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Studies on Genetic Parameters, Character Association and Path Analysis of Yield and its Components in Finger Millet (*Eluesine Coracana* L. Gaertn)

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ABSTRACT: An experiment was carried out to estimate the genetic parameters like variability, heritability and genetic advance, character association and path analysis for eight quantitative characters *viz.*, plant height, number of productive tillers per plant, days to 50% flowering, days to maturity, number of fingers per ear, main ear length, grain yield and straw yield per plot in 25 genotypes of Finger Millet (*Eluesine Coracana* L. Gaertn). The genotypic coefficients of variation for all the characters studied were lesser than the phenotypic coefficients of variation indicating the interaction of genotypes with environment. High heritability coupled with high genetic advance was observed for grain yield per plot and straw yield per plot indicating the importance of additive gene action in governing the inheritance of these traits. Hence, simple selection is effective to improve the respected trait. Association studies revealed that, plant height and main ear length shows positive correlation with grain yield per plot at genotypic and phenotypic levels and days to 50% flowering, days to maturity, number of fingers per ear shows positive correlation with grain yield per plot at phenotypic level. Path analysis studies revealed that plant height and main ear length showed true relationship by establishing positive association and direct effect on grain yield per plant both at genotypic and phenotypic levels and number of productive tillers per plant, days to 50% flowering and number of fingers per ear at genotypic level and days to maturity at phenotypic level.

Key words: Genetic variability, Heritability, Genetic advance, Character association, Path analysis, Finger millet, direct and indirect effects.

I. INTRODUCTION

Finger millet (*Eleusine coracana* (L.) Gaertn.) is one of the most important small millets grown in eastern and southern Africa. It serves as a subsistence and food security crop that is especially important for its nutritive and cultural value. It is an important food crop in traditional low input cereal-based farming systems in Africa, and is of particular importance in upland areas of and It is an important food crop in traditional low input cereal-based farming systems in Africa, and is of particular importance in upland areas of eastern Africa, where it commands a high market price compared with other cereals Finger millet has also a high-yielding potential though yields are variable (compared to other cereals) but are generally good and needs improvement. To improve such important small millet crop through breeding, study on genetic variability of important traits responsible for grain yield. Knowledge on heritability and genetic advance of the character indicate the scope for the improvement of a trait through selection. Heritability estimates along with genetic advance are also helpful in predicting the gain under selection (Johnson *et al.,* 1955).

Grain yield being a complex character is very difficult to improve by selecting the genotypes for yield *per se*, therefore identifying the characters which are closely related and have contributed to yield becomes highly essential. The estimates of correlation coefficients mostly indicate the inter-relationships of the characters whereas path analysis permits the understanding of the cause and effect of related characters (Wright, 1921) [10]. The path analysis reveals whether the association of characters with yield is due to their direct effect on yield or is a consequence of their indirect effects via other component characters. Therefore, the present study was conducted in finger millet to study the genetic parameters like variability, heritability & genetic advance, correlation and path coefficient effects of different yield components on grain yield.

II. MATERIAL AND METHODS

The field experiment was conducted at Agricultural Research Station, Vizianagaram during *Kharif* 2014. The design adopted was Randomised Block Design with three replications.

Each plot consisted of ten rows of 3 meters length with a spacing of 22.5 × 10 cm. The fertilizer dose of 60:40:30kg NPK/ha (50% N in + Full P & K at the time of sowing) was applied at the time of sowing seed and seeds were sown by hand dibbling. The remaining 50% N was applied after three weeks of sowing. Standard pest management measures were taken during the crop growth period as and when required. Observations were recorded on five plants for eight quantitative characters *viz.*, plant height, number of productive tillers per plant, days to 50% flowering, days to maturity, number of fingers per ear, main ear length, grain yield and straw yield per plot. The data was subjected to statistical analysis and estimates of correlation coefficients were worked out as per Snedecor and Cochran, (1967) [8], direct and indirect effects of yield components on yield were calculated as suggested by Dewey and Lu (1959) [3].

