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Research article

ESTIMATES OF VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN CERTAIN INBREEDS OF MAIZE (*Zea mays*, L.)

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ABSTRACT: Genetic variability, heritability (broad sense) and genetic advance were studied in 39 inbreeds of maize. The data were recorded on twelve quantitative traits viz., days to 50% silking, days to 50% tasseling, plant height (cm), ear height (cm), ear length (cm), ear diameter (cm), ear weight without husk (g). ear weight with husk (g), number of kernel rows per ear, number of kernels pr row, 100-seed weight and grain yield per palnt (g). Significant differences among the genotypes were observed for all the characters under study. The phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were highest for characters namely, ear weight without husk, ear weight with husk, number of kernels per row, 100 grain weight and grain yield per plant suggesting that these characters are under the influence of genetic control. High values of heritability coupled with high genetic advance as per cent of mean was noticed for traits viz., grain yield per plant, ear height, plant height, number of kernels per row, number of kernel rows per ear, ear length, 100 grain weight, ear weight with husk and without husk indicating their effectiveness in selection.

Key words: PCV, GCV, heritability, genetic advance, genetic advance as per cent of mean.

INTRODUCTION

Genetic variability is the pre requisite for any crop improvement programme. Improvement in any trait depends solely on the amount of variability present in the base material for that trait. The study of genetic parameters like genotypic coefficient of variation, phenotypic coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean provides a clear cut idea about the extent of variability present in a plant population and a relative measure of efficiency of selection of genotypes based on phenotype in a highly variable population. The aim of this study is to work out the magnitude and extent of genotypic and phenotypic coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean in thirty nine inbreds of maize (*Zea mays*, L.) for twelve quantitative characters under Genetic advance as per cent of mean was also high for grain yield per plant, ear height, plant height, number of kernels per row, number of kernel rows per ear, ear length, 100 grain weight, ear weight with husk and without husk, under Varanasi condition.

MATERIALS AND METHODS

The experimental materials consisted of 39 diverse germplasm of maize obtained from all the All India Co-ordinated Maize Improvement Project, Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The details are presented in Table 1. Thirty nine genotypes were sown on 10th December, 2011 in Randomized Block Design with three replications. Each entry was sown as single row of 3 meter length with row-to-row and plant-to-plant distance of 60 cm and 20 cm respectively. Initially two seeds per hill were sown and later on one plant was thinned to maintain single plant per hill. Two border rows were also planted to avoid the border effect. The crop was raised as per the recommended package of practices. . The observations on twelve quantitative characters namely days to 50% silking, days to 50% tasseling, plant height (cm), ear height (cm), ear length (cm), ear diameter (cm), ear weight without husk (g). ear weight with husk (g), number of kernel rows per ear, number of kernels pr row, 100-seed weight and grain yield per palnt (g) were recorded. Observations were recorded on five plants selected at random from each genotype in each replication and were averaged. The data was analysed
Using WINDOSTAT software and PCV, GCV, heritability (broad sense), genetic advance (GA) and genetic advance as per cent of mean were estimated in 39 inbreds for all twelve traits under study.

Table 1. List of thirty nine genotypes

Sl. No	Genotypes	Origin	Sl. No	Genotypes	Origin
1	HUZM-536	BHU, Varanasi	21	HUZM-722	BHU, Varanasi
2	HUZM-4	BHU, Varanasi	22	HUZM-48	BHU, Varanasi
3	HKI 323	Karnal	23	HUZM-67	BHU, Varanasi
4	LM-10	Ludhiana	24	HUZM-1	BHU, Varanasi
5	CML-161	CIMMYT, Mexico	25	HUZM-3	BHU, Varanasi
6	HKI 1105	Karnal	26	HUZQPM-7	BHU, Varanasi
7	HUZM-185	BHU, Varanasi	27	LTP-3	Ludhiana
8	HUZM-711	BHU, Varanasi	28	LM-6	Ludhiana
9	HUZM-705	BHU, Varanasi	29	LM-16	Ludhiana
10	HUZM-53	BHU, Varanasi	30	P-7421	Pantnagar
11	HUZM-65-1	BHU, Varanasi	31	DMSC-4	DMR, New Delhi
12	HUZM-70-1	BHU, Varanasi	32	WIN PINK L5-1	DMR, New Delhi
13	HUZM-77	BHU, Varanasi	33	HKI 17-2	Karnal
14	HUZM-79	BHU, Varanasi	34	HUZQPM-8	BHU, Varanasi
15	HUZM-427	BHU, Varanasi	35	72149	DMR, Hyderabad
16	HUZM-446	BHU, Varanasi	36	17	DMR, Hyderabad
17	HUZM-488	BHU, Varanasi	37	102	DMR, Hyderabad
18	HUZM-509	BHU, Varanasi	38	294	DMR, Hyderabad
19	HKI 193-1	Karnal	39	1033-1	DMR, Hyderabad
20	HUZM-329	BHU, Varanasi			

