CHARACTER ASSOCIATION AND PATH ANALYSIS STUDIES IN INBRED LINES OF MAIZE (*Zea mays* L.)

J. L. joshi [1], S. Sugandhi[1]* and Ajish Muraleedharan[2]

[1]Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai nagar, Tamil nadu, India - 608002.
[2]Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalai nagar, Tamil nadu, India - 608002.

*Author for correspondence

ABSTRACT

Correlation and path coefficient among ten quantitative traits of thirty two maize inbred lines along with commercial checks *viz.*, Arjun, NK 6240 grown during *kharif* 2012 were studied. Character association analysis revealed that grain yield exhibited significant positive correlation with cob girth, number of kernels per row, plant height, cob length, 100 kernel weight. Further, path coefficient analysis partitioned the correlation into direct and indirect effects. Path analysis revealed highest positive direct influence of cob girth followed by number of kernels per row and days to 50 percent silking on grain yield; hence selection based on these characters would be more rewarding.

Keywords: maize inbreds, association studies, path coefficient

INTRODUCTION

Maize (*Zea mays* L.) is the third most important cereal food crop of the world belonging to the family Poaceae and tribe Maydeae (Poehlman, 1997). It contributes maximum among the food cereal crops i.e. 38% annually in the global food production as compared to 30% for wheat and 20% for rice. In India, maize accounted with annual production of around 21.5 million tonnes (nearly 2.4%) ranks third and fifth in total area from 8.67 million hectares, almost 5% (FAOSTAT, 2011). In country like India, rapid growth in population outstrips our grain in cereal production. Increased production of maize and its alternate utilization in food channel can reduce the pressure on wheat, rice and its imports. Now a days, maize has also been recognized as an industrial crop because of the diversified products that can be developed like starch, syrup, glucose, gluten and oil. Nearly 49% of the total maize produced is being utilized as a raw material in the poultry feed industry. Hence, it clearly implies that maize has a unique place in Indian economy.

The correlation studies reveal the direction and magnitude of association among a pair of variables, when more than two variables are involved; path coefficient analysis provides clear picture of association among variables by alienated this association into direct and indirect effects towards grain yield. The association of traits under selection is necessary to effect the selection and for this correlation and path coefficient analysis are active tools to improve the efficiency of breeding programs. Hence, this investigation was undertaken to study the correlation and path coefficient in maize inbred lines.

MATERIALS AND METHODS

The present study was carried out at the Plant breeding farm of the Department of Genetics and Plant Breeding, Annamalai University, Chidambaram during kharif season of 2012. The experimental material consisted of thirty two maize inbred lines with two commercial checks *viz*., Arjun, NK 6240 was sown in Randomized Block Design with three replications at row to row and plant to plant distance of 60 cm and 20 cm, respectively. Recommended cultural practices were followed to raise the crop.

Days to 50 percent silking, days to 50 percent tasseling, plant height (cm), cob length (cm), cob girth (cm), number of kernel rows per cob, number of kernels per row, days to maturity, 100-kernel weight (g) and grain yield per plant (g) were recorded on ten randomly selected plants in each plot. The mean values were used for statistical analysis. The phenotypic and genotypic correlation coefficients were worked out as per the method suggested by Johnson *et al*., (1955). Path analysis was carried out using the simple correlation coefficient to know the direct and indirect effects of the yield and components of yield as suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences for ten quantitative traits in inbred lines of maize. Significant variation among the genotypes indicated the presence of sufficient genotypic differences there by to provide better scope for selection.

The phenotypic correlation coefficient for ten quantitative traits are presented in Table 1. The character association studies revealed that grain yield per plant showed highly significant and positive association with cob girth (0.758), number of kernels per row (0.696), plant height (0.590), cob length (0.578), 100 kernel weight (0.528). It was observed that among the yield components cob girth exhibited a highly significant positive association with grain yield. Such kind of association were reported by Kaundal and Sharma (2005), Rafiq *et al.* (2010) and Zarei *et al.* (2012). The characters *viz*., days to 50 percent silking (-0.281), days to 50 percent tasseling (-0.257) and days to maturity (-0.223) exhibited negative and significant correlation with grain yield (Barros *et al*. 2010). Hence selection for these traits could not bring improvement in yield and yield attributes in maize. But these traits could be used as efficient indicator of identifying early maturing lines and this suggested the impact of yield on breeding for early maturing genotypes.

Path coefficient analysis (Table 2) provides better means for selection by resolving the correlation coefficient of yield and its components into direct and indirect effects. This analysis revealed that the traits, cob girth followed by number of kernels per row, 100 kernel weight and number of kernels per row exhibited the largest direct and positive effect on grain yield per plant. Similar results were reported by Packiaraj (1995) for plant height and 100-kernel weight, Manivannan (1998) for number of kernel rows per ear, number of kernels per row, Kumar and Singh (2004) for days to 50 percent silking and Umakantha and Khan (2001) for negative direct effects.

