Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5479

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (4):** 1525-1530 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Studies on Genetic Pameters for Yield and Yield Contributing Characters in Popcorn Genotypes (*Zea mays* var. *Everta*)

M. Sridhar[1*], K. Murali Krishna[1], Razia Sultana[2] and M.H.V. Bhave[3]

[1]Department of Genetics and Plant Breeding, [2]Department of Seed Science and Technology,
[3]Department of Statistics & Mathematics, College of Agriculture., PJTS Agricultural University,
Rajendranagar - 500 030 (Telangana)

*Corresponding Author E-mail: sriagrico73@gmail.com

Received: 22.07.2017 | Revised: 5.08.2017 | Accepted: 8.08.2017

ABSTRACT

The present investigation was carried out to assess the variability, heritability and genetic advance in thirty genotypes for eleven yield and its contributing traits. Analysis of variance revealed that the mean sum of squares due to genotypes showed significant differences for all the 12 characters studied. Variability studies indicated that the estimates of phenotypic coefficient of variation were slightly higher than genotypic coefficient of variation for all the traits, indicating less influence of environment. Among all the characters under study, grain yield per plant exhibited highest PCV (25.78) and GCV (24.51), whereas lowest PCV (2.30) and GCV (1.18) were recorded for days to maturity. Ear height, no. of kernel rows ear^{-1}, no. of kernels row^{-1}, 100-kernel weight, grain yield plant^{-1} and popping expansion ratio exhibited high heritability coupled with high genetic advance as a per cent of mean, which indicated the preponderance of additive gene action in controlling these traits. Hence direct selection of these characters would be effective in improving the seed yield. Emphasis should be given on these characters, while selection is made to improve yield potential and popping quality in popcorn breeding.

Key words: *Genetic advance, Genotypic coefficient of variation, Heritability, Phenotypic coefficient of variation, Popcorn.*

INTRODUCTION

Popcorn, a speciality type of corn is believed to be one of the oldest types of the corn belongs to the tribe Maydeae of the grass family *Poaceae* and has been referred to as the original cereal snack food as it is the finest form of flint type available. The kernels of popcorn consist of hard starch grain embedded in colloidal material, which pops on heating and produce large puffed flakes. This character separates popcorn from all other types of corn. Yield in popcorn, as in other crops, is a very complex character and depends upon several component characters. Popcorn quality is measured primarily by the expansion volume and number of unpopped kernels[15].

Cite this article: Sridhar, M., Krishna, K.M., Sultana, R. and Bhave, M.H.V., Studies on Genetic Pameters for Yield and Yield Contributing Characters in Popcorn Genotypes (*Zea mays* var. *Everta*), *Int. J. Pure App. Biosci.* **5(4):** 1525-1530 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5479

The success of plant breeding depends on the extent of genetic variability present in a crop. Knowledge on the nature and magnitude of genetic variation governing the inheritance of quantitative characters like yield and its components is essential for genetic improvement. A critical analysis of genetic variability present in the individuals of the population of a crop and its estimation is a pre-requisite for initiating any crop improvement programme as well as adopting appropriate selection techniques.

Partitioning of observed variability into heritable and non-heritable components is very much essential to get a true indication of the genetic coefficient of variability as a useful measure of the magnitude of genetic variance present in the population. It is very difficult to judge whether observed variability is heritable or not. Heritability indicates the extent of transmissibility of a character into future generations. Moreover, knowledge of heritability is also essential for selection of component traits for yield improvement.

Again the heritable portion of the total variation might not be always due to additive gene action. Thus estimates of heritability alone will not give a clear indication of the associating genetic progress that would result from selecting the best plants. It is also essential to find out the relative magnitude of additive and non-additive genetic variances with regard to the characters of concern. Therefore it should be combined with information on genetic advance. Thus a character possessing high heritability along with high genetic advance will be valuable in the selection programme.

The area of popcorn production is increasing gradually as the consumption of popcorn is increasing in urban and semi urban areas. The genetic information of popcorn is limiting for the development of improved varieties or hybrids. Keeping in view the importance of aforesaid aspects, the present investigation was undertaken to study the genetic variability, heritability and genetic advance for yield, its contributing traits and popping quality traits among the popcorn genotypes.