RESULTS AND DISCUSSION

The data were subjected to RBD analysis, the results given in Table 2 indicate that the treatment differences were found significant for all twelve characters studied, this indicated sufficient variability existing in the material under study. The estimates of variability, heritability and genetic advance as per cent of mean in 39 genotypes for 12 characters under study were given in Table 3. The phenotypic coefficient of variability and genotypic coefficient of variability were highest for ear weight without husk, ear weight with husk, number of kernels per row, 100 grain weight and grain yield per plant suggesting that these characters are under the influence of genetic control. Hence, these characters can be practiced for further improvement. High phenotypic and genotypic coefficient of variability for number of kernels per row, 100 grain weight and grain yield per plant was also reported by Kumar *et al*., 2006 and Sofi and Rather, 2007. Days to 50% tasseling recorded low genotypic coefficient of variation indicating the predominance of non-additive gene action. This is in conformity with the findings of Raju, 2001. The PCV was slightly higher than the GCV for all the characters studied, which indicated that environment also played a considerable role in expression of these characters, these results are in consonance with Kumar *et al*., 2011. There was a close resemblance between PCV and GCV for all the characters indicating that selection for these characters would be effective. This is in conformity with the findings of Alake *et al.,* 2008. Heritability estimates revealed the heritable portion of variability present in different characters. The knowledge of heritability enables the plant breeder to decide the course of selection procedure to be followed under a given situation (Li and Yang, 1985). However, heritability values coupled with genetic advance would be more reliable and useful in formulating selection procedure. Heritabilty estimates were high for all the characters studied. This suggested the greater effectiveness of selection and improvement to be expected for these characters in future breeding programme as the genetic variance is mostly due to the additive gene action. Similar results were observed by several workers, high heritability estimates for plant height, number of kernels per row (Najeebet *et al.,* 2009 and Gautham *et al.,* 2011), ear diameter (Singhal *et al.,* 2006 and Kumar *et al.,* 2011;), ear weight with husk and without husk (Ojo *et al.,* 2006) and grain yield per plant (Sofi and Rather, 2007 ; Alake *et al*., 2008 and Rafiq *et al.,* 2010). Genetic advance as per cent of mean was also high for grain yield per plant, ear height, plant height, number of kernels per row, number of kernel rows per ear, ear length, 100 grain weight, ear weight with husk and without husk. Similar results were observed for plant height (Najeeb *et al.,* 2009 and Rafiq *et al.,* 2010), ear length, number of kernels per row (Rafiq *et al.,* 2010,) grain yield (Rafiq *et al.,* 2010 and Kumar *et al.,* 2011). The high heritability coupled with high genetic advance noticed for these traits indicate the role of additive gene action in controlling the traits, hence pedigree method of breeding will be a rewarding one to improve the traits under investigation.

Similar results were observed by several workers. High heritability coupled with high genetic advance for plant height was reported by Singhal *et al.*, 2006 and Alake *et al.*, 2008. High heritability coupled with high genetic advance for ear height, number of kernel rows per ear was reported by Alake *et al.*, 2008. High heritability coupled with high genetic advance for number of kernels per row was reported by Alake *et al.*, 2008. High heritability coupled with high genetic advance for 100 grain weight was reported by Gautham *et al.*, 2011 and for grain yield per plant, high heritability coupled with high genetic advance was reported by Alake *et al.*, 2008 and Kumar *et al.*, 2011. Other traits like days to 50% tasseling and days to 50% silking recorded high heritability with low genetic advance as per cent of mean, indicating that the characters were influenced by the environment and were not stable.

Table 2. Analysis of variance for twelve characters in maize

Source of variation	d.f	Days to 50% tasseling	Days to 50% silking	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear diameter (cm)	Ear weight without husk (g)	Ear weight with husk (g)	Number of kernel rows per ear	Number of kernels per row	100 grain weight (g)	Grain yield per plant (g)
Replications	2	0.717	2.111	7.031	6.285	1.208	0.005	21.482	5.875	0.243	0.824	1.285	62.106
Genotypes	38	63.719**	74.418**	759.404**	141.866**	12.000**	0.304**	1903.889**	1897.656**	7.592**	65.268**	43.051**	756.831**
Error	76	0.726	1.076	15.567	8.419	0.594	0.046	17.227	21.447	0.620	1.492	0.622	20.763
S.E. m±		0.492	0.598	2.278	1.675	0.445	0.123	2.396	2.673	0.454	0.705	0.455	2.630
C.V (%)		0.752	0.895	3.730	7.210	5.137	5.287	5.279	4.606	6.127	5.566	3.661	7.940
C.D (5%)		1.386	1.686	6.416	4.718	1.253	0.349	6.749	7.531	1.281	1.986	1.282	7.410

**Significant at 1 percent level.

Table 3. Estimation of variability, heritability and genetic advance as per cent of mean for twelve characters in thirty nine genotypes of maize

S. No.	Characters	Mean ± S.E. m	Range		PCV (%)	GCV (%)	h^2_{bs} (%)	GA as % of mean
			Minimum	Maximum				
1	Days to 50% tasseling	113.333 ± 0.492	104.333	121.666	4.113	4.043	96.700	8.189
2	Days to 50% silking	115.838 ± 0.598	106.333	124.000	4.361	4.268	95.800	8.606
3	Plant height (cm)	105.753 ± 2.278	79.790	146.333	15.350	14.890	94.100	29.753
4	Ear height (cm)	40.200 ± 1.675	25.143	58.723	18.093	16.591	84.100	31.340
5	Ear length (cm)	15.005 ± 0.445	11.206	21.643	13.973	12.995	86.500	24.895
6	Ear diameter (cm)	4.059 ± 0.123	3.253	4.600	8.953	7.225	65.100	12.010
7	Ear weight without husk (g)	78.617 ± 2.396	39.333	122.666	28.423	27.292	97.300	53.984
8	Ear weight with husk (g)	100.527 ± 2.673	54.000	143.666	25.300	24.877	96.700	50.390
9	Number of kernel rows per ear	12.858 ± 0.454	8.256	15.866	13.346	11.856	78.900	21.697
10	Number of kernels per row	21.949 ± 0.705	10.780	34.000	21.732	21.007	93.400	41.830
11	100 grain weight(g)	21.544 ± 0.455	12.803	29.813	17.836	17.456	95.800	35.194
12	Grain yield per plant (g)	57.393 ± 2.630	26.470	105.393	32.332	31.898	92.200	64.829

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