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Character Association and Path Coefficient Analysis in Finger Millet (*Eleusine coracana* (L.) Gaertn.)

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ABSTRACT

Correlation and path coefficient analysis was carried out from the data of yield and yield attributes of 55 genotypes of finger millet. Grain yield plant^{-1} showed positive and significant genotypic correlation with plant height, number of basal tillers, flag leaf length, flag leaf sheath length, inflorescence width, number of fingers/ear suggesting that these are major yield contributing traits. Inflorescence length had high positive direct effect followed by inflorescence exertion, days to 50% flowering, plant height, number of basal tillers. These traits deserve special emphasis in selection while selecting for improvement of grain yield in finger millet

Key words : Character association, Finger millet, Path coefficient analysis.

Finger millet (*Eleusine coracana* (L.) Gaertn.) commonly known as *ragi,* is an important cereal crop amongst the small millets and third in importance after sorghum and pearl millet. Finger millet is the only millet which has been able to touch an average productivity level of more than 1.5 tonnes per hectare and serve as a sustainable and food security crop that is especially important for its nutritive and cultural values. The crop has a wide range of seasonal adaptation and is grown in varying climatic conditions. The crop can withstand both biotic and abiotic stresses.

Improvement in any crop usually involves exploiting the genetic variability in specific traits and associations among them. Simultaneous improvement of these traits depends on the nature and degree of association between traits (Mnyenyembe and Gupta, 1998).

To facilitate selection in breeding for high yield, therefore, it is logical to examine various components and give more attention to those having the greatest influence on yield. The ultimate expression of yield in crop plants is usually dependent upon the action and interaction of a number of important characters. Correlation, therefore, is helpful in determining the component characters of a complex trait, like yield. With more variables in correlation studies, indirect associations become more complex and important; consequently, a correlation study coupled with path analysis is more effective tool in the study of yield attributing characters.

Hence the present study was undertaken with the objectives of finding associations among traits and assessing the direct and indirect contribution of each trait to grain yield of finger millet.

MATERIAL AND METHODS

The experimental material consisting of 55 genetically diverse genotypes including five checks of finger millet was evaluated in a randomized block design with three replications at College Farm, Agricultural College, Naira, A.P., during kharif 2011. Each genotype was represented by two rows of three meter length and spaced 30 cm apart. The recommended package of practices was followed to raise good and healthy crop. Five competitive plants were selected at random from each replication and observations were recorded on 16 quantitative traits viz., days to 50% flowering, plant height (cm), number of basal tillers, flag leaf blade length (mm), flag leaf blade width (mm), flag leaf sheath length (mm), peduncle length (mm), inflorescence exertion (mm), inflorescence length (mm), inflorescence width (mm), length of longest finger (mm), width of longest finger (mm), number of fingers ear^{-1}, neck blast (%), finger blast (%) and grain yield plant^{-1} (g). Genotypic and phenotypic correlation coefficients for grain yield and its component traits were calculated as suggested by Johnson *et al.* (1955). The direct and indirect effects of yield related traits on grain yield plant^{-1} was worked out through path coefficient analysis.

Table 1. Estimates of phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients for 16 characters in finger millet genotypes

Character	FLG	PLHT	NBT	FLBL	FLBW	FLSL	INFEX	PEDL	INFL
FLG	—	0.533**	-0.680**	-0.020	0.306**	-0.445**	-0.348**	-0.396**	0.323**
PLHT	0.573**	—	-0.376**	0.343**	0.384**	-0.103	0.038	0.077	0.295**
NBT	-0.735**	-0.421**	—	0.084	-0.335**	0.326**	0.371**	0.392**	-0.262**
FLBL	-0.031	0.406**	0.098	—	0.437**	0.143	0.060	0.092	0.351**
FLBW	0.363**	0.485**	-0.419**	0.484**	—	-0.124	-0.159	-0.174*	0.625**
FLSL	-0.582**	-0.193*	0.433**	0.100	-0.238**	—	0.044	0.327**	-0.046
INFEX	-0.387**	-0.020	0.420**	0.076	-0.226*	0.115	—	0.843**	-0.404**
PEDL	-0.462**	-0.018	0.456**	0.075	-0.249**	0.383**	0.916**	—	-0.413**
INFL	0.338**	0.342**	-0.282**	0.362**	0.705**	-0.110	-0.437**	-0.466**	—
INFW	0.142	0.286**	-0.188*	0.337**	0.671**	0.096	-0.389**	-0.382**	0.906**
LLF	0.306**	0.335**	-0.229**	0.402**	0.692**	-0.081	-0.405**	-0.434**	0.997**
WLF	0.539**	0.466**	-0.578**	0.177*	0.517**	-0.526**	-0.196*	-0.398**	0.223*
NFPE	-0.439**	-0.376**	0.444**	-0.048	-0.154	0.419**	0.003	0.090	-0.073
NB	-0.606**	-0.556**	0.604**	-0.263**	-0.362**	0.345**	0.381**	0.485**	-0.439**
FB	-0.794**	-0.633**	0.428**	-0.143	-0.103	0.498**	0.171	0.294**	-0.113
GYP	-0.331**	0.252**	0.488**	0.379**	0.065	0.427**	0.174*	0.207*	0.063

Table 1 cont....