MATERIALS AND METHODS

In the present investigation was carried out during *Kharif*, 2013 at Agricultural Research Station, Karimnagar, Telangana in a Randomized Block Design with thirty genotypes replicated thrice. Each entry was sown in two rows of four meters length with a spacing of 75 cm between rows and 20 cm between the plants. Observations were recorded on five randomly tagged plants for plant height, ear height**,** ear length, ear girth, number of kernel rows ear^{-1}, number of kernels row^{-1}, 100-kernel weight and grain yield plant^{-1}. Whereas, observations for the characters namely days to 50 % tasseling, days to 50 % silking and days to maturity were recorded on plot basis. The mean values were used for statistical analysis. The popping expansion ratio calculated as the ratio of pop volume weight^{-1} of popped kernels as reported by Pordesimo *et al*. The data collected on all the characters were subjected to standard methods of analysis of variance (9). Phenotypic and genotypic coefficient of variation was calculated as suggested by Falconer[4]. Heritability (broad sense) (6), genetic advance (2) and genetic advance as a percent of mean (6) were also estimated.

RESULTS AND DISCUSSION

Genetic Variability

The analysis of variance revealed the existence of significant differences among the genotypes for all the traits (Table 1), indicating the presence of considerable genetic variability among the experimental material under study. Thus there is ample scope for improvement of different traits through selection. The mean values, genotypic and phenotypic coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean (Table 2) of thirty genotypes were calculated for yield and its contributing traits and quality parameters.

For all the characters under study, phenotypic coefficient of variation values are slightly higher than the genotypic coefficient of variation values indicating that the characters were less influenced by the environment. Therefore, response to direct selection may be effective in improving these traits. Genotypic variability was high for grain yield, plant height, ear height. Moderate estimates of genotypic variability recorded for number of kernels per row, 100 kernel weight, popping expansion ratio. Whereas low genetic variability was recorded for days to 50 per cent silking, days to 50 per cent tasseling, days to maturity, ear length, ear girth, number of kernel rows per ear. High estimates of genotypic variance and phenotypic variance were recorded for grain yield, plant height, ear height, number of kernels per row, 100-kernel weight and popping expansion ratio. Thus indicating presence of sufficient inherent genetic variance over which selection can be effective. Similar results were reported by Rather *et al*[12], Jawaharlal *et al*[5] and Vashistha *et al*[16].

The characters studied in the present investigation exhibited low (less than 10 %), moderate (10-20 %) and high (more than 20 %) phenotypic and genotypic coefficients of variation. High phenotypic and moderate genotypic coefficient variations were observed for ear height (24.09/19.74), grain yield plant^{-1} (25.78/24.51) and popping expansion (25.30/23.35). Phenotypic and genotypic coefficients of variation were moderate for ear length (16.53/12.67), ear girth (14.63/11.66), number of kernel rows ear^{-1} (16.92/14.91), number of kernels row^{-1} (19.10/17.38), 100-kernel weight (17.42/14.86). Similar results of PCV and GCV values for grain yield and other traits were reported by Bello *et al*[1], Vashistha *et al*[16] and Rajesh *et al*[11]. Whereas, traits namely days to 50 % tasseling (2.82/1.40), days to 50 % silking (3.03/1.66), days to maturity (2.30/1.18) and plant height (8.64/6.05) expressed low phenotypic and genotypic coefficients of variation. These results were in accordance with Sesay *et al*[14].

Heritability and Genetic Advance

Seven characters under investigation namely ear height (67 %), ear girth (63 %), No. of kernel rows/ear (77 %), No. of kernels row-1 (82 %), 100-kernel weight (72 %), grain yield plant-1 (90 %), Popping expansion ratio (85 %) expressed high estimates of heritability in broad. High heritability for quantitative characters indicates the scope of genetic improvement of these characters through selection, which revealed that these characters are less influenced by environment and there could be greater correspondence between phenotypic and breeding values. Similar results were reported by Chen *et al*[3] and Satyanarayana and Kumar[13]. Whereas plant height (50 %) and ear length (59 %) were recorded moderate heritability estimates. Low estimates of heritability in broad were observed for three traits *viz.*, days to 50 % tasseling (24 %), days to 50 % silking (30 %) and days to maturity (26 %).

Heritability alone provides no indication of the amount of genetic improvement that would result from selection of individual genotypes. Hence knowledge about genetic advance coupled with heritability is most useful. Character exhibiting high heritability may not necessarily give high genetic advance. High heritability should be accompanied with high genetic advance to arrive more reliable conclusion (6). Expected genetic advance as per cent of mean indicates the mode of gene action in the expression of a trait, which helps in choosing an appropriate breeding method. Genetic advance as a per cent of mean is classified as low (less than 10 %), moderate (10-20 %) and high (more than 20 %). Among the characters ear girth had moderate (19.17%) genetic advance as a per cent of mean. Days to 50 % tasseling (1.43 %), days to 50 % silking (1.9 %), days to maturity (1.24 %) and plant height (8.74 %) exhibited low genetic advance as a per cent of mean. Remaining all the traits exhibited high estimates of genetic advance as a per cent of mean.

