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

B Rama Devi, Lal Ahamed M, D Ratna Babu and T Madhumathi
Department of Genetic and Plant Breeding, Agricultural College, Bapatla 522 101

ABSTRACT

Knowledge on the genetic components of variances and of yield and its yield traits will improve the efficiency of breeding programmes through the use of appropriate selection procedures. Forty inbreds of maize were evaluated in a randomized block design with two replications at Agricultural College, Bapatla for seed yield and yield components. The analysis of variance indicated the presence of sufficiuent variability for all the traits. Low PCV and GCV were observed for all the traits considered under study. High heritability was observed for days to 50% tasseling, days to 50% silking, number of nodes per plant, plant height, cob height, cob length and 100 seed weight. High heritability with high genetic advance was observed for plant height, cob height, cob length and 100 seed weight which indicated that most likely the heritability was due to the influence of additive genes and selection may be effective for such traits.

Key words: *GCV, Genetic advance, Heritability, Maize, PCV.*

Maize is the third most important food grain in India after wheat and rice. In India, about 28% of maize produced is used for food purpose, about 11% as livestock feed, 48% as poultry feed, 12% in wet milling industry (for starch and oil production) and 1% as seed. In the last one decade, it has registered the highest growth rate among all food grains including wheat and rice because of newly emerging food habits as well as enhanced industrial requirements. In India, maize accounts for 9 per cent of total food grain production. In India, maize is cultivated over an area of 9.3 mha with a production and productivity of 21.07 mt and 2557 kg ha^{-1}, respectively. For the development of superior hybrids in maize, one needs to select superior inbreds. Success of any hybrid development program largely depends on the selection of elite parental inbreds. Selection of superior inbreds will be possible only when adequate variability exists in the gene pool. Hence, an attempt was made in the current study to estimate the genetic variability among the available inbreds with the aid of genetic parameters such as phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), broad sense heritability and genetic advance (GA) to exploit these traits in breeding programmes for development of potential hybrids.

MATERIAL AND METHODS

The experiment was conducted at Agricultural College Farm, Bapatla, located in coastal region of the Krishna Agro Climatic Zone of Andhra Pradesh at 15^0 54' N latitude and 80^0 25' E longitude with an altitude of 5.49 m above the mean sea level (MSL) and about 7 km away from the Bay of Bengal. The experimental material used in the present study comprised of 40 inbred lines obtained from IARI Regional Maize Research Center, Dharwad, Karnataka and University of Agricultural Sciences, Dharwad, Karnataka. Inbreds were evaluated in randomized complete block design with two replications. Each plot consisted of two rows of three -meter long with row and plant spacings of 60 and 30 cm, respectively. The observations were recorded on five randomly selected plants from each genotype per replication for characters days to 50% tasseling, days to 50% silking, number of nodes per plant, plant height (cm), cob height (cm), cob length (cm), 100 seed weight (g) and seed yield per plant (g). Data on days to 50 % tasseling and days to 50%

silking were recorded on plot basis. Standard cultural practices were adopted from sowing till harvest for the proper maintenance of the crop growth and plant stand in the field. Phenotypic and Genotypic coefficients of variation (PCV and GCV) were computed according to Burton (1952). Heritability in broad sense was estimated as per Lush (1940) and Allard (1960) and genetic advance was estimated as per the formula proposed by Lush (1940) and Johnson *et al*. (1955).

RESULTS AND DISCUSSION

The mean, range, PCV, GCV, heritability and genetic advance as percent of mean were presented in Table-1. The narrow difference between genotypic and phenotypic variance was observed for all the characters indicating that a major portion of phenotypic variation for these characters was contributed by genetic component.

Low PCV and GCV were exhibited by Days to 50% tasseling (6.04 and 4.98), days to 50% silking (4.44 and 3.84). Indicating the availability of low levels of variability for selection. Similar results were also reported by Hefney (2011) and Shanthi *et al.* (2011). Moderate PCV and GCV showed by number of nodes per plant (13.17 and 10.83), plant height (15.32 and 13.27) and cob length (15.83 and 13.61). Similar results were also shown by Shanthi *et al.* (2011). High PCV and GCV exhibited by cob height (24.32 and 22.64). Similar result was also reported by Kumar *et al.* (2014), Nzuve *et al.* (2014) and Maruthi and Jhansirani (2015). High to moderate PCV and GCV were exhibited by 100 seed weight (20.71 and 19.26). Similar result was also observed by Reddy *et al.* (2013). Moderate to low PCV and GCV showed by seed yield per plant (16.70 and 8.93). Moderate PCV was also reported by Hemavathy *et al.* (2008) and Bharathiveeramani *et al.* (2012). The estimates of PCV were slightly higher than corresponding GCV's for all characters which may be due to interaction of genotypes with environment and the contribution of environment is very little in the expression of the traits.

