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Correlation and Path Coefficient Analysis of Morphological Traits in Sunflower (*Helianthus annuus* L.) Populations

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ABSTRACT

Four open pollinated sunflower populations, each having 13 lines were included in this study for correlation and path coefficient analysis of morphological traits. The highest correlation of seed yield was observed with number of filled seeds per plant, followed by seed filling percentage and head diameter. Maximum direct effect on seed yield was exerted by number of filled seeds per plant. Head diameter also had a considerable effect on seed yield. It was concluded that number of filled seeds per plant, head diameter and 1000-seed weight were important characters to improve seed yield.

Key Words: Sunflower; Morphological traits; Correlation; Path analysis

INTRODUCTION

Pakistan is facing a shortage of edible oil. Local production of edible oil is hardly enough to meet 30% of the total requirement. Rest of the 70% requirement is met through import costing huge amount of foreign exchange (Economic Survey of Pakistan, 2001). There is a dire need to increase local edible oil production by increasing the area and production of conventional oilseed crops and also paying attention to the non-conventional oilseed crops. Among the non-conventional oilseed crops, sunflower has a maximum potential for bridging the gap in the demand and production of edible oil in the country. Its seed contain high oil content ranging from 35-40% with some types yielding upto 50% (Skoric & Marinkovic, 1986).

Correlation of a particular character with other characters contributing to seed yield is of great importance in indirect selection of genotypes for higher seed yield. Seed yield generally exhibit positive and significant correlation with number of filled seeds, head diameter and 1000-seed weight (Lakshmaniah, 1978; Niranjanmurthy & Shambulingappa, 1989; Mogali & Virupakshappa, 1994). Path coefficient analysis is a statistical technique of partitioning the correlation coefficients into its direct and indirect effects, so that the contribution of each character to yield could be estimated, the present work was carried out to estimate the genotypic and phenotypic correlation between different morphological traits and to work out path coefficients to know direct and indirect contribution of different traits to seed yield.

MATERIALS AND METHODS

The present work was conducted in the research area of the department of Plant Breeding and Genetics at the Post-graduate Research Station (PARS), University of Agriculture, Faisalabad. Four open pollinated sunflower populations (G1, G2, G3 and G6) and each population having 13 lines were evaluated in the field. Seed were sown keeping plant to plant and row to row distances of 25 and 75 cm, respectively. The experiment was laid out in a randomized complete block design with three replications. The data were recorded for plant height, stem diameter, head diameter, days to 50% flowering, number of leaves per plant, 1000-seed weight, seed yield per plant, number of filled seeds per plant, seed filling percentage. The data recorded were subjected to correlation analysis to estimate the correlation between different traits at phenotypic and genotypic levels. Path coefficients were determined following Dewey and Lu (1957) to study direct and indirect effects of different morphological traits under study on the seed yield.

RESULTS

The strongest correlation of seed yield was observed with number of filled seeds per plant at both genotypic (r = 0.843) and phenotypic (r = 0.810) levels (Table I). Seed yield was positively and significantly correlated, at phenotypic and genotypic levels, with plant height (r = 0.631 and 0.472, respectively), stem diameter (r = 0.643 and 0.375), head diameter (r = 0.497 and 0.471), 1000-seed weight (r = 0.313 and 0.297) and seed filling percentage (r = 0.417 and 0.338). The results are in line with the findings of Caylak and Emiroglu (1984) and Deshmukh *et al.* (1986). A significant and positive correlation of seed yield with number of filled seeds per plant and seed filling percentage was also reported by Lakshmaniah (1978) and Anand and Chandra (1980). Plant height revealed significant and positive correlation with all characters under discussion at both genotypic and phenotypic levels, except seed filling percentage which showed positive but non-significant correlation, at genotypic and phenotypic levels. Plant height exhibited a high correlation with seed yield (r = 0.631) at phenotypic level. The results are at par with the findings of Vanishree *et al*. (1988). The highest correlation of plant

Table I. Genotypic (upper value) and phenotypic (lower value) correlation coefficients for morphological traits in sunflower

Character	Stem diameter (cm)	Head diameter (cm)	Days to flowering	Leaves per plant	1000-seed wt.(g)	Seed yield (g)	Filled seeds per plant	Seed filling percent
Plant height	0.595**	0.619**	0.432**	0.656**	0.359**	0.631**	0.434**	0.082
	0.575**	0.594**	0.360**	0.637**	0.345**	0.472**	0.419**	0.085
Stem diameter		0.667**	0.510**	0.618**	0.211**	0.643**	0.395**	0.174
		0.665**	0.417**	0.508**	0.216**	0.375**	0.383**	0.145
Head diameter			0.385**	0.485**	0.350**	0.497**	0.443**	0.106
			0.327**	0.460**	0.246**	0.471**	0.429**	0.104
Days to flowering				0.378**	0.136	0.252**	0.183*	0.107
				0.299**	0.108	0.162*	0.161*	0.105
Leaves per plant					0.409**	0.479**	0.427**	0.093
					0.404**	0.456**	0.417**	0.085
1000-seed weight						0.313**	0.287**	0.092
						0.297**	0.236**	0.054
SeedYield							0.843**	0.417**
							0.810**	0.338**
Filled seeds/plant								0.473**
								0.465**

* = significant at 0.05 probability level; ** = significant at 0.01 probability level

Table II. Direct (in bold) and indirect effects of yield components on seed yield