Character	INFW	LLF	WLF	NFPE	NB	FB	GYP
FLG	0.121	0.291**	0.406**	-0.350**	-0.373**	-0.537**	-0.315**
PLHT	0.237**	0.300**	0.355**	-0.279**	-0.346**	-0.460**	0.247**
NBT	-0.147	-0.214*	-0.393**	0.357**	0.318**	0.289**	0.476**
FLBL	0.331**	0.391**	0.179*	0.019	-0.051	-0.070	0.322**
FLBW	0.590**	0.607**	0.415**	-0.019	-0.212*	-0.085	0.072
FLSL	0.149	-0.016	-0.307**	0.298**	0.192*	0.246**	0.341**
INFEX	-0.346**	-0.371**	-0.139	0.023	0.172	0.037	0.166
PEDL	-0.309**	-0.378**	-0.263**	0.054	0.236**	0.095	0.196*
INFL	0.853**	0.982**	0.192*	-0.030	-0.244**	-0.061	0.062
INFW	—	0.832**	0.206**	0.149	-0.195*	0.043	0.247**
LLF	0.896**	—	0.153	0.001	-0.210*	-0.044	0.095
WLF	0.167	0.187*	—	-0.201*	-0.219*	-0.218*	0.038
NFPE	0.111	-0.051	-0.391**	—	0.109	0.262**	0.387**
NB	-0.383**	-0.430**	-0.431**	0.243**	—	0.360**	-0.062
FB	0.026	-0.093	-0.423**	0.497**	0.476**	—	0.066
GYP	0.255**	0.101	0.009	0.456**	0.034	0.154	—

*, ** Significance at 5 (P=0.005) and 1 (P=0.001) percent level of significance, respectively.
FLG=days to 50% flowering, PLHT=plant height (cm), NBT=number of basal tillers, FLBL=flag leaf blade length (mm), FLBW=flag leaf blade width (mm), FLSL=flag leaf sheath length (mm), INFEX=inflorescence exertion (mm), PEDL=peduncle length (mm), INFL=inflorescence length (mm), INFW=inflorescence width (mm), LLF=length of longest finger (mm), WLF=width of longest finger (mm), NFPE=number of fingers ear^{-1}, NB=neck blast (%), FB=finger blast (%), GYP=grain yield plant^{-1} (g).

Table 2. Genotypic path coefficient analysis for 16 characters in finger millet.

Character	FLG	PLHT	NBT	FLBL	FLBW	FLSL	INFEX	PEDL	INFL	INFW	LLF	WLF	NFPE	NB	FB
FLG	1.4456	0.8280	-1.0629	-0.0450	0.5242	-0.8417	-0.5591	-0.6678	0.4884	0.2059	0.4425	0.7785	-0.6351	-0.8763	-1.1482
PLHT	0.7522	1.3133	-0.5530	0.5332	0.6364	-0.2541	-0.0265	-0.0230	0.4486	0.3760	0.4394	0.6123	-0.4937	-0.7301	-0.8315
NBT	-0.7923	-0.4538	1.0776	0.1054	-0.4514	0.4664	0.4525	0.4912	-0.3034	-0.2026	-0.2468	-0.6233	0.4784	0.6512	0.4613
FLBL	-0.0223	0.2904	0.0700	0.7153	0.3462	0.0718	0.0542	0.0535	0.2591	0.2414	0.2875	0.1266	-0.0340	-0.1883	-0.1026
FLBW	-0.1014	-0.1355	0.1172	-0.1354	-0.2797	0.0665	0.0631	0.0695	-0.1971	-0.1877	-0.1937	-0.1447	0.0431	0.1013	0.0289
FLSL	-0.4322	-0.1436	0.3213	0.0745	-0.1765	0.7422	0.0853	0.2840	-0.0819	0.0713	-0.0598	-0.3901	0.3111	0.2563	0.3698
INFEX	-0.8705	-0.0454	0.9453	0.1704	-0.5079	0.2585	2.2509	2.0611	-0.9835	-0.8751	-0.9112	-0.4402	0.0071	0.8586	0.3859
PEDL	1.2936	0.0491	-1.2764	-0.2095	0.6962	-1.0715	-2.5641	-2.8002	1.3037	1.0691	1.2139	1.1153	-0.2518	-1.3573	-0.8236
INFL	2.2039	2.2285	-1.8371	2.3627	4.5959	-0.7199	-2.8505	-3.0371	6.5235	5.9113	6.5023	1.4541	-0.4783	-2.8617	-0.7354
INFW	0.0446	0.0897	-0.0589	0.1057	0.2102	0.0301	-0.1218	-0.1196	0.2839	0.3133	0.2807	0.0522	0.0347	-0.1200	0.0081
LLF	-2.2460	-2.4547	1.6802	-2.9490	-5.0800	0.5910	2.9701	3.1807	-7.3133	-6.5748	-7.3371	-1.3735	0.3723	3.1533	0.6858
WLF	-0.1912	-0.1655	0.2053	-0.0628	-0.1836	0.1866	0.0694	0.1414	-0.0791	-0.0592	-0.0665	-0.3550	0.1387	0.1529	0.1503
NFPE	-0.0673	-0.0576	0.0680	-0.0073	-0.0236	0.0642	0.0005	0.0138	-0.0112	0.0170	-0.0078	-0.0598	0.1531	0.0372	0.0761
NB	-0.1423	-0.1305	0.1418	-0.0618	-0.0850	0.0811	0.0895	0.1138	-0.1030	-0.0899	-0.1009	-0.1011	0.0570	0.2347	0.1117
FB	-1.2053	-0.9607	0.6496	-0.2176	-0.1570	0.7561	0.2602	0.4463	-0.1711	0.0393	-0.1418	-0.6423	0.7536	0.7222	1.5175
GYP (r_g)	-0.3308	0.2518	0.4880	0.3789	0.0645	0.4274	0.1737	0.2075	0.0634	0.2551	0.1009	0.0090	0.4563	0.0339	0.1541