III. RESULTS AND DISCUSSION

The analysis of variance revealed significant difference among the genotypes for all the five characters studied (Table 1). In the present study, the variation among genotypes was estimated as coefficient of variation and the phenotypic coefficient of variance (PCV) was slightly higher in magnitude than genotypic coefficient of variance (GCV) for all the characters studied indicating the interaction of genotypes with environment (Table 2). High PCV and GCV were recorded for number of productive tillers per plant, grain yield per plot and straw yield per plot indicating sufficient variation among the genotypes studied. Heritability is a measure of genetic relationship between parents and progeny. In the present study, heritability estimates were high for days to 50% flowering (98.80%), days to maturity (99.00%), straw yield per plot (82.70%) and grain yield per plot (76.30%). High heritability alone is not sufficient enough to exercise selection unless the information is accompanied with substantial amount of genetic advance. Thus genetic advance is another important selection parameter which is exploited along with heritability to predict the genetic advance of the trait. High heritability coupled with high genetic advance was observed for grain yield per plot and straw yield per plot indicating the importance of additive gene action in governing the inheritance of these traits. These results were in accordance with findings of Manoj Kumar *et al*. (2015) [6], Ezeaku *et al.* (2015) [4] and Suryanarayana *et al.* (2014) [9].

Table 1: Analysis of variance (mean sum of squares) for yield and yield component characters in Finger millet (*Eluesine coracana* L. Gaertn).

Source of variations	d.f.	Plant height	Number of productive tillers	Days to 50% flowering	Days to maturity	No. of fingers/ear	Main ear length	Grain yield	Straw yield
Replications	2	42.819	0.885	4.493	1.693	0.759	0.069	0.029	0.170
Genotypes	24	187.906**	0.223	298.503**	419.474**	0.891**	1.734**	0.336**	8.303**
Error	48	35.069	0.106	1.243	1.346	0.466	0.370	0.032	0.542

**Significant at 1% level.

Table 2: Estimates of variability, heritability and genetic advance as per cent of mean for grain yield and yield components in Finger millet (*Eluesine coracana* L. Gaertn).

S. No.	Character	Mean	Range		Coefficient of variation		Heritability (broad sense)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1.	**Plant height**	101.907	93.600	134.200	9.101	7.004	9.20	11.104
2.	**Number of productive tillers**	1.840	1.200	2.333	20.725	10.727	26.80	11.437
3.	**Days to 50% flowering**	85.173	67.667	102.000	11.760	11.687	98.80	23.926
4.	**Days to maturity**	117.813	96.667	135.667	10.069	10.021	99.00	20.544
5.	**No. of fingers/ ear**	7.421	6.667	8.533	10.501	5.073	23.30	5.048
6.	**Main ear length**	7.655	6.100	9.267	11.864	8.807	55.10	13.467
7.	**Grain yield**	1.268	0.714	1.965	28.781	25.144	76.30	45.252
8.	Straw yield	4.579	1.873	9.163	38.631	35.124	82.70	65.787

Genotypic correlations were higher than the corresponding phenotypic correlations, low phenotypic correlations can be explained due to masking or modifying effects of environment on genetic association between characters. Plant height and main ear length shows positive correlation with grain yield per plot at genotypic and phenotypic levels and days to 50% flowering, days to maturity, number of fingers per ear shows positive correlation with grain yield per plot at phenotypic level (Table 3).

Table 3: Phenotypic and genotypic correlation coefficient in 25 genotypes of Finger millet (*Eluesine coracana* L. Gaertn).

