research article | International Journal of Plant Sciences, (January to June, 2010) Vol. 5 Issue 1 : 290-293

Genetic variability and heritability studies in F_2 and F_3 generations of QPM and NON-QPM maize crosses

S. MURUGAN, J. PADMANABAN AND S. MANIRAJAN

Accepted : December, 2009

SUMMARY

The present investigation was carried out to estimate various variability parameters, *i.e.*, genotypic (GCV) and phenotypic (PCV) coefficients of variation, broad-sense heritability (h^2) and genetic advance (GA) using data derived from a number of plant characters [days to 50 per cent silking , plant height ,number of leaves, cob length, cob girth, number of grain rows per cob, number of grains per row, hundred grain weight, grains per cob, grain protein, grain tryptophan, and seed yield] in F_2 and F_3 generations of four crosses involving quality protein maize (QPM) and non quality protein maize (Non-QPM) maize. The crosses exhibited moderate PCV and GCV estimates for all the traits. Genotypic coefficient of variation (GCV) was less than its corresponding estimates of phenotypic coefficient of variation (PCV) for most of the quantitative characters indicating significant role of environment in the expression of these traits Low, medium and high estimates of broad sense heritability were found in different plant characters under study.

Key words : Heritability, Genetic advance, Crosses, Generation, PCV, GCV, Maise crosses

India is the fifth largest producer of maize in the world contributing 3% of the global production. Maize plant has a wide adaptation, and is able to grow in regions ranging from semi-arid to those where annual rainfall may exceed 400 cm. Morphologically it exhibits a greater diversity of phenotypes than perhaps any other grain crop (Kuleshov, 1933). The range of cultivation for maize crop stretches from 50° N to 40° S latitude and at altitude from sea level to 3,300 meters. Proper evaluation of genetic variability and heritability of a trait is a very important from the aspect of practical selection. Keeping this in view the study was conducted in four crosses of maize to estimate the genetic component of variance for grain yield and its related traits and to compute broad sense heritability and genetic advance for different plant traits.

MATERIALS AND METHODS

The study was conducted in the Plant Breeding Farm, Department of Agricultural Botany, Faculty of Agriculture, Annamalai University . The F_2 seeds of four crosses namely CML 176 X DMR 17 (QPM X QPM , Cross 1), UMI 124A X UMI 369 (Non- QPM X QPM , Cross 2) , CML 176 X UMI 124A (QPM X Non-QPM , Cross 3) and UMI 124 A X CML 176 (Non-QPM X Non-QPM, Cross 4) were raised in Randomized Block Design with three replications. A total of 250 plants were raised in each cross per replication and were selfed to maintain genetic purity. A total of 30 families in each of the 4 crosses were selected. The seeds of individual plants were sown as progeny rows of 4 meter length. A total of 60 seeds from each 30 families was sown at the rate of 20 seeds per replication during the month of September 2005. A population of 600 plants per replication was maintained. Observations were recorded on 90 individual earmarked plants in F_2 and F_3 of each cross @ 30 plants per replication. Genetic parameters GCV, PCV, heritability and GA were estimated by as described by Johnson *et al*. (1955).

The coefficients of variation were categorized as proposed by Sivsubramanian and Menon (1973).

Per cent of variability	Category
0-10	Low
11-20	medium
> 20	high

The heritability values were categorized as proposed by Robinson *et al*. (1949).

Per cent of heritability	Category
0-30	Low
31-60	medium
> 60	high

The genetic advance was classified as below:

Correspondence to:
S. MURUGAN, Department of Agricultural Botany, Faculty of Agriculture, Annamalai University, ANNAMALAINAGAR (T.N.) INDIA
Authors' affiliations:
J. PADMANABAN AND M. PRIYADARSHINI, Department of Agricultural Botany, Faculty of Agriculture, Annamalai University, ANNAMALAINAGAR (T.N.) INDIA

GA as per cent of mean	Category
<10	Low
10-20	medium
> 20	high

RESULTS AND DISCUSSION

The potentiality of the crosses generated by breeding is not only measured by mean performance but also by the extent of the variability created for economic characters. In the present study low, medium or high co-efficient of variability was recorded for different plant characters studied (Table 1). In F_2 generation maximum PCV (21.76) was observed for grain tryptophan in cross 2 followed by grain yield in cross 1 (20.86). The highest GCV was observed for grian yield in cross 4 (17.56) followed by grain tryptophan in cross 2 (15.81). In F_3 generation grain yield per plant exhibited maximum PCV and GCV in the cross 4. The cross 4 (in F_2) exhibited moderate PCV and GCV for grain yield, cob girth, number of grains per cob and number of grains per row. In cross 4 (in F_3) moderate variability was observed for grain yield, cob girth and number of grains per cob. This is in confirmation with the findings of Robin and Subramanian (1994) for grain yield, Jha *et al*. (1979) for cob girth, Singh *et al*. (1995) for number of grains per cob, grain rows per cob and grains per cob.

