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Studies on Genetic Variability, Association of Characters and Path Analysis in Maize (*Zea mays* L.) inbreds

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ABSTRACT

In the present investigation analysis of variance revealed highly significant differences among the genotypes for all the twelve characters studied, indicated the wide range of genetic variability in the existing material. The phenotypic correlation coefficients were numerically higher than genotypic correlation coefficients . The characters viz; Plant height, ear head height, ear length, number of grains per cob, 100- grain weight, number of cobs per plant, days to 50 per cent tasselling and silking showed significant positive correlation with seed yield per plant. In the association among component characters, days to 50 per cent tasseling significantly and positively correlated with days to 50 per cent silking, plant height, days to 50 per cent maturity, ear head height, shelling percentage and seed yield per plant, whereas protein content was negatively correlated. Days to 50 per cent maturity was positively correlated with ear head height, ear length and shelling percentage. Path analysis revealed that number of grains per cob, 100- grain weight, days to 50 per cent maturity, number of cobs per plant and plant height recorded the maximum and positive direct effects on seed yield per plant and their association with seed yield per plant was also positive and highly significant except days to 50 per cent maturity.

Key words: *Correlation, Path Analysis, Variability, Maize.*

INTRODUCTION

Maize is a well known cereal crop of global importance and also called as corn. Maize is the third most important cereal after rice and wheat in India. It provides food, feed and fodder and serves as a source of basic raw material for number of industrial products, *viz*; starch, oil, protein, alcoholic beverages, food sweeteners, cosmetics, bio-fuel *etc*. The crop improvement efforts are directed to increase the grain production. Studies on correlation coefficients of different characters are useful criterion to identify desirable traits that contribute to improve the grain yield Maize is mostly utilized as a source of human food (24%), animal feed (11%), and poultry feed (52%), starch (11%), brewery (1%) and seed (1%). But now a day's it is occupying the place in the rich communities due to its multifarious uses.

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Path analysis is also equally beneficial since it is an efficient biometrical tool which indicates the direct contribution of characters and its influence through other traits in influencing the yield. Therefore, the present research work was undertaken to study the correlation and path coefficient in 50 inbreds of maize.

MATERIAL AND METHODS

The present investigation was conducted at Botany Farm, College of Agriculture, Pune-5 during *kharif*, 2014. The experiment was laid in Randomized Block Design with three replications. Each entry was represented by a single row of 4 m length with a spacing of 75 cm between rows and 20 cm between plants. All the crop management and plant protection operations were carried out as per recommended package of practices. The observations were recorded on five randomly selected plants for characters *viz*; days to 50 per cent tasseling, days to 50 per cent silking, days to 50 per cent maturity, plant height, ear head height, ear length, number of cobs per plant, number of seeds per cob, 100- grain weight, shelling percentage, protein content and grain yield per plant. The per cent protein in seeds was calculated by multiplying per cent nitrogen in sample by 6.25 representing the common factor for material used. The mean of five plants were subjected to statistical analysis. The data were analyzed by using ANOVA and genetic parameters such as PCV and GCV and heritability in broad sense(h^2) were calculated by the formula given by Burton[2] and genetic advance as per cent of mean (genetic gain) were worked out as suggested by Johnson *et. al*.[4]. The phenotypic and genotypic correlation coefficient were calculated according to the method suggested by Singh and Chaudhary[12] and path coefficient analysis was carried out as per the Dewey and Lu[3].

RESULTS AND DISCUSSION

Analysis of variance revealed highly significant differences for yield and yield contributing components, indicating presence of good amount of genetic variability. It was revealed that the phenotypic coefficient of variation (PCV) were greater in magnitude, than the genotypic coefficient of variation (Table 1) for all the characters, indicating the greater influence of environment on these traits. The highest magnitude of GCVand PCV was recorded for number of cobs per plant, followed by number of grains per cob, yield per plant, ear head height, 100 -grain weight, ear length and plant height. The character days to 50 per cent maturity recorded magnitudinaly lowest GCV and PCV, followed by shelling percentage, days to 50 per cent tasseling, days to 50 per cent silking and protein content. Satyanarayan and Sai Kumar[9] reported highest GCV and PCV for grain yield per plant. and Mani *et al*.[5] also reported high amount of GCV and PCV for 100- grain weight.

