IJABR, VOL.7 (3) 2017: 549-551 ISSN 2250 – 3579

INTERNATIONAL JOURNAL OF ADVANCED BIOLOGICAL RESEARCH

EXTENT OF GENETIC VARIABILITY IN OVER ENVIRONMENTS OF DIFFERENT LAND RACES OF MAIZE (*ZEA MAYS* L.)

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ABSTRACT
Present study was carried out to ascertain the extent of genetic variability in the population of 51 different land races with respect to yield and its attributes in maize. In pooled analysis of variance, the environmental variances were significantly high for plant height, ear height, number of cobs per plot and shelling (%). It indicates that very high influence of over years on the expression of these traits. Genotypic component of variance was higher than environmental component for days to 50% pollen shed, days to 50% silking, days to 75% dry husk and grain yield per ha. The moderate genotypic coefficient of variation (GCV %) was observed for grain yield per ha. (11.35%), 100 seed weight (10.74%), Ear height (9.76%). Moderately high heritability estimates were observed for days to 75% dry husk (68.0%), days to 50% pollen shed (66.0%), days to 50% silking (57.0 %) and 100 seed weight (48.0%).

KEYWORDS: Maize land races, Genotypic coefficient of variation (GCV %), Phenotypic coefficient of variation (PCV %), Heritability and Genetic advance**.**

INTRODUCTION
Maize (Zea mays) is the third most important cereals in India as well as world after rice and wheat FAO, 2002; CMIE, 2015). In India, about 55% of maize produced is used for food purposes, about 14% as livestock feed, 18% as poultry feed, 12% in wet milling industry (*i.e*., starch and oil production) and 1% as seed. Maize being a C_4 plant is physiologically more efficient, has higher kernel yield and wider adaptation over wide range of environmental conditions (Reddy & Jabeen, 2016). It has been widely cultivated as a *kharif* crop in India, but with the evolution of new improved hybrids and assured availability of irrigation facility, it can be successfully grown during *rabi* in many parts of the country. The yield level of maize during *rabi* season is considerably higher than that of *kharif* due to its higher water and fertilizer use efficiencies. In addition, the recent put more importance on the development of hybrid meant for both the seasons has remunerated surplus in the terms of higher maize production and productivity in the country. Sufficient variability provides options from which selection are made for genetic improvement and breeding purpose. The magnitude of genetic variability is of greatest interest to researchers since it plays a vital role in framing successful breeding programme for development of new cultivars and other breeding lines. To utilize present material in breeding programme, it is essential to study variability and partition of lines based on variability present in it thus the present investigation was undertaken to estimate extent of genetic variability through different parameters *i.e*., Genotypic Coefficient of Variation (GCV), Phenotypic Coefficient of Variation (PCV), heritability (bs %), Genetic Advance (GA), etc for kernel yield and its attributes in different land races of maize.

MATERIALS & METHODS
The experiment was performed to evaluate 51 different land races of maize. The experiment was conducted in three consecutive years (*kharif* 2014-2016) in randomized block design at Maize Research Station, S. D. Agricultural University, Bhiloda. Each genotype was grown in two rows of 3m length with 60 x 20 (cm^2) spacing. The size of net plot was $3.6m^2$ and each plot >90 per cent plant population were maintained. The data were recorded from five randomly selected plants from each entry in each replication for plant height (cm), ear height (cm), 100 seed weight (g) and shelling (%) whereas days to 50 % tasseling, days to 50% silking days to 75 % dry husk were recorded on visual basis per plot while number of cobs and cob weight were measured from plot basis. The grain yield (kg/ ha.) for each genotype was estimated by reducing grain moisture content to 15% with step wise formula. (a) grain yield at observed grain moisture content [cob yield (kg/plot) at harvest x Multiple factor for ha x shelling proportion (%)], (b) grain dry matter content = 1-moisture per cent at harvest, (c) grain yield at 15% grain moisture content=[(grain yield at observed grain moisture content x grain dry matter content)/0.85], (d) grain yield at 15 % grain moisture content = [(grain yield at 15% grain moisture content)/100]. The mean of the data recorded over years were used for statistical analysis. The analysis of variance was calculated with the method suggested by Panse and Sukhatme, 1985. The genotypic and phenotypic coefficients of variation (GCV and PCV) were estimated as per Burton, 1953, while classification of GCV and PCV were followed by Sivasubramanian and Madhavamenon, 1973. Heritability in the broad sense and genetic advance (GA), suggested by Allard, 1960 and genetic gain