Low, medium and high estimates of broad sense heritability were found in different plant characters under study (Table 2). A narrow range of variability was observed for plant height, number of leaves, cob length, cob girth, number of grain rows per cob, grain protein and grain yield. This was in confirmation with the findings of Robin and Subramanian (1994) for cob girth and number of grains per row.

Table 1: PCV and GCV of the traits in F_3 and F_4 generations of maize

Crosses	F_2		F_3		F_2		F_3	
	PCV	GCV	PCV	GCV	PCV	GCV	PCV	GCV
	Days to 50 per cent silking				Plant height			
C_1	4.13	3.65	4.91	3.90	11.52	10.10	7.56	5.30
C_2	2.12	1.09	1.88	0.58	4.93	2.40	6.36	7.21
C_3	2.05	1.61	2.6	1.89	8.66	7.27	9.15	6.93
C_4	3.16	2.34	2.87	2.46	8.15	8.78	9.97	8.78
	Number of leaves				Cob length			
C_1	8.29	6.36	10.72	8.49	8.85	6.82	10.96	13.53
C_2	12.56	7.51	6.42	7.82	5.42	3.06	5.42	7.03
C_3	5.36	4.71	6.05	3.43	4.59	2.91	7.41	5.48
C_4	7.23	5.50	10.85	8.43	8.67	7.50	7.81	7.51
	Cob girth				No. of grain rows per cob			
C_1	10.33	7.13	7.95	4.70	13.59	9.23	16.66	10.31
C_2	7.15	4.38	10.88	6.40	5.38	3.09	9.33	8.03
C_3	6.34	5.71	10.34	8.71	5.23	3.58	8.89	7.91
C_4	14.93	12.02	11.46	11.20	10.18	8.89	7.51	6.79
	Number of grains per row				Hundred grain weight			
C_1	9.43	7.86	6.83	5.32	3.77	2.47	1.82	1.04
C_2	6.94	4.48	7.79	6.43	1.47	0.52	3.92	3.10
C_3	4.01	3.42	3.21	2.44	2.44	1.55	2.66	1.84
C_4	11.56	10.21	5.65	3.38	5.47	4.16	5.04	4.68
	Grains per cob				Grain protein			
C_1	15.56	11.08	6.35	4.32	7.83	7.64	2.10	2.02
C_2	3.20	1.93	6.24	6.04	9.82	9.43	2.06	1.85
C_3	11.61	1.90	11.61	1.09	1.60	0.96	1.60	0.96
C_4	14.20	12.78	11.3	10.63	2.33	2.15	3.01	1.72
	Grain tryptophan				Grain yield			
C_1	6.69	5.50	7.65	2.93	20.86	13.20	3.86	3.00
C_2	21.76	15.81	3.01	2.25	3.21	1.74	5.21	4.84
C_3	3.89	2.23	3.89	2.23	2.53	1.87	2.53	1.87
C_4	7.11	6.35	5.44	3.73	19.11	17.56	18.10	17.11

Table 2 : Heritability and genetic advance for the traits in F_3 and F_4 generations of maize

