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ORIGINAL ARTICLE

ASSESSMENT OF GENETIC VARIABILITY FOR MORPHOECONOMIC TRAITS IN QUALITY PROTEIN MAIZE INBREDS

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ABSTRACT

Variation and selection are the two basic requirements of genetic improvement in any crop. Without variation, selection becomes ineffective. Almost all morpho-economic traits exhibited wide array of genetic variation. Estimates of PCV and GCV in the present investigation were very close in all characters except days to 75% dry husk, no. of rows per cob, no. of grains per row and single plant yield indicating selection on phenotypic values of such characters.All traits except those concerning to maturity revealed high genetic variability in terms of GCV and PCV. The highest genotypic coefficient of variation was observed in grain yield per plant (27.69%) followed by 25.96% in number of grains per row and 21.40% in ear height indicating vast scope of selection for improvement of these traits. Among the character studied, grain yield per plant followed by number of grains per row, ear height, plant height and cob length exhibited high genetic advance (30.45 - 53.64%) coupled with high heritability (88.45 - 99.77%) indicating presence of additive gene action for these characters. So, selection of genotypes basing on these characters can be fairly reliable.

Key words: Genetic variability, genetic advance, heritability, morpho-economic traits, QPM maize

INTRODUCTION

Maize is the most important cereal crop in the world after wheat and rice. It has great yield potential and attained the leading position among cereals based on production as well as productivity of global level. In India 77% of maize produced is used for human consumption, while only 2% is used as feed for animals. This indicates the importance of maize in India, and the role it plays in meeting the ever-increasing demand for food and also warrants the development of new, high yielding varieties and hybrids of maize.

Maize endosperm harbour 9-11% crude protein, but deficient in lysine and tryptophan. Discovery of *opaque* 2 mutation made maize endosperm nearly twice as nutritious as those found in normal maize. This gave birth of quality protein maize having tryptophan content on an average more than 0.50% and lysine more than 2.50%. Therefore, a major emphasis was laid on conversion of normal genotypes to opaque-2 versions in recent years. The major breeding approach for increasing productivity rely on production of hybrids using heterosis breeding. In this context, the first step is to develop maize inbred lines and assess the extent of genetic variability. The present pursuit entails study of genetic variation in a set of 49 inbreds of maize for morpho-economic characters including seed yield *per se*.

MATERIALS AND METHODS

The experimental materials used in the present investigation comprised 49 inbreds developed from different maize populations received from Directorate of Maize Research, New Delhi; Agril. Research Station, Karnal, Haryana and CIMMYT, Hyderabad (INDIA).The experiment was laid out in a randomized complete block design (RCBD) with three replications. Each inbred line was sown in two rows of 4 meter length with a spacing of 60cm x 25cm. Fertilizers were applied at the rate of 120 kg N, 60 kg P_2O_5 and 60 kg K_2O per hectare in the form of Urea, SSP and MOP respectively along with FYM 12 cart loads/ha and Zinc Sulphate 25kg/ha. In order to ensure uniform plant stand 2 seeds were dibbled per hill and later thinned to one seedling per hill. Normal agronomic practices and plant protection measures were applied to raise a successful crop. Need based irrigation was given to avoid problems due to moisture stress.

The analysis of variance was carried out separately for each morpho-economic trait including seed yield/plant following the procedures of Panse and Sukhatme, 1985. The genotypic co-efficient of variation (GCV) and the phenotypic co-efficient of variation (PCV) were calculated by the formulae given by Burton (1952). Heritability (h_b) estimation was worked out by using the formulae suggested by Lush (1949) and genetic advance was estimated as per the formula suggested by Johnson (1955).

RESULTS AND DISCUSSION

For genetic improvement of any character, existence of genetic variability is a pre-requisite as It is the genetic component of the variation that responds to selection. Therefore, knowledge on the extent of genetic variability with regards to various traits and their nature of transmission to the succeeding generations is indispensable for reliable selection. Most of the economically important traits in crop plants are quantitative in nature with polygenic inheritance whose expression is very much influenced by environment. The degree of environmental effect on the expression of a quantitative character affects the efficacy of phenotypic selection for the character. The magnitudes of variability with regard to range, phenotypic and genotypic coefficient of variation for all ten agro-economic characters are presented in Table 1. All morpho-economic traits exhibited wide array of genetic variation in terms of range and it was very high in case of plant height, no. of grains per row and seed yield/plant. In general, phenotypic coefficient of variation was higher than the estimates at genotypic level suggesting the relative influence of environment in expression of the characters. Estimates of PCV and GCV in the present investigation were very close in all characters except days to 75% dry husk, no. of rows per cob, no. of grains per row and single plant yield which indicates negligible influence of environment and such characters may be considered stable. Hence, selection on phenotypic values of such characters is expected to be effective. Whereas, the influence of environment is significantly high in days to 75% dry husk, no. of rows per cob, no. of grains per row and single plant yield as revealed from large difference between PCV and GCV. Hepziba *et al.* (2013) assessed variability in 70 diverse inbreds collected from different locations. They obtained maximum genotypic and phenotypic coefficients of variation for grain yield per plant followed by number of rows per cob and number of kennels per row. While, Bharathiveeramani *et al.*(2012) evaluated one hundred and fourty four maize inbreds for 15 different quantitative characters. Their study revealed that the difference between PCV and GCV was very low for all the characters except anthesis, silking, interval, cob yield/plant and grain yield/plant which showed that there was very little environmental effect on these characters. In their study, Characters such as grain yield/plant, cob yield/plant and ear height showed comparatively moderate PCV and GCV. Days to 50% tasseling, days to 50% silking and number of leaves/plant showed low PCV and GCV.