expressed as a percentage of mean were computed according to Johnson *et al.*, 1955.

RESULTS & DISCUSSION

The analysis of variance revealed the existence of considerable genetic differences among the genotypes for all the traits (Table 1). This indicated suitability of experimental material for estimation of genetic parameters. In pooled analysis of variance, the environmental variances were significantly high for plant height, ear height, number of cobs per plot and shelling (%). This indicated very high influence of over years on the expression of these traits in maize land races (Table 1). The genotypic variation for grain yield and its attributing traits were highly significant among all the genotypes. Mean value for grain yield per ha. ranged from 2521.37 kg (LR-43) to 5265.47 kg (LR-29). The overall mean was estimated as 3776.71 kg. The estimates of genotypic, phenotypic and environment variance were 183840.6, 1204716 and 1020875 respectively (Table 2). The phenotypic range of variation is not the precise criterion to estimate the amount of genetic variability present in a breeding population. The other genetic parameters such as variance components, genotypic coefficient of variation, heritability and genetic advance are important to get an idea about the extent of genetic variability more precisely. The phenotypic variance was partitioned into its genotypic and environmental components. Genotypic component of variance was higher than environmental component for days to 50% pollen shed, days to 50% silking, days to 75% dry husk and grain yield per ha. indicating phenotypic variability was a reliable measure of genotypic variability. Therefore, selection would be effective for these characters. High to medium estimates of genotypic and phenotypic variances were observed for most of the traits. (Table 2). Similar finding were also reported by Ogunniyan and Olakojo (2014). Low estimates of genotypic variance were recorded for number of cobs per plot (1.91) and cob weight per plot (0.027) (Table.2). Thus, the variation in these yield contributory traits was under genetic control. Hence, selection for these traits population studied would be effective for its improvement. However, these genotypic, phenotypic and environmental variances components do not provide an exact measurement of variation for its comparison among the characters because they are based on different units of measurements having different means. Hence, genotypic coefficient of variation and phenotypic coefficient of variation were computed to compare variability of various traits. Earlier Satanarayana and SaiKumar (1996), Sumalini and Manjulatha (2012) also reported role of environment and genetic factor for yield and its component traits in maize.

The moderate genotypic coefficient of variation (GCV %) was observed for grain yield (11.35%), 100 seed weight (10.74%), Ear height (9.76%) (Table 3). Such level of GCV (%) was also reported by Ogunniyan and Olakojo (2014) for ear par plant. ear and grain yield, Sumalini and Manjulatha (2012) for yield and its component traits in maize. A wide difference was observed between GCV and PCV for yield and attributes indicating that environment played very a visible role for expression of traits. Heritability indicates the effectiveness of selection of genotypes which could be based on phenotypic performance. The expected genetic advance under selection gives clear idea of possible change in mean value in the generation trailing of selection. Moderately high heritability estimates were observed for days to 75% dry husk (68.0%), days to 50% pollen shed (66.0%), days to 50% silking (57.0 %) and 100 seed weight (48.0%). Whereas traits like total plant height (38.0%) and ear height (33.0%) had moderate heritability. Traits like shelling percent (28.0%) number of cobs per plot (21.0%), grain yield (15.0%) and cob weight per plot (12.0%) confined low heritability. Medium to high level of heritability also observed earlier by Reddy and Jabeen (2016). Sumalini and Manjulatha (2012) also reported high heritability for days to 50% silking in maize. Overall yield and attributes confined moderate to low level of heritability coupled with low genetic advance in most of the trait studies, thus the substantial contribution of non-additive genetic variance combined with visible effects of environment for expression of these traits, environment was played a significant role over years on the expression of these yield and its component traits in maize land races.