S. No	Characters		Plant height	Number of productive tillers	Days to 50% flowering	Days to maturity	No. of fingers/ear	Main ear length	Straw yield	Grain yield
1.	Plant height	r_p	1	-0.004	-0.109	-0.105	-0.312	-0.052	0.480	0.061
		r_g	1	-0.329	-0.152	-0.152	-0.413	-0.180	0.125	0.119
2.	Number of productive tillers	r_p		1	0.069	0.029	-0.091	-0.069	-0.112	-0.145
		r_g		1	0.108	0.049	-0.606	-0.408	-0.045	-0.333
3.	Days to 50% flowering	r_p			1	0.978**	0.069	-0.191	0.065	0.002
		r_g			1	0.979**	0.145	-0.269	0.077	-0.008
4.	Days to maturity	r_p				1	0.100	-0.194	0.075	0.004
		r_g				1	0.216	-0.258	0.085	-0.005
5.	No. of fingers/ear	r_p					1	0.012	-.264*	0.002
		r_g					1	-0.066	-0.696	-0.119
6.	Main ear length	r_p						1	0.118	0.218
		r_g						1	0.173	0.354
7.	Straw yield	r_p							1	-0.314
		r_g							1	-0.425
8.	Grain yield	r_p								1
		r_g								1

r_p = Phenotypic correlation coefficient. *Significant at 5% level, r_g = Genotypic correlation, coefficient. **Significant at 1% level

These results were in accordance with the findings of Anuradha *et al.* (2013) [1], Brunda *et al.* (2015) [2], Ezeaku *et al.* (2015) [4], Manoj Kumar *et al*. (2015) [6] and Patil *et al.* (2013) [7]. This suggests selecting for the characters with high positive correlation would improve the grain yield in finger millet. Path analysis revealed that plant height and main ear length showed true relationship by establishing positive association and direct effect on grain yield per plant both at genotypic and phenotypic levels and number of productive tillers per plant, days to 50% flowering and number of fingers per ear at genotypic level and days to maturity at phenotypic level (Table 4). These results were in accordance with findings of Anuradha *et al.* (2013), Brunda *et al.* (2015), Ezeaku *et al.* (2015), Manoj Kumar *et al*. (2015) and Patil *et al.* (2013). Considering the nature and magnitude of character association and their direct and indirect effects, it can be inferred that improvement of grain yield per plot is possible through simultaneous manifestation of plant height, main ear length, number of productive tillers per plant, days to 50% flowering and days to maturity.

Table 4: Path coefficients of yield and yield components of Finger millet (*Eluesine coracana* L. Gaertn).

S. No	Characters		Plant height	Number of productive tillers	Days to 50% flowering	Days to maturity	No. of fingers/ear	Main ear length	Straw yield	Grain yield
1.	Plant height	P	**0.070**	-0.000	-0.007	-0.007	-0.022	-0.004	0.003	0.061
		G	**1.062**	-0.349	-0.162	-0.161	-0.439	-0.192	0.133	0.119
2.	Number of productive tillers	P	0.000	**-0.186**	-0.013	-0.005	0.017	0.013	0.021	-0.145
		G	-0.323	**0.982**	0.016	0.049	-0.595	-0.400	-0.044	-0.333
3.	Days to 50% flowering	P	0.000	0.000	**-0.000**	-0.000	0.000	0.000	0.000	0.002
		G	-0.084	0.059	**0.553**	0.542	0.080	-0.149	0.043	-0.008
4.	Days to maturity	P	-0.012	0.003	-0.111	**0.114**	0.011	-0.022	0.008	0.004
		G	0.054	-0.018	-0.350	**-0.358**	-0.077	-0.092	-0.039	-0.005
5.	No. of fingers/ear	P	0.036	0.011	-0.008	-0.011	**-0.115**	-0.001	0.030	0.002
		G	-0.390	-0.573	0.137	0.205	**0.946**	-0.063	-0.059	-0.119
6.	Main ear length	P	-0.015	-0.019	-0.054	-0.055	0.003	**0.281**	0.033	0.218
		G	-0.194	-0.437	-0.289	-0.277	-0.071	**1.074**	0.186	0.354
7.	Straw yield	P	-0.019	0.046	-0.027	-0.031	0.108	-0.049	**-0.410**	-0.314
		G	-0.066	0.002	-0.004	-0.005	0.037	-0.009	**-0.053**	-0.425

Bold are direct effects, P: Phenotypic path coefficient, Residual effects (P): 0.883, G: Genotypic path coefficient, (G):0.957