Table 1. Genetic parameters of variability for grain yield and ancillary agroeconomic traits in 49 maize inbreds.

Characters	Mean ±SE	Range	PCV (%)	GCV (%)	h_b (%)	GA	GA(% of mean)
Days to 50% tasselling	66.05 ± 1.013	58.33-75.66	5.46	5.39	97.41	6.187	9.37
Days to 50 % silking	67.59 ± 0.572	59.33-77.66	5.28	5.24	98.50	6.187	9.15
Days to 75 % Dry husk	96.49 ± 5.483	87.66-104.6	3.95	3.69	87.39	5.856	6.07
Plant height	147.3 ± 12.83	101.2-217.6	17.97	17.92	99.39	46.30	31.44
Ear height	72.07 ± 1.636	41.06-110.8	21.43	21.40	99.77	27.11	37.62
Cob length	13.30 ± 0.334	07.63-16.83	17.66	17.48	97.99	4.053	30.45
Cob diameter	12.29 ± 0.203	07.70-15.56	12.62	12.44	97.18	2.654	21.59
No. of rows per cob	13.36 ± 0.666	08.66-16.00	09.82	09.17	87.10	2.011	15.05
No. of grains per row	24.38 ± 1.833	12.36-34.60	26.16	25.96	98.50	11.05	45.35
Single plant yield	92.52 ± 5.696	51.4-153.46	29.44	27.69	88.45	49.63	53.64

Characters concerning to maturity traits e.g., days to 50% tasselling, days to 50% silking and days to 75% dry husk revealed considerably lower amount of variability while rest of the traits exhibited high variability expressed in terms of PCV and GCV. The highest genotypic coefficient of variation was observed in grain yield per plant (27.69%) followed by 25.96% in number of grains per row and 21.40% in ear height indicating vast scope of selection for improvement of these traits. Khodarahmpour (2013) conducted an experiment to understand genetic diversity in 28 maize hybrids under heat stress conditions. The phenotypic coefficient variation was obtained highest for grain yield, grains per ear and grains per row.

Heritability depends upon the amount of genetic variation present in the population and environmental conditions under which the population is evaluated (Allard, 1960). A relative comparison of heritability and expected genetic advance gives an idea about the nature of gene action. The estimate of heritability (broad sense) alone is not very much useful in predicting resultant effect for selecting the best individuals or genotypes, because it includes both additive as well as non-additive gene effects. High genetic advance occurs only due to additive gene action (Panse, 1957). So, Heritability estimates coupled with the genetic advance would be more useful than heritability alone. In the present investigation, heritability ranged from 87.10% for number of rows per cob to 99.77% in case of ear height. Whereas, genetic advance expressed as percentage of mean varied from 6.07% in days to 75% dry husk to 53.64% in single plant seed yield. Among the character studied, grain yield per plant followed by number of grains per row, ear height, plant height and cob length exhibited high genetic advance (30.45 - 53.64%) coupled with high heritability (88.45 - 99.77%) indicating presence of additive gene action for these characters. So, selection of genotypes basing on these characters can be fairly reliable. Characters concerning to maturity traits e.g., days to 50% tasselling, days to 50% silking and days to 75% dry husk revealed considerably higher heritability(87.39-98.50%) coupled with low genetic advance which envisaged role of both additive and non-additive gene action for expression of these characters. Similarly, high heritability along with moderate genetic advance was observed for cob diameter and number of rows/cob which is indicative of both additive and non –additive gene action. Hemavathy *et al.*(2008) reported high heritability for cob length and grain yield; and high genetic advance for cob length, 100 seed weight and grain yield. While, Jawaharlal et al.(2011) recorded low heritability for grain yield and ear length, but higher estimates of heritability for number of seeds per cob, number of seeds per row and days to 50% tasseling and high genetic advance for number of seeds per cob, grain yield and number of seeds per row.

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