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TABLE 1: Analysis of variance (ANOVA) showing mean squares of different land races of maize

Source of variation	d.f.	Days to 50% Pollen shed	Days to 50% Silking	Days to 75% Dry husk	Plant Height (cm.)	Ear Height (cm.)	Number of Cobs per Plot	Cob wt. per Plot (Kg)	100-seed weight	Shelling (%)	Grain yield (kg/ha)
Environment	2	0.160	2.85	15.98	1551.49**	747.11**	14.71**	0.28	1.79	119.33**	1766896
Replication	1	1.44	0.33	2.04	60.36	89.29	4.23	0.022	1.54	31.71	232.62
Genotypes	50	43.60**	40.05**	77.74**	1695.70**	818.06**	18.67**	0.36**	65.87**	164.36**	2123919.04**
Error	250	3.39	4.49	5.62	360.91	203.88	7.24	0.20	10.06	48.86	1020875.326
S.Em.±		0.74	0.85	0.95	7.68	5.77	1.09	0.18	1.28	2.82	408.42
C.D. at 5%		2.09	2.40	2.70	21.60	16.23	3.06	0.50	3.61	7.95	1148.91
C.V. %		3.47	3.69	2.87	9.80	13.77	10.69	23.93	11.18	9.09	26.75

*,** Significant at 5 % and 1% level respectively

TABLE 2: Range, mean and components of variances of various characters in maize

Characters	Range	Mean	Components of variance		
			Genotypic	Phenotypic	Environmental
Days to 50% Pollen shed	49.17-58.67	53.02	6.70	10.09	3.39
Days to 50% Silking	53.50-63.34	57.38	5.93	10.41	4.49
Days to 75% Dry husk	75.67-88.17	79.83	12.02	17.64	5.62
Plant Height (cm.)	153.54-227.44	170.88	222.47	583.37	360.91
Ear Height (cm.)	75.55-127.14	87.05	102.36	306.25	203.89
Number of Cobs per Plot	21.67-28.34	25.83	1.91	9.15	7.24
Cob wt. per Plot (Kg)	1.12-2.37	1.61	0.027	0.224	0.197
100-seed weight	23.02-35.40	28.39	9.30	19.37	10.06
Shelling (%)	55.65-85.34	79.91	12.25	68.11	48.86
Grain yield (kg/ha)	2521.37-5265.47	3776.71	183840.6	1204716	1020875

TABLE - 3 : Genotypic and phenotypic coefficient of variation , heritability, expected genetic advance and genetic advance in per cent of mean for different characters in maize

S.N	Characters	Genotypic coefficient of variation (GCV %)	Phenotypic coefficient of variation (PCV %)	Heritability (broad sense %)	Expected genetic advance	Genetic advance in per cent of mean
1.	Days to 50% Pollen shed	4.88	5.99	66.0	4.34	8.19
2.	Days to 50% Silking	4.24	5.62	57.0	3.78	6.59
3.	Days to 75% Dry husk	4.20	5.08	68.0	5.90	7.14
4.	Plant Height (cm.)	7.70	12.46	38.0	18.97	9.79
5.	Ear Height (cm.)	9.76	16.88	33.0	12.05	11.62
6.	Number of Cobs per Plot	5.48	12.02	21.0	1.30	5.15
7.	Cob wt. per Plot (Kg)	8.93	25.54	12.0	0.12	6.44
8.	100-seed weight	10.74	15.50	48.0	4.35	15.34
9.	Shelling (%)	5.71	10.73	28.0	4.81	6.25
10.	Grain yield (kg/ha)	11.35	29.06	15.0	345.04	9.14