This clearly depicts that the cob girth is the major determining factors for yield improvement in maize. The indirect effects of traits render us a set of indices to be concerned for improving yield attributed traits. In this study it was observed that number of kernels per row positively influenced the yield indirectly through cob girth. Also, the trait, cob girth were found to indirectly affect the grain yield through their positive influence on number of kernels per row. Similarly, the cob girth and number of kernels per row showed a positive effect for grain yield. Thus the traits, cob girth, number of kernels per row, plant height and cob length are crucial traits for considering crop improvement in maize.

It may be concluded that cob girth, number of kernels per row, plant height, cob length, 100-kernel weight had a significant positive association with yield. Cob girth, days to 50 percent silking and number of kernels per row had a direct positive effect on grain yield which also contributed maximum to higher grain yield compared to the other characters. Thus, selection for these characters could be considered as important selection criteria in improving hybrid maize for higher grain yield.

Table 1. Phenotypic correlation coefficients (r) between yield and its contributing characters

	D50%T	D50%S	PH(cm)	DTM	CL(cm)	CG(cm)	NK/R	NR/C	100-KW	GY(g)
D50%T	**1.000**									
D50%S	0.958**	**1.000**								
PH(cm)	-0.029	-0.068	**1.000**							
DTM	0.921**	0.962**	-0.082	**1.000**						
CL(cm)	-0.162	-0.269**	0.531**	-0.248*	**1.000**					
CG(cm)	-0.278**	-0.270**	0.685**	-0.229*	0.565**	**1.000**				
NK/R	-0.310**	-0.353**	0.489**	-0.299*	0.748**	0.575**	**1.000**			
NR/C	-0.155	-0.123	0.358**	-0.120	0.131	0.342**	0.136	**1.000**		
100-KW	-0.252**	-0.239*	0.357**	-0.122	0.317**	0.489**	0.403**	0.209**	**1.000**	
GY(g)	-0.257**	-0.281**	0.590**	-0.223*	0.578**	0.758**	0.696**	0.288**	0.528**	**1.000**

**Significant at 1% level; *Significant at 5% level

D50%T-Days to 50 percent tasseling; D50%S-Days to 50 percent shelling; PH-Plant height(cm); DTM-Days to maturity; CL-Cob length(cm); CG-Cob girth(cm); NK/R-Number of kernels per row; NR/C-Number of kernel rows per cob; 100-KW- 100 kernel weight(g); GY-Grain yield(g)

Table 2. Path coefficients showing direct and indirect effect of various quantitative traits on grain yield

	D50%T	D50%S	PH(cm)	DTM	CL(cm)	CG(cm)	NK/R	NR/C	100 –KW	GY(g)
D50%T	**-0.1980**	0.2294	0.0066	0.0133	-0.0131	-0.0958	-0.0869	-0.0001	-0.0276	-0.2457
D50%S	-0.1892	**0.2348**	0.0124	0.0142	-0.0200	-0.1156	-0.0945	-0.0001	-0.0269	-0.2715
PH(cm)	0.0068	-0.0165	**-0.1792**	-0.0010	0.0402	0.2847	0.1337	0.0001	0.0417	0.5876
DTM	-0.1780	0.2256	0.0134	**0.0142**	-0.0193	-0.0990	-0.0856	-0.0001	-0.0138	-0.2178
CL(cm)	0.0346	-0.0626	-0.0954	-0.0037	**0.0674**	0.2412	0.2032	0.0001	0.0366	0.5783
CG(cm)	0.0474	-0.0633	-0.1234	-0.0034	0.0439	**0.4165**	0.1598	0.0001	0.0556	0.7538
NK/R	0.0637	-0.0826	-0.0891	-0.0045	0.0587	0.2455	**0.2674**	0.0001	0.0453	0.7013
NR/C	0.0282	-0.0261	-0.0657	-0.0018	0.0102	0.1437	0.0387	**0.0002**	0.0236	0.2897
100-KW	0.0508	-0.0573	-0.0653	-0.0018	0.0249	0.2114	0.1134	0.0001	**0.1098**	0.5317

Residue = 0.4742

D50%T-Days to 50 percent tasseling; D50%S-Days to 50 percent shelling; PH-Plant height(cm); DTM-Days to maturity; CL-Cob length(cm); CG-Cob girth(cm); NK/R-Number of kernels per row; NR/C-Number of kernel rows per cob; 100-KW- 100 kernel weight(g); GY-Grain yield(g)

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