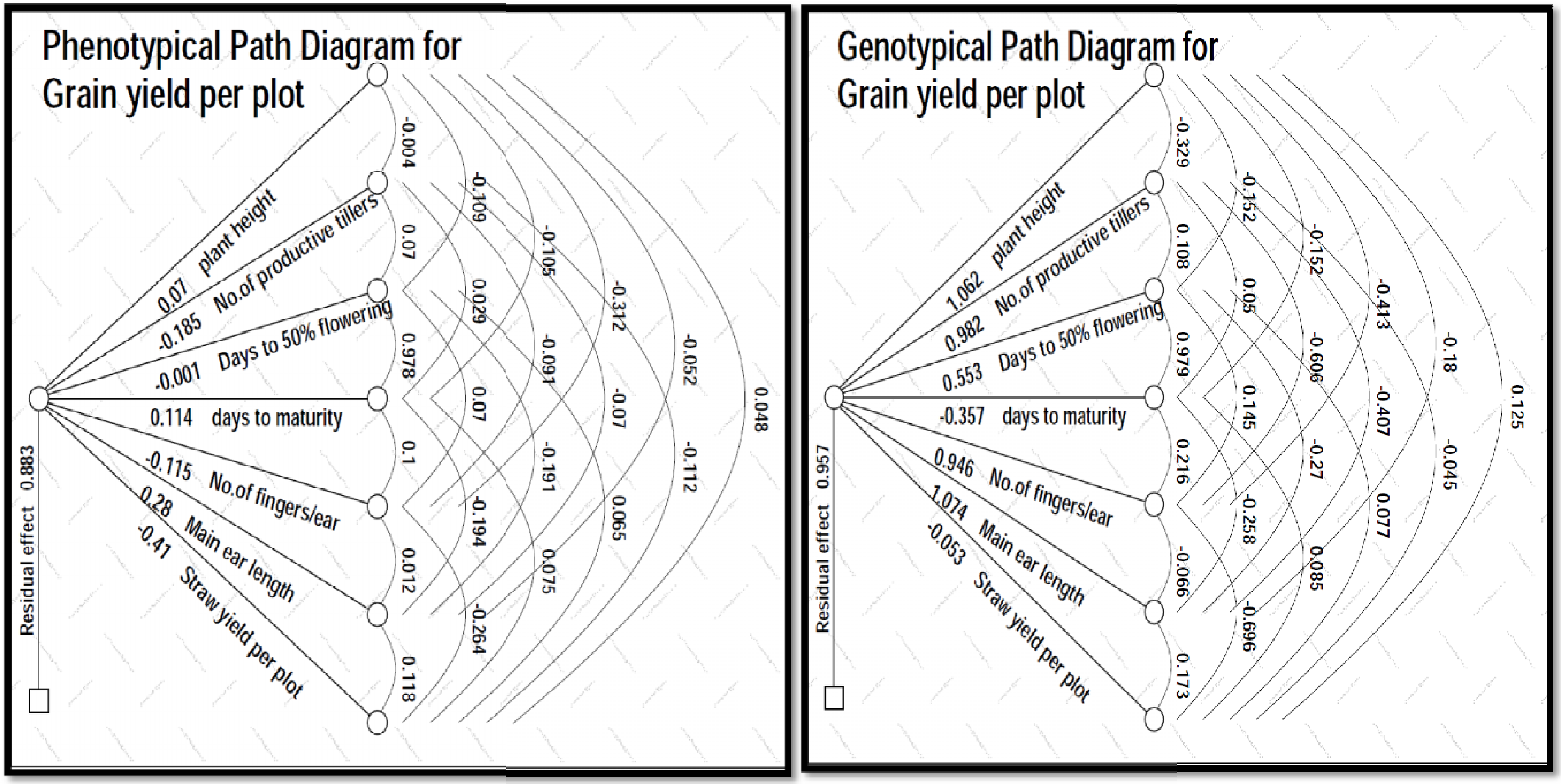

Fig. 1. Phenotypic and genotypic path diagrams showing cause-effect relationship of yield components with grain yield per plot of finger millet.

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