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Research article

STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE ESTIMATES IN NEWLY DEVELOPED MAIZE GENOTYPES (*ZEA MAYS* L.)

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ABSTRACT: The present study was carried out at Research farm, College of Agriculture, ANGRAU, Rajendranagar, Hyderabad during *kharif*, 2011 to determine the various parameters of genetic variability, broad sense heritability and genetic advance estimates in newly developed 65 maize genotypes. Analysis of variance revealed that the mean sum of squares due to genotypes showed significant differences for all the 11 characters studied. High to moderate estimates of GCV and PCV were recorded for Grain yield, number of kernels per row, 100-kernel weight, ear length and plant height which represents considerable variability and offers scope for genetic improvement through selection. Grain yield, number of kernels per row, 100-kernel weight, ear length and ear height had high GCV estimates with high heritability. Moderate estimates of genetic advance with high heritability was recorded for Grain yield, number of kernels per row, 100-kernel weight, ear length, ear height and plant height which further leads to improvement of traits under selection. Thus provides better opportunities for selecting plant material for these traits in maize breeding program.

Key words: Maize, Broad sense heritability, PCV, GCV, Genetic advance

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops and occupies prominent position in global agriculture after wheat and rice. Maize being a C_4 plant is physiologically more efficient, has higher grain yield and wider adaptation over wide range of environmental conditions. The crop has assumed a place of prominence in Indian agriculture owing to its varied usage. Globally, 67% of maize is used for livestock feed, 25% for human consumption and rest for industrial purposes. Morphologically maize exhibits greater diversity of phenotypes than any other grain crop (Kuleshov, 1933), and is extensively grown in temperate, subtropical and tropical regions of the world. The existence of variability is essential for resistance to biotic and abiotic factors and also for wider adaptability in genotypes. Genetic variability among individuals in population offers effective selection. The magnitude of genetic variability present in population is of paramount importance for the success of any plant breeding program. Knowledge of heritability and genetic advance of characters indicates scope for improvement of traits through selection. Hence the present study was under taken to estimate the genetic component of variance for grain yield and its related traits to compute broad sense heritability, genetic advance in maize.

MATERIALS AND METHODS

The present study was conducted at Research farm, College of Agriculture, ANGRAU, Rajendranagar, Hyderabad during *kharif*, 2011 in newly developed 65 maize genotypes. Each entry was raised in two rows with a row length of 4m and the spacing maintained was 75 cm between rows and 20 cm between plants. The recommended package of practices was followed to raise a good crop. Observations were recorded on five randomly selected plants for plant height, ear height, ear length, ear girth, number of kernel rows per ear, number of kernels per row, 100-kernel weight and grain yield per plant. However, observations for the characters namely days to 50 per cent tasseling, days to 50 per cent silking, days to maturity were recorded on plot basis. The mean values were used for statistical analysis. Analysis of variance was done for partitioning the total variation into variation due to treatments and replications according to procedure given by Panse and Sukhatme (1967). Heritability in broad sense was calculated by the formula given by Burton and Devane (1953). The estimates of genetic advance were obtained by the formula given by Johnson *et al.*, (1955).

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences for all the 11 quantitative traits studied which was presented in Table 1. Genotypic variability was high for grain yield (1484.31), plant height (507.87), ear height (155.34). Moderate estimates of genotypic variability recorded for number of kernels per row (25.66), 100-kernel weight (14.84), days to 50 per cent silking (14.31), days to 50 per cent tasseling (13.87), days to maturity (12.24). Whereas low genetic variability was recorded for ear length (3.91), ear girth (1.42), number of kernel rows per ear (1.20). High estimates of genotypic variance and phenotypic variance were recorded for grain yield, plant height, ear height, number of kernels per row and 100-kernel weight, thus indicating presence of sufficient inherent genetic variance over which selection can be effective. Similar results were reported by Rather *et al* (2003), Jawaharlal *et al* (2011) and Anshuman *et al* (2013). High to moderate PCV and GCV recorded for grain yield, number of kernel rows per ear, ear height, 100-kernel weight, ear length and plant height as presented in Table 2. suggesting sufficient variability and offers scope for selection. Similar results of PCV and GCV values for grain yield and other traits were reported by Zahid Mahmood *et al* (2004) and Abirami *et al* (2005). Heritablity was found to be high for grain yield (99.73), 100-kernel weight (98.70), number of kernels per row (97.99), ear length (92.16), number of kernel rows per ear (89.99), ear girth (89.08), days to 50 per cent tasseling (88.71), days to 50 per cent silking (88.60), days to maturity (83.30), ear height (80.54) and plant height (79.11) as presented in Table 2. High values of heritability in broad sense indicate characters is less influenced by environmental effects. Similar results were roprted by Chen *et al* (1991), Satyanarayan and Kumar (1995) and Ojo *et al* (2006).