Residual effect = 0.424 , Bold items denotes direct effect, *, ** Significance at 5 (P=0.005) and 1 (P=0.001) percent level of significant correlation with grain yield

FLG=days to 50% flowering, PLHT=plant height (cm), NBT=number of basal tillers, FLBL=flag leaf blade length (mm), FLBW=flag leaf blade width (mm), FLSL=flag leaf sheath length (mm), INFEX=inflorescence exertion (mm), PEDL=peduncle length (mm), INFL=inflorescence length (mm), INFW=inflorescence width (mm), LLF=length of longest finger (mm), WLF=width of longest finger (mm), NFPE=number of fingers ear^{-1}, NB=neck blast (%), FB=finger blast (%), GYP=grain yield $plant^{-1}$ (g).

The analysis was done following the method suggested by Dewey and Lu (1959), which provides a means of untangling the complex correlations into direct and indirect contributions.

RESULTS AND DISCUSSION

The genotypic correlation coefficient values in general were found higher than phenotypic correlation coefficient values (Table 1) indicating strong inherent association between different traits and phenotypic selection would be effective as the association was mainly governed by genetic factors, while the phenotypic values were reduced by the significant interaction of the environment. Plant height (0.247**, 0.252**), number of basal tillers (0.476**, 0.488**), flag leaf blade length (0.322**, 0.379**), flag leaf sheath length (0.341**, 0.427**), peduncle length (0.196*, 0.207*), inflorescence width (0.247**, 0.255**) and number of fingers/ ear (0.387**, 0.456**) showed high positive and significant correlation with grain yield plant^{-1} both at genotypic and phenotypic levels. Whereas, inflorescence length (0.062, 0.063), length of longest finger (0.095, 0.101) and width of longest finger (0.038, 0.009) exhibited non significant positive relationship with grain yield plant^{-1}. Thus, present results are in consonance with those of Bedis *et al.* (2006) Gowda *et al.* (2008), Kadam *et al.* (2009), Priyadharshini *et al.* (2011).

Path coefficient analysis is useful in determining the direct and indirect correlations of various yield attributes. The direct and indirect effects of fifteen characters on grain yield are presented in Table 2. Path analysis revealed that inflorescence length (6.524) had the highest positive direct effect on grain yield plant^{-1} which was followed by inflorescence exertion (2.251), days to 50% flowering (1.446), plant height (1.313) and number of basal tillers (1.078). The genotypic association of plant height (0.252**) and number of basal tillers (0.488**) was significantly positive suggesting the true perfect association of these characters and also indicating its role in simultaneous selection, while selecting genotypes with high grain yield. Hence, direct selection for these traits would be rewarding for yield improvement, which will also reduce the undesirable effect of the component traits studied. Similar findings were reported by Bedis *et al.* (2006), Kadam *et al.* (2009), Andualem and Tadesse (2011), Priyadharshini *et al.* (2011).

Regarding the indirect effect of component traits on grain yield, days to 50% flowering had high indirect effect through number of basal tillers (-0.792) and plant height (0.752).

Hence, from the results, it could be inferred that the traits inflorescence length, inflorescence exertion, days to 50% flowering, plant height and number of basal tillers have to be accounted for direct selection for yield improvement.

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