High heritability exhibited by days to 50% tasseling (68.14), days to 50% silking (74.63), number of nodes per plant (67.65), plant height (75.10), cob height (86.63), cob height (73.96) and 100 seed weight (86.57). Similar results were also reported by Langade *et al.* (2013), Vashishta *et al.* (2013), Kumar *et al.* (2014) and Maruthi and Jhansirani (2015). Low heritability observed for seed yield per plant. Similar result was also reported by Bharathiveeramani *et al.* (2012) and Langade *et al.* (2013).

High genetic advance as percent of mean observed for plant height (23.70), cob height (43.41), cob length (24.12) and 100 seed weight (36.93). Similar results were also observed by Sumathi *et al.* (2005), Hemavathy *et al.* (2008), Reddy *et al.* (2012), Bharathiveeramani *et al.* (2012), Reddy *et al.* (2013), Nataraj *et al.* (2014) and Maruthi and Jhansirani (2015). Moderate genetic advance as percent of mean observed for number of nodes per plant (18.36.) Similar results were also reported by and Low genetic advance as percent of mean observed for days to 50% tasseling (8.48), days to 50% silking (6.83) and seed yield per plant (9.85). Similar results were also reported by Shakoor *et al.* (2007), Reddy *et al.* (2012), Reddy *et al.* (2013) and Maruthi and Jhansi rani (2015).

High heritability coupled with high genetic advance as per cent of mean was observed for plant height, cob height, cob length and 100 seed weight indicating the predominance of additive gene action and hence, direct phenotypic selection may be useful with respect to these traits. Similar results were also reported by Sumathi *et al.* (2005), Hemavathy *et al.* (2008), Reddy *et al.* (2012), Reddy *et al.* (2013), Nataraj *et al.* (2014) and Maruthi and Jhansirani (2015).

High heritability coupled with moderate genetic advance was observed in case number of nodes per plant revealing the role of additive and non-additive gene action. High heritability coupled with low genetic advance was observed for days to 50% tasseling indicating the role of nonadditive gene action, similar results were also reported by Shakoor *et al.* (2007) and Maruthi and Jhansirani (2015).

Low heritability with low genetic advance observed for seed yield per plant indicating that selection is ineffective due to high environmental influence. Similar results were observed by Bharathiveeramani *et al.* (2012) and Langade *et al.* (2013).

Thus the present study indicated the propendance of additive gene action in expression of the traits like, plant height, cob height, cob length

Table 1. Mean, genetic variability, heritability (broad sense) and genetic advance as per cent of mean for seed yield per plant and morphological components in maize (*Zea mays* L.)

S.No.	Character	Mean	Range		Coefficient of variation		Heritability (%) (*broad sense)	Genetic advance as per cent of mean
			Min.	Max.	PCV	GCV		
1	Days to 50% tasseling	60.46	51.00	69.00	6.04	4.98	68.14	8.48
2	Days to 50% silking	55.93	51.50	62.00	4.44	3.84	74.63	6.83
3	No. of Nodes/ plant	9.68	7.40	11.90	13.17	10.83	67.65	18.36
4	Plant height (cm)	156.81	122.90	205.00	15.32	13.27	75.1	23.70
5	Cob height (cm)	60.37	35.50	88.00	24.32	22.64	86.63	43.41
6	Cob length (cm)	22.41	16.10	30.50	15.83	13.61	73.96	24.12
7	100 seed weight (g)	27.66	17.50	47.30	20.71	19.26	86.57	36.93
8	Seed yield/ plant (g)	266.08	211.60	374.00	16.70	8.93	28.63	9.85

PCV = Phenotypic coefficient of variation GCV = Genotypic coefficient of variation

and 100 seed weight indicating the simple selection for the improvement of these traits. The remaining traits expression is controlled by both additive and nonadditive gene actions indicating the exploitation of heterosis breeding or mass selection.

