shoot length and vigour index mass. Regarding these characters, the heritability is mainly due to non additive gene effect (dominance and epitasis) hence the expected genetic advance would be low. Since the characters are mainly governed by non additive component of variation which is non fixable, heterosis breeding can be fruitfully exploited for improving these characters. The character root shoot ratio showed low heritability along with low expected genetic advance indicating no scope for the selection of this trait.

## References

Abdul-Baki, A. A. and J. D. Anderson (1973). Vigour determination of soybean seeds by multiple criteria. *Crop Science*, **13** : 630-633.

Burton, G. W. (1951). Quantitative inheritance in pear millet. *Agron. J.*, **43(9)** : 409-417.

Elangovan, M., P. Kiran Prabhu, D. Chandra Sekara Reddy, Usha Saxena, G. Vincent Reddy and V. A. Tonapi (2013). Genetic and environmental variability in sorghum (*Sorghum bicolor* (L.) Moench) germplasm collected from Rajasthan and Madhya Pradesh. *Ind. J. Plant Genet. Resour*, **26(1)** : 19-24.

Johnson, H. W., H. F. Robinson and R. E. Comstock (1955). Estimate of genetic and environmental variability in Soybean. *Agron. J.*, **47(6)** : 314.

Khade, P. A. (2012). Genetic variability studies in some of the land races of sorghum (*Sorghum bicolor* (L.) Moench). *M. Sc. thesis* (Unpub.) Dr. PDKV., Akola.

Khare, D. and M. S. Bhale (2000). *Seed technology*. Scientific publishers India (Jodhpur). pp- 111.

Sumathi, P., M. Sumathi and P. Veerabandhiran (2010). Genetic variability for different biometrical traits in pearl millet genotypes (*Pennisetum glaucum* L. R. BR.). *Electronic J. of Plant Breeding*, **1(4)** : 437-440.

Panse, V. G. and P. V. Sukhatme (1967). *Statistical Methods for Agri. Workers*. ICAR Publication, New Delhi.