Crosses	F_2		F_3		F_2		F_2	
	h^2	GA	h^2	GA	h^2	GA	h^2	GA
	Days to 50 per cent silking				Plant height			
C_1	9.33	0.40	9.50	0.36	76.93	18.26	77.82	11.57
C_2	26.53	1.15	9.50	0.36	23.65	2.40	77.84	11.57
C_3	61.82	2.61	52.63	2.82	83.99	0.07	91.36	9.70
C_4	54.82	3.56	73.68	4.35	68.76	11.55	77.68	15.95
	Number of leaves				Cob length			
C_1	58.95	10.07	67.30	10.85	59.35	10.82	65.74	9.52
C_2	35.81	9.26	68.30	21.85	31.94	3.57	65.74	9.52
C_3	77.39	8.54	32.22	4.08	40.40	3.81	54.86	8.37
C_4	57.89	8.62	60.38	13.50	74.88	13.38	92.31	14.86
	Cob girth				No. of grain rows per cob			
C_1	47.73	10.16	55.81	5.69	46.15	12.92	38.29	13.14
C_2	30.16	3.82	34.16	7.76	32.94	13.65	74.12	14.25
C_3	22.9	11.41	81.29	10.62	46.82	15.04	79.18	14.51
C_4	70.67	17.36	95.09	20.50	76.27	26.00	81.86	12.66
	Number of grains per row				Hundred grain weight			
C_1	69.60	13.52	60.76	18.55	43.07	3.34	32.70	11.22
C_2	41.66	15.96	68.19	10.94	15.87	13.39	62.73	15.06
C_3	72.92	16.02	57.81	13.82	40.21	12.02	47.76	2.61
C_4	78.07	28.59	35.86	14.17	57.97	6.53	86.11	18.95
	Grains per cob				Grain protein			
C_1	50.73	16.27	46.26	6.05	95.24	15.37	92.41	4.10
C_2	36.49	2.41	93.74	12.06	92.27	18.67	80.55	3.42
C_3	26.81	0.64	47.83	2.53	35.82	1.18	80.25	1.15
C_4	80.97	23.69	88.45	20.60	85.31	4.10	32.87	2.04
	Grain tryptophan				Grain yield			
C_1	67.60	9.32	14.72	2.32	40.03	17.20	60.53	4.81
C_2	52.75	23.65	56.07	3.48	29.29	1.94	86.07	9.25
C_3	32.87	2.64	42.44	7.77	54.43	2.84	68.62	2.46
C_4	79.72	11.68	47.06	5.27	84.39	33.23	89.35	33.32

All the traits exhibited high heritability in both generations in atleast one of the crosses except grain tryptophan in F_3 and hundred seed weight in F_2 (Table 2). However, for grain yield per plant all the crosses in F_3 showed high heritability. Hassan *et al*. (2006) reported high heritability for most of the yield traits in maize .High GA was exhibited by cross 4 for the traits cob girth (in F_3), number of grains per row (in F_2), grains per cob (in F_2 and F_3) , number of grain rows per cob (in F_2) and grain yield (in F_2 and F_3). The remaining crosses in both generations exhibited either low or medium GA values. Highest heritability coupled with high genetic advance estimates were found for cob girth (95.09) and seed yield per plant (33.32) in cross 4 of F_3. However, the heritability and genetic advance were dependent on the crosses. Greater magnitude of broad sense heritability coupled with moderate genetic advance in characters under study provided the evidence that these plant parameters were under the control of additive genetic effects indicating that selection should lead to genetic enhancement of the material.

REFERENCES

Hassan, G., Salim Shah, S., Raziuddin, S., Rahman-ur-Hidayat and Sardar Ali (2006). Estimates of variability, heritability and genetic advance for fodder traits in two maize populations. *Pakistan J. Biol. Sci.*, **14**(9) : 2618-2623

Jha, P.B., Singh, T.P. and Akhtar, S.A. (1979). Analysis of yield components in early maize germplasm complexes. *Madras agric. J.*, **66**: 561-564.

Johnson, H.W., Robinson, H.F. and Comstock, R.E. (1955). Estimates of genetic and environmental variability in soybean. *Agron. J.*, **47**: 314-318.

Kuleshov, N.N. (1933). World's diversity of phenotypes of maize. *J. Agron.*, **25**: 688–700.

Robin, S. and Subramanian, M. (1994). Genetic variability study in biparental progenies in maize (*Zea mays* L.). *Crop Res.*, **7** : 79-83.

Robinson,H.F., Comstock, R.E. and Harvey, P.H. (1949). Estimation of heritability and the degree of dominance in corn. *Agron. J.*, **41**: 353-359.

Singh, Gyanendra, Singh, M. and Dhiman, K.R. (1995). Genetic analysis of maize (*Zea mays* L.) in Sikkim. *Indian J. agric. Sci.*, **65**: 293-294.

Sivsubramanian,S. and Madhava Menon, P. (1973). Genotypic and phenotypic variability in rice. *Madras agric. J.*, **60**: 1093-1096.

****
*****