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Studies on Genetic Variability, Heritability and Genetic Advance Estimates in Maize (*Zea mays* L.)

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ABSTRACT

An investigation was carried out to assess the variability, heritability and genetic advance for thirteen characters *viz.,* days to 50% tasseling, days to 50% silking, days to maturity, plant height, ear height, cob length, kernel rows per cob, number of kernels per row, leaf number, relative growth rate (RGR) 60-90 days after sowing (DAS), net assimilation rate (NAR) 60-90 DAS, 100-seed weight and grain yield per plant in 30 genotypes (twenty one hybrids, seven parents along with two checks, DHM 117 and 30 V 92) of maize. The analysis of variance indicated significant differences among the 30 genotypes for all the characters studied. The results revealed that high PCV and GCV were recorded for plant height, ear height, number of kernels per row, 100-seed weight and grain yield per plant. The estimates of heritability and genetic advance as per cent of mean were high for the characters *viz.,* plant height, ear height, cob length, number of kernels per row, leaf number, RGR 60-90 DAS, NAR 60-90 DAS, 100-seed weight and grain yield per plant indicating that most likely the heritability is due to additive gene action and selection may be effective.

Key words : Genetic advance, Heritability, Maize, Variability.

Maize is the third most important cereal in India after rice and wheat. It ranks first in both productivity and production among the cereals and is having worldwide significance due to its demand as food, feed and industrial utilization. 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. Hence, insight into the magnitude of genetic variability present in a population is of paramount importance to a plant breeder for starting a judicious breeding programme. Knowledge of heritability and genetic advance of the character indicate the scope for the improvement of a trait through selection. Heritability estimates along with genetic advance are also helpful in predicting the gain under selection (Johnson *et al.,* 1955). Hence, the present study was carried out to have knowledge on genetic variability, heritability and genetic advance as per cent of mean present in the available genetic material

MATERIAL AND METHODS

Crossing programme with seven inbred lines in diallel fashion as suggested by Griffing (1956) without reciprocals (Method-2) was effected during *kharif* 2013 to generate twenty one hybrids. The twenty one hybrids, seven inbred lines along with two standard checks (DHM 117 and 30 V 92) were evaluated for different traits was carried out at Agricultural College Farm, Bapatla during *rabi,* 2013-14 in Randomized Complete Block Design (RCBD) with three replications. Observations were recorded for thirteen quantitative characters *viz.,* days to 50% tasseling, days to 50% silking, days to maturity, plant height, ear height, cob length, kernel rows per cob, number of kernels per row, leaf number, relative growth rate (RGR) 60-90 days after sowing (DAS), net assimilation rate (NAR) 60-90 DAS, 100-seed weight and grain yield per plant. The data were subjected to statistical analysis and various genetic parameters such as genotypic and phenotypic coefficients of variation were calculated according to the method suggested by Burton (1952) and heritability estimates were obtained following the method of Hanson *et al.* (1956). The genetic advance as per cent of mean was calculated by the formula given by Johnson *et al.* (1955).

RESULTS AND DISCUSSION

The analysis of variance revealed significant differences among all the 30 genotypes

Table 1. Analysis of variance for yield and yield component characters in maize (*Zea mays* L.)

Source of variations	d.f.	Days to 50% tasseling	Days to 50% silking	Days to maturity	Plant height	Ear height	Cob length	Kernel rows per cob	Number of kernels per row	Leaf number	RGR 60-90	NAR 60-90	100-seed weight	Grain yield per plant
Replications	2	0.211	0.011	2.344	69.287	5.381	3.244	0.009	11.417	0.131	0.206	0.000	0.585	120.213
Entries	29	35.381**	44.613**	17.700**	6037.835**	2074.713**	19.349**	4.816**	164.774**	8.586**	14.241**	0.042**	55.954**	3589.756**
Error	58	0.751	0.965	3.965	243.252	33.543	1.530	0.599	4.555	1.138	1.402	0.002	0.605	106.220

** Significant at 1% level

Table 2. Estimates of variability, heritability and genetic advance as per cent of mean for grain yield and yield components in maize (*Zea mays* L.)