Among all the characters studied, days to 50 % tasseling (1.43), days to 50 % silking (1.9 %), days to maturity and plant height (8.74 %) exhibited high heritability coupled with low genetic advance as a per cent of mean. High heritability coupled with low genetic advance as a per cent of mean indicates that the expression of the trait is under the control of non-additive type of gene action and its response to selection would be poor. In such case hybridization programme is rewarded. Ear girth expressed high heritability coupled with moderate genetic advance as a per cent of mean. High heritability coupled with moderate genetic advance as per cent of mean, suggested that the expression of this trait was mostly influenced by additive type of gene action. Hence its response to selection would be effective in improving the seed yield. As results obtained by Kumar *et al*[7], plant height and ear length exhibited moderate heritability coupled with low and high genetic advance as a percent of mean respectively. All the remaining characters expressed high heritability coupled with high genetic advance, which indicated the preponderance of additive gene action in controlling the traits. Hence direct selection of such characters would be effective in improving the yield. These results were in line with Patil *et al*[10] and Ogunniyan *et al*[8].

Table 1: Analysis of variance for randomized block design for yield and yield component characters in popcorn

Source of variation / Characters	Replication	Genotypes	Error
d.f.	**2**	**29**	**58**
Days to 50% tasselling	1.033	2.615*	1.321
Days to 50% silking	0.311	3.764**	1.633
Days to maturity	2.533	5.297**	2.568
Plant height (cm)	8.345	289.94**	74.503
Ear height (cm)	77.004	278.15**	38.948
Ear length (cm)	6.832	12.87**	2.438
Ear girth (cm)	2.293	5.165**	0.827
No. of kernel rows/ear	0.988	10.134**	0.884
No. of kernels/row	5.984	100.97**	6.531
100 kernel weight (g)	2.194	24.606**	2.727
Grain yield/plant (g)	13.878	454.67**	15.546
Popping expansion ratio (ml/g)	6.395	68.49**	3.745

*Significant at 5 per cent level; ** Significant at 1 per cent level.

Table 2: Estimation of variability, heritability and genetic advance for yield and yield component characters in popcorn

S.No.	Character	Mean	Range		Phenotypic Variance	Genotypic Variance	PCV (%)	GCV (%)	h^2 (%)	GA	GA as % of Mean
			Min	Max							
1.	**Days to 50% tasseling**	46.83	45.33	49.00	1.75	0.43	2.82	1.40	24	0.67	1.43
2.	**Days to 50% silking**	50.51	48.00	52.33	2.34	0.71	3.03	1.66	30	0.95	1.9
3.	**Days to maturity**	80.733	78.00	83.33	3.47	0.90	2.30	1.18	26	1.00	1.24
4.	**Plant height (cm)**	139.89	118.16	153.33	146.31	71.81	8.64	6.05	50	12.23	8.74
5.	**Ear height (cm)**	45.21	28.06	62.91	118.68	79.73	24.09	19.74	67	15.07	33.34
6.	**Ear length (cm)**	14.71	11.11	18.23	5.91	3.47	16.53	12.67	59	2.94	20.02
7.	**Ear girth (cm)**	10.30	8.03	12.65	2.27	1.44	14.63	11.66	63	1.97	19.17
8.	**No. of kernel rows/ear**	11.77	9.13	15.86	3.96	3.08	16.92	14.91	77	3.18	27.09
9.	**No. of kernels/row**	32.27	21.36	43.13	38.01	31.48	19.10	17.38	82	10.51	32.58
10.	**100 kernel weight (g)**	18.17	11.87	22.67	10.02	7.29	17.42	14.86	72	4.74	26.11
11.	**Grain yield/plant (g)**	49.35	29.18	66.83	161.92	146.37	25.78	24.51	90	23.69	48.01
12.	**Popping expansion ratio (ml/g)**	19.90	13.14	27.70	25.32	21.58	25.30	23.35	85	8.83	44.40

Min-Minimum; Max-Maximum; PCV-Phenotypic Coefficient of variation; GCV-Genotypic coefficient of variation; h^2-Heritability in broadsense; GA-Genetic Advance

CONCLUSION

A perusal of genetic parameters *viz*., phenotypic and genotypic coefficients of variation revealed less influence of environment on the characters under study. Therefore, response to direct selection may be effective in improving these traits.