Character	Plant height (cm)	Stem diameter (cm)	Head diameter (cm)	Days to flowering	Leaves per plant	1000-seed wt. (g)	Filled seeds per plant	Seed filling percent
Plant height	0.0858	-0.0331	0.0702	-0.0089	0.0418	0.0212	0.2879	-0.0016
Stem diameter	0.0487	-0.0585	0.0787	-0.0100	0.0335	0.0135	0.2725	-0.0020
Head diameter	0.0503	-0.0386	0.1198	-0.0080	0.0303	0.0153	0.0305	-0.0017
Days to flowering	0.0306	-0.0244	0.0386	-0.0231	0.0198	0.0069	0.1064	-0.0017
Leaves per plant	0.0541	-0.0296	0.0543	-0.0074	0.0662	0.0248	0.2863	-0.0016
1000-seed weight	0.0293	-0.0128	0.0289	-0.0032	0.0266	0.0614	0.1591	-0.0013
Filled seeds/plant	0.0356	-0.0224	0.0507	-0.0044	0.0275	0.0146	0.7037	-0.0042
Seed filling %	0.0073	-0.0087	0.0121	-0.0031	0.0059	0.0037	0.3201	-0.0080

height was observed with number of leaves per plant, followed by head diameter and stem diameter. Seed filling percentage was positively but non-significantly correlated with all the characters under study at both levels except seed yield and number of filled seeds per plant which exhibited significant and positive correlation. The results corroborate the findings of Mogali and Virupakshappa (1994), and Niranjanmurthy and Shambulingappa (1989). The results suggest that head diameter, number of filled seeds per plant, 1000-seed weight and seed filling percentage are important yield components and could be used as selection criteria to improve seed yield.

Path coefficients (Table II) revealed that number of filled seeds per plant had maximum direct effect on seed yield. The indirect effects of all other traits under discussion were also high and positive through number of filled seeds per plant. Pathak *et al.* (1983) and Mogali and Virupakshappa (1994) also reported the highest direct effect of filled seeds per plant on seed yield. Head diameter was second in the highest direct and indirect effects on seed yield. Stem diameter, days to 50% flowering and seed filling percentage had negative direct effect on seed yield. This emphasizes that the selection based on number of filled seeds per plant and head diameter will be more effective in improving seed yield. High direct effect of head diameter on seed yield was also reported by Vanozzi *et al.* (1986).

DISCUSSION

Plant height showed positive and significant correlation with most of the traits studied. When the plant height is more, obviously the number of leaves will be more providing greater fixation of carbon leading to more accumulation of dry matter. This may lead to increase in stem size, head diameter and 1000-seed weight, resulting in higher yields (Vanishree *et al*., 1988). The strongest correlation of seed yield with number of filled seed per plant and highly significant and positive correlation of head diameter with number of filled seeds per plant and seed yield suggests that if the diameter of head is more, more number of seeds will be produced on it and there will be more number of filled seeds per plant leading to a high seed yield (Caylak & Emiroglu, 1984; Mogali & Virpakshappa, 1994).

CONCLUSION

It is concluded that seed yield mainly depends upon the number of filled seeds per plant, seed filling percentage and head diameter. This emphasizes that selection based on these characters will be more effective in improving seed yield.

REFERENCES

Anand, I.J. and S. Chandra, 1980. Genetic diversity and interrelationship of oil yielding traits in sunflower. *Sunflower Newsl*., 3: 5–8.

Caylak, B. and S.H. Emiroglu, 1984. Correlation among some agronomic and technological characters in sunflower (*Helianthus annuus* L.). *Ege Universitisi Ziraat Fadultesi Dergisi*, 21: 191–9.

Deshmukh, P.S., G.C. Shrivastava and O.P.S. Tomar, 1986. Effect of environmental factors on correlation coefficients between morphological parameters of yield in sunflower (*Helianthus annuus* L.). *Indian J. Plant Physiol*., 29: 345–50.

Dewey, D.R. and K.H. Lu, 1957. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J*., 51: 515–8.

Govt. of Pakistan, 2001. *Economic Survey of Pakistan.* Finance Division, Economic Advisory Wing, Islamabad, Pakistan.

Lakshmaniah, V.H., 1978. Genetic variability and association of morphological characters with seed yield and oil content in sunflower. *Agron. J*., 44: 202–9.

Mogali, S.C. and K. Virupakshappa, 1994. Intercharacter association and path coefficient analysis in sunflower (*Helianthus annuus* L.). *Indian J. Genet*., 54: 366–70.

Niranjanmurthy and K.G. Shambulingappa, 1989. Path analysis for seed yield in sunflower. *J. Oilseeds Res*., 6: 22–5.

Pathak, A.R., M.U. Kukadia and B.A. Kunadra, 1983. Path coefficient analysis in sunflower. *Indian J. Agric. Sci*., 53: 607–8.

Skoric, D. and R. Marinkovic, 1986. Most recent results in sunflower breeding. *Int. Symposium on sunflower, Budapest, Hungary*, pp: 118–9.

Vanishree, G., K. Ananthasayana, G.V.S. Nagabhushanam and C.A. Jagadish, 1988. Correlation and path coefficient analysis in sunflower. *J. Oilseeds Res*., 5: 46–51.

Vanozzi, G.P., P. Belloni and F. Martorana, 1986. Correlations among yield components in sunflower. *Somenti Elitte,* 32: 25–31.

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