The highest magnitudinal difference between GCV and PCV was recorded for number of cobs per plant (2.24) followed by days to 50 per cent silking (0.94), days to 50 per cent tasseling (0.66), days to 50 per cent maturity (0.40) and grain yield per plant (0.30) whereas lowest difference between GCV and PCV was found for plant height (0.04) (Table 1). The highest heritability (b.s.) was observed for ear head height and 100- grain weight (99%) followed by plant height (98.90%) and number of grains per cob (98.40%). The lowest heritability was recorded for ear length (3.40%). In the present investigation high heritability estimates were recorded for all traits except ear length.The characters plant height, ear head height, number of grains per cob and grain yield per plant showed high heritability accompanied with good genetic advance, indicating direct selection for these traits in maize improvement. Reddy and Agrawal[7] for plant height and Robin and Subramanian[8] for grain yield reported high heritability with high genetic advance.

In the present investigation significant positive correlation were observed between seed yield per plant with ear length followed by number of grains per cob, plant height, number of cobs per plant, ear head height, 100- grain weight, days to 50 per cent silking, and tasseling. Panchanandan *et al* (1978) for

100- seed weight, Ahmed *et al*.[1] for ear length, Sharma and Kumar[10] for number of grains per row reported significant positive correlation with grain yield per plant. However, the character protein content showed significant and negative correlation with seed yield per plant. In the association among component characters plant height showed positive and significant correlation with ear head height, days to 50 per cent maturity, number of cobs per plant and ear length. Ear length showed positive and significant correlation with shelling percentage, protein content, 100-grain weight and number of grains per cob. Plant height and ear length showed positive correlation with grain yield, suggesting selection for these traits will be rewarded with increased seed yield per plant.

The path coefficient analysis indicated that number of grains per cob, 100- grain weight, days to 50 per cent maturity, number of cobs per plant and plant height recorded maximum and positive magnitude to direct effects on seed yield per plant and their association with seed yield per plant were also highly significant and positive, indicating the facts that there exists a true and perfect association between these characters.(Table 3). Venugopal *et al.*[13] reported that ear circumference had direct effect on seed yield per plant. Shakoor *et. al*.[11] reported high magnitude of direct effect for days to 50 per cent tasseling and seed yield per plant. Ear head height had negative significant direct effect and was positively and significantly correlated with seed yield per plant. It exhibited negative indirect effects *via* plant height, days to maturity, days to 50 per cent tasseling, days to 50 per cent silking and number of cobs per plant. The yield component ear length recorded minimum negative direct effect but was significantly and positively correlated with seed yield per plant. These findings suggested indirect selection of ear length for yield improvement. Whereas, the trait earhead height exhibited the maximum negative and significant magnitude of direct effect on seed yield per plant (Table 3).

In the present investigation the analysis of variance revealed highly significant differences among the genotypes for all the twelve characters under study, indicated the wide range of genetic variability among the 40 inbred lines. Thus there is a ample scope for selection of these inbred lines for different characters for maize improvement. Association of characters and path analysis revealed that number of grains per cob, 100 - grain weight, days to maturity, number of cobs per plant and plant height were good indicators for seed yield per plant in maize and can be used for making direct selection for yield.

Table 1: Genetic parameters for twelve characters in Maize inbred lines

Characters	General mean	Range	GCV	PCV	Heritability (h^2)% bs	GA	GA as percent of mean
Days to 50% tasseling	48.75	46.03-51.96	2.62	3.28	64.00	2.11	4.33
Days to 50% silking	49.71	46.37-52.27	2.75	3.69	55.60	2.10	4.23
Plant height(cm)	162.21	147.60-187.00	7.02	7.06	98.90	23.35	14.39
Days to 50 % maturity	85.05	82.35-90.66	1.96	2.36	69.20	2.86	3.36
Ear head height (cm)	68.66	46.32-94.24	14.60	14.68	99.00	20.56	29.94
Ear length(cm)	15.22	12.27-41.59	9.02	8.80	93.40	0.52	3.43
No. of grains per cob	411.05	288.69-533.04	18.25	18.39	98.40	15.33	37.30
100 grain weight(g)	20.51	14.01-24.67	12.98	13.04	99.00	5.45	26.60
Shelling percentage	83.02	77.36-85.70	2.33	2.39	95.40	3.90	4.70
Number of cobs /plant	1.22	1.00-2.29	35.03	37.27	88.30	0.83	67.81
Protein content (%)	8.86	7.91-9.42	4.97	5.15	93.20	0.87	9.90
Yield/plant(g)	80.61	55.00-105.66	15.44	15.74	96.30	25.16	31.22