Ear height, no. of kernel rows ear^{-1}, no. of kernels row^{-1}, 100-kernel weight, grain yield $plant^{-1}$ and popping expansion ratio expressed high heritability coupled with high genetic advance as a per cent of mean, which indicated the preponderance of additive gene action in controlling these traits. Hence direct selection of these characters would be effective in improving the yield and quality. Ear girth expressed high heritability coupled with moderate genetic advance as a per cent of mean suggesting that the expression of this trait was mostly influenced by additive type of gene action. Hence its response to selection would be effective in improving the seed yield. While, days to 50 % tasseling, days to 50 % silking, days to maturity and plant height had low heritability coupled with low genetic advance as per cent of mean indicating that the expression of this trait was under the control of non-additive type of gene action, hence its response to selection would be poor.

REFERENCES

1. Bello, O.B., Ige, S.A., Azeez, M.A., Afolabi. M.S., Abdulmaliq, S.Y. and Mahamood, J. Heritability and Genetic Advance for Grain Yield and its Component Characters in Maize (*Zea Mays* L.). *Int. J. Plant Res*. **2(5)**: 138-145. (2012).
2. Burton, G.W. Quantitative inheritance in grasses. *Proceedings of 6th International Grassland Cong*ress. 1: 277-283. (1952).
3. Chen ling, Cuishaoping, Chen, L., Cui, A. P. and Sun, Y. B. Analysis of the gene effect on ear characters in maize. *Acta Agri. Bareli Sinica*. **11(2)**: 28-32. (1996).
4. Falconer, D.S. *Introduction to Quantitative Genetics*. Oliver and Boyd, London. 340. (1981).
5. Jawaharlal, J., Lakshmikantha Reddy, G. and Sai Kumar, R. Genetic variability and character association studies in maize. *Agri. Sci. Digest*. **31 (3)**: 173-177. (2011)
6. Johnson, H.W., Robinson, H.F. and Comstock, R.E. Estimates of genetic and environmental variability in soybean. *Agro. J.* **47**: 314-318. (1955).
7. Kumar, G. P., Reddy, V. N., Kumar, S.S. and Rao, P. V. Genetic variability, heritability and genetic advance studies in newly developed maize genotypes (*Zea*

mays L.). *Int. J. Pure. App. Biosci*. **2(1)**: 272-275. (2014).

8. Ogunniyan, D.J. and Olakojo, S.A. Genetic variation, heritability, genetic advance and agronomic character association of yellow elite inbred lines of maize (Zea mays L.). *Nig. J. Gen.* **28**:24-28. (2014).
9. Panse, V.G. and Sukhatme, P.V. *Stat. Methods Agri. Workers*. ICAR, New Delhi. 235 - 246. (1985).
10. Patil, S.M., Kumar, K., Jakhar, D.S., Rai, A., Borle, U.M. and Singh, P. Studies on Variability, Heritability, Genetic advance and Correlation in Maize (*Zea mays* L.). *Int. J. Agri. Env. Biotech*. **9(6)**: 1103-1108. (2016).
11. Rajesh, V., Kumar, S.S. Reddy, V.N. and Shankar A.S. Studies on genetic variability, heritability and genetic advance estimates in newly developed maize genotypes (*Zea mays* L.). *Int. J. App. Bio. Pharma. Tech*. **4(4)**: 242-245. (2013).
12. Rather, A. G., Bhatt, M. A. and Zargar, M. A. Genetic variation in maize (*Zea mays* L.) population in high altitude temperate conditions in Kashmir. *Ind. J. Agri. Sci.* **79(3)**: 179-180. (2003).
13. Satyanarayana, E. and Sai Kumar, R. Genetic variability and *Per se* performance of non-conventional hybrids in maize. *Mysore J. Agri. Sci*. **29(3)**: 213:218. (1995).
14. Sesay, S., Ojo, D.K., Ariyo, O.J. and Meseka, S. Genetic variability, heritability and genetic advance studies in top-cross and three-way cross maize (*Zea mays* L.) hybrids. *Maydica Eloct. Pub.* **61**. (2016).
15. Song, A., Eckhoff, S.R., Paulsen, M. and Litchfield, J.B. Effects of kernel size and genotype on popcorn popping volume and number of unpoped kernels. *Cereal chem*. **68(5)**: 464-467. (1991).
16. Vashistha, A., Dixit, N. N., Dipika., Sharma, S. K. and Marker, S. Studies on heritability and genetic advance estimates in Maize genotypes. *Biosci. Disc.* **4(2)**: 165-168. (2013).