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 (Johnson *et al*, 1995). 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. High to moderate heritability with moderate estimates of genetic advance were observed for grain yield, plant height, ear height, number of kernels per row, 100-kernel weight. High to moderate heritability along with moderate and low estimates of genetic advance were observed for days to 50 per cent tasseling, days to 50 per cent silking, days to maturity. Whereas high to moderate heritability along with low estimates of genetic advance were observed for ear length, ear girth and number of kernel rows per ear were presented in Table 2.

Table 1. Analysis of variance for different quantitative characters in Maize

S.No.	Characters	Mean Sum of Squares		
		Replication (df= 2)	Genotypes (df= 64)	Error (df= 128)
1	Days to 50% tasseling	2.06	43.37 **	1.76
2	Days to 50% silking	3.33	44.78 **	1.82
3	Days to maturity	8.55	39.19 **	2.45
4	Plant height (cm)	391.17	1657.71 **	134.09
5	Ear height (cm)	184.14	503.58 **	37.54
6	Ear length (cm)	1.48	12.06 **	0.33
7	Ear girth (cm)	0.86	4.45 **	0.17
8	Number of kernel rows per ear	0.03	3.73 **	0.13
9	Number of kernels per row	0.10	77.50 **	0.52
10	100-kernel weight (g)	0.04	44.72 **	0.19
11	Grain yield (g per plant)	2.13	4456.92 **	3.98

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

Table 2. Estimation of genetic parameters for different quantitative characters in Maize

Characters	$\sigma^2 g$	$\sigma^2 p$	Cofficient of Variation		h^2 (b.s) (%)	GA (%)		GA as percent mean	
			GCV (%)	PCV (%)		GA 5%	GA 1%	5%	1%
Days to 50% tasseling	13.87	15.63	7.43	7.89	88.71	7.22	9.26	14.43	18.49
Days to 50% silking	14.31	16.14	7.12	7.56	88.68	7.34	9.40	13.82	17.71
Days to maturity	507.87	641.96	10.01	11.26	79.11	41.29	52.91	18.35	23.51
Plant height (cm)	155.34	192.88	13.25	14.77	80.54	23.04	29.52	24.50	31.41
Ear height (cm)	12.24	14.70	3.97	4.35	83.30	6.58	8.43	7.46	9.56
Ear length (cm)	3.91	4.24	11.06	11.53	92.16	3.91	5.01	21.89	28.05
Ear girth (cm)	1.42	1.60	8.10	8.58	89.08	2.32	2.97	15.75	20.19
Number of kernel rows per ear	1.20	1.33	7.58	7.99	89.99	2.14	2.74	14.82	19.00
Number of kernels per row	25.66	26.18	15.01	15.16	97.99	10.32	13.23	30.61	39.23
100-kernel weight (g)	14.84	15.03	12.68	12.77	98.70	7.88	10.10	25.97	33.28
Grain yield (g per plant)	1484.31	1488.29	28.43	28.47	99.73	79.25	101.57	58.50	74.98

Where, σ^2g= Genotypic variance, σ^2p = Phenotypic variance, GCV=Genotypic coefficient of variation, PCV= Phenotypic coefficient of variation, h2 (bs)= Heritability broad sense, GA= Genetic advance