Table 2: Genotypic correlation coefficient of 12 characters in 40 inbred lines of Maize

Characters	Days to 50% tasseling	Days to 50% silking	Plant height (cm)	Days to 50 % maturity	Earhead height (cm)	Ear length (cm)	No. of grains/ cob	100 grain weight (g)	Shelling percentage	Number of cobs /plant	Protein content (%)	Seed Yield/ plant(g)
Days to 50% tasseling	1.00	1.073**	0.452**	0.970**	0.604**	0.112	0.119	0.092	0.348**	0.044	-0.105	0.190*
Days to 50% silking		1.00	0.251**	0.790**	0.446**	-0.339**	0.220*	0.135	0.273**	0.046	-0.192*	0.232**
Plant height (cm)			1.00	0.448**	0.755**	0.236**	0.127	0.165	0.016	0.408**	-0.016	0.395**
Days to 50 % maturity				1.00	0.635**	0.424**	0.107	-0.016	0.261**	-0.027	-0.168	0.151
Earhead height (cm)					1.00	-0.428**	0.141	0.061	0.137	0.350**	-0.237**	0.251**
Ear length (cm)						1.00	0.230*	0.357**	0.708**	0.006	0.380*	0.722**
No. of grains/cob							1.00	-0.497*	0.239**	0.266**	-0.520**	0.522**
100 grain weight(g)								1.00	-0.228*	-0.019	0.259**	0.240**
Shelling percentage									1.00	0272**	-0.169	-0.045
Number of cobs /plant										1.00	-0.197*	0.384**
Protein content(%)											1.00	-0.340**
SeedYield/ plant(g)												1.00

***, ** significant at 5% and 1% respectively**

Table 3: Direct (diagonal) and indirect (above and below diagonal) path effects of different characters towards seed yield at genotypic level in Maize

Characters	Days to 50% tasseling	Days to 50% silking	Plant height (cm)	Days to 50 % maturity	Earhead height (cm)	Ear length (cm)	No. of grains per cob	100 grain weight (g)	Shelling percentage	Number of cobs /plant	Protein content (%)	Correlation withYiel/ plant(g)
Days to 50% tasseling	-0.222	-0.238**	-0.100	-0.216*	-0.134	-0.025	-0.026	-0.020	-0.077	-0.009	0.023	0.190*
Days to 50% silking	-0.158	-0.147	-0.037	-0.116	-0.066	0.050	-0.032	-0.020	-0.040	-0.006	0.028	0.232*
Plant height (cm)	0.097	0.054	0.215	0.096	0.162	0.051	0.027	0.035	0.036	0.088	-0.003	0.395**
Days to 50 % maturity	0.543**	0.442**	0.250**	0.559	0.355**	0.237**	0.059	-0.009	0.146	-0.015	-0.094	0.151
Earhead height (cm)	-0.197*	-0.146	-0.247**	-0.207*	-0.327	0.140	-0.046	-0.020	-0.045	-0.114	0.077	0.251**
Ear length (cm)	-0.002	0.008	-0.006	-0.010	0.010	-0.025	-0.005	-0.009	-0.018	-0.000	-0.009	0.722**
No. of grains/cob	0.095	0.175	0.101	0.085	0.113	0.183*	0.797	-0.396**	0.191*	0.212*	-0.415**	0.522**
100 grain weight(g)	0.062	0.092	0.112	-0.011	0.041	0.242**	-0.337**	0.678	-0.154	-0.013	0.176	0.240**
Shelling percentage	-0.048	-0.037	-0.002	-0.036	-0.019	-0.098	-0.033	0.031	-0.138	-0.037	0.023	-0.045
Number of cobs /plant	0.011	0.012	0.107	-0.007	0.092	0.001	0.070	-0.005	0.071	0.263	-0.052	0.384**
Protein content (%)	0.010	0.018	0.001	0.015	0.022	-0.036	0.049	-0.024	0.016	0.018	-0.094	-0.340**

***, ** significant at 5% and 1% respectively**

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