S. No.	Character	Mean	Range		Coefficient of variation		Heritability (broad sense)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1.	Days to 50% tasseling	52.72	47.00	58.33	6.65	6.44	93.90	12.86
2.	Days to 50% silking	56.41	49.33	63.33	6.98	6.76	93.80	13.49
3.	Days to maturity	85.98	80.33	89.67	3.40	2.49	53.60	3.75
4.	Plant height (cm)	201.50	120.27	264.93	23.14	21.81	88.80	42.34
5.	Ear height (cm)	90.43	44.03	130.50	29.55	28.85	95.30	58.01
6.	Cob length (cm)	16.75	10.83	21.43	16.32	14.55	79.50	26.73
7.	Kernel rows per cob	14.41	11.67	16.80	9.83	8.23	70.10	14.20
8.	Number of kernels per row	27.88	10.83	39.23	27.31	26.21	92.10	51.83
9.	Leaf number	12.10	8.03	14.63	15.72	13.02	68.60	22.21
10.	RGR 60-90	17.32	12.07	21.41	13.76	11.95	75.30	21.36
11.	NAR 60-90	0.61	0.33	0.76	20.34	18.75	85.00	35.60
12.	100-seed weight (g)	16.40	7.17	25.33	26.62	26.19	96.80	53.10
13.	Grain yield per plant (g)	77.57	25.97	154.47	45.90	43.93	91.60	86.62

PCV = Phenotypic coefficient of variation GCV = Genotypic coefficient of variation for all the characters studied indicating a high degree of variability in the material (Table 1). In the present study, the variation among genotypes was estimated as coefficient of variation and the phenotypic coefficient of variance (PCV) was slightly higher in magnitude than genotypic coefficient of variance (GCV) for all the characters studied indicating the influence of environment on expression of these traits (Table 2). High PCV and GCV were recorded for plant height (The variation for this character ranged from 120.27 cm to 264.93 cm with a mean of 201.50 cm), ear height (The variation for this character ranged from 44.03 cm to 130.50 cm with a mean of 90.43 cm), number of kernels per row (The range of variation for number of kernels per row varied from 10.83 to 39.23 with a mean of 27.88), 100-seed weight (The variation for 100-seed weight was ranged from 7.17 g to 25.33 g with a mean of 16.40 g) and grain yield per plant (This character possessed significant variation which was ranged from 25.97 g to 154.47 g with a mean of 77.57 g) indicating high variation among the genotypes studied. These results were in accordance with the findings of Reddy *et al.* (2012) and Reddy *et al.* (2013) for grain yield per plant. Moderate PCV and GCV were recorded for cob length, leaf number and RGR 60-90 DAS while days to 50% tasseling, days to 50% silking, days to maturity and kernel rows per cob exhibited low PCV and GCV.

Heritability is a measure of genetic relationship between parents and progeny. In the present study, heritability estimates were high for days to 50% tasseling, days to 50% silking, plant height, ear height, cob length, kernel rows per cob, number of kernels per row, leaf number, RGR 60-90 DAS, NAR 60-90 DAS, 100-seed weight and grain yield per plant. Moderate heritability was recorded for days to maturity. The maximum value for heritability was recorded by 100-seed weight (96.80%) and minimum was recorded by days to maturity (53.60%).

High heritability alone is not sufficient enough to exercise selection unless the information is accompanied with substantial amount of genetic advance. Thus genetic advance is another important selection parameter which is exploited along with heritability to predict the genetic advance of the trait. The estimates of heritability and genetic advance as per cent of mean were high for plant height, ear height, cob length, number of kernels per row, leaf number, RGR 60-90 DAS, NAR 60-90 DAS, 100-seed weight and grain yield per plant indicating the predominance of additive gene action and hence simple selection may be rewarding. These findings was in agreement with Nataraj *et al.* (2014) for plant height, ear height, cob length, number of kernels per row, 100-seed weight and grain yield per plant.

High heritability coupled with moderate genetic advance as per cent of mean was observed for days to 50% tasseling, days to 50% silking and kernel rows per cob indicating the role of both additive and non-additive gene actions in the inheritance of these traits and can be improved either by population improvement methods or even heterosis breeding methods like production of hybrids and synthetics. While moderate heritability coupled with low genetic advance as per cent of mean was observed for days to maturity indicating the role of non-additive gene action and can be improved by population improvement methods involving selection, intermating among selected ones and reselection may help to improve these traits besides exploiting the methods of heterosis breeding.

Thus, the characters *viz.,* plant height, ear height, cob length, number of kernels per row, leaf number, RGR 60-90 DAS, NAR 60-90 DAS, 100-seed weight and grain yield per plant having high heritability and genetic advance as per cent of mean can be exploited in the breeding programmes by using simple selection.

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