Characters like grain yield, plant height, ear height, number of kernels per row, 100-kernel weight exhibited moderate to high heritability along with high GCV and Genetic advance indicating additive gene action and provides scope for improvement of traits through selection. Whereas days to 50 per cent tasseling, days to 50 per cent silking, days to maturity, ear length, ear girth and number of kernel rows per ear exhibited moderate to high heritability along with low GCV and Genetic advance indicating non-additive gene action and provides limited scope for improvement of traits through selection. Similar results were reported by Zahid Mahmood *et al* (2004), Thanga Hemavathy *et al* (2008), Jawaharlal *et al* (2011) and Anshuman *et al* (2013).

CONCLUSION

High estimates of PCV and GCV were recorded for grain yield, number of kernel rows per ear, ear height, 100-kernel weight, ear length and plant height which provides considerable variability and offers scope for gentic improvement through selection. Further high to moderate heritability with moderate estimates of genetic advance were observed for grain yield, number of kernel rows per ear, ear height, 100-kernel weight, ear length and plant height indicating careful selection leads to improvement of traits. Thus provides better opportunities for selecting plant material for these traits in maize breeding program.

REFERENCES

Abirami, S., Vanniarajan, C and Armugachamy, S. (2005). Genetic variability Studies in maize (*Zea mays* L.) germplasm. Plant Archieves. 5 (1): 105-108.

Anshuman vashistha., Dixit, N. N., Dipika., Sharma, S. K and Marker, S. (2013). Studies on heritability and genetic advance estimates in Maize genotypes. Bioscience Discovery. 4(2): 165-168.

Burton, G. W and Devane, E. H. (1953). Estimating heritability in tall fascue (*Restuca arundican*) from replicated clonal material. Agronomy Journal. 45(1): 478-481.

Chen ling, Cuishaoping, Chen, L., Cui, A. P and Sun, Y. B. (1996). Analysis of the gene effect on ear characters in maize. Acta Agricultural Bareli Sinica. 11(2): 28-32.

Jawaharlal, J., Lakshmikantha Reddy, G and Sai Kumar, R. (2011). Genetic variability and character association studies in maize. Agriculture Science Digest. 31 (3): 173-177.

Johnson, H. W., Robinson, H. F and Comstock, R. E. (1955). Estimates of genetic and environmental variability in soybean. Agronomy Journal. 47: 314-318.

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Kuleshov, N.N. (1933). World`s diversity of phenotypes of maize. Journal of Agronomy. 25: 688-700.

Ojo, D.K., Omikunle, O.A., Oduwaye, O.A., Ajala, M.O and Ogunbayo, S. A. (2006). Heritability, character correlation and path coefficient analysis among six inbred-lines of maize (*Zea mays* L.). World Journal of Agricultural Sciences. 2 (3): 352-358.

Panse and Sukhatme, P. V. (1967). *Satistical methods for agricultural workers* (IInd ed.), ICAR Publications, New Delhi.

Rather, A. G., Bhatt, M. A and Zargar, M. A. (2003). Genetic variation in maize (*Zea mays* L.) population in high altitude temperate conditions in Kashmir. Indian Journal of Agricultural Sciences. 79(3): 179-180.

Satyanarayana, E and Sai Kumar, R. (1995). Genetic variability and *Per se* performance of non conventional hybrids in maize. Mysore Journal of Agricultural Sciences. 29(3): 213:218.

Thanga Hemavathy, A., Balaji, K., Ibrahim, S.M., Anand, G and Deepa Sankar. (2008). Genetic variability and correlation studies in Maize (*Zea mays* L.). Agriculture Science Digest. 28 (2) : 112 – 114.

Zahid Mahmood., Shahid Raiz Mailk, Raheel Akthar and Tariq Rafique. (2004). Heritability and genetic advance estimates from maize genotypes in Shishi Lusht a valley of Krakurm. International Journal of Agriculture and Biology. 2 (2): 253-257.