LITERATURE CITED

Allard R W 1960 *Principles of Plant Breeding*. John Wiley and Sons Inc., New York. 145-147.

Azam G M D, Umakantha Sarker, Maniruzzam and Bhagya Rani B 2014 Genetic variability of yield and its contributing characters in maize inbreds under drought stress. *Bangladesh Journal of Agricultural Research,* 39 (3):419-426.

B Prakash M and Seetharam A 2012a Variability studies of quantitative characters in maize (*Zea mays* L.). *Electronic Journal of Plant Breeding,* 3 (4): 995-997.

Bupesh K, Razdan AK and Gupta B B 2013 Heterosis and character association for grain yield and its component traits in single cross maize hybrids under mid hills of Jammu and Kashmir, India. *Agricultural Science Digest,* 33 (3): 198-202.

Burton G W 1952 Quantitative inheritance in grasses. *Proceedings of the 6th International Grassland Congress*, 277-283.

Hefny M 2011 Genetic parameters and path analysis of yield and its components in corn inbred lines (*Zea mays* L.) at different sowing dates. *Asian Journal of Crop Science.* 3 ,(3): 106-117.

Hemavathy A T, Balaji K, Ibrahim S M, Anand G and Sankar, D 2008 Genetic variability and correlation studies in maize (*Zea mays* L.). *Agricultural Science Digest,.* 28 (2): 112-114.

Jawaharlal J, Reddy G L and Kumar R S 2011 Genetic variability and character association studies in maize. *Agricultural 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.

Kumar P G, Prashanth Y, Reddy N V, Kumar S S and Rao V P 2014 Character association and path coefficient analysis in maize (*Zea mays* L.). *International Journal of Applied Biology and Pharmaceutical Technology*, 5 (1): 257-260.

Langade D M, Shahi J P, Srivastava K, Singh A and Sharma A 2013 Appraisal of genetic variability and seasonal interaction for yield and quality traits in maize (*Zea mays* L.). *Plant Gene and Trait*, 4 (18): 95-103.

Lush J L 1940 Intra-sire correlation on regression of offspring on dams as a method of estimating heritability of characters. *Proceedings of American Society for Animal Production,* 33: 392-401.

Maruthi RT and Jhansirani K 2015 Genetic variability, heritability and genetic advance estimates in maize *(Zea mays* L.*)* inbred lines. *Journal of Applied and Natural Science,* 7 (1): 149-154.

Nataraj V, Shahi J P and Vandana D 2014 Estimates of variability, heritability and genetic advance in certain inbreds of maize (*Zea mays* L.). *International Journal of Applied Biology and Pharmaceutical Technology,* 5 (1): 205-208.

Nzuve F, Githiri S, Mukunya M and Goethi J 2014 Genetic variability and correlation studies of grain yield and related agronomic traits in maize. *Journal of Agricultural Science,* 6:166-176.

Reddy V R, Rao A S and Sudarshan M R 2012 Heritability and character association among grain yield and its components in maize (*Zea mays* L.). *Journal of Research. ANGRAU.* 40 (2): 45-49.

Reddy V R, Jabeen F, Sudarshan M R and Rao A S 2013 Studies on genetic variability, heritability, correlation and path analysis in maize (*Zea mays* L.) over locations. *International Journal of Applied Biology and Pharmaceutical Technology,* 4 (1): 195-199.

Shakoor S M, Muhammad Akbar and Amer Hussain 2007 Correlation and path coefficient studies of some morpho-physiological traits in maize double crosses. *Pakistan Journal of Agricultural Sciences,* 44 (2): 213-216.

Shanthi P, Satyanarayana E, Suresh Babu G and Kumar R S 2011 Studies on variability for phenological, yield and quality parameters in quality protein maize (*Zea mays* L.). *Crop Research.* 41 (1, 2&3):188-191.

Sumathi P, Nirmalakumari A and Mohanaraj K 2005 Genetic variability and traits interrelationship studies in industrially utilized oil rich CIMMYT lines of maize (*Zea mays* L.). *Madras Agriculture Journal.* 92 (10-12): 612-617.

Vashistha A, 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.

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