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STUDIES ON GENETIC PARAMETERS, CHARACTER ASSOCIATION AND PATH ANALYSIS OF YIELD AND ITS COMPONENTS IN LITTLE MILLET (*PANICUM SUMATRENSE*)

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Abstract- An investigation was carried out to assess the genetic parameters like variability, heritability and genetic advance, character association and path analysis for five yield component characters *viz.,* plant height, number of productive tillers per plant, days to 50% flowering, days to maturity and grain yield per plot in 18 genotypes of Little millet (*Panicum sumatrense* Roth. ex. Roem. and Schultz.). 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 days to 50% flowering and grain 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, number of productive tillers per plant exhibited highly significant positive correlation with grain yield per plot at genotypic level. However, the traits plant height, number of productive tillers per plant and days to 50% flowering were found to possess association in desirable direction with grain yield per plot at both genotypic and phenotypic levels. Path analysis studies revealed that days to 50% flowering showed true relationship by establishing significant positive association and direct effect on grain yield per plot both at genotypic and phenotypic levels and plant height at genotypic level and number of productive tillers at phenotypic level.

Keywords- Genetic variability, Heritability, Genetic advance, Character association, Path analysis, Little millet, direct and indirect effects.

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Introduction

The transformation of agriculture to more productive systems has often been accompanied by increased production of a fewer crops species. Concurrently, the area and production of a great diversity of traditional crops have declined. Yet in many parts of the world, these traditional crops play an important role in maintaining stable and sustainable forms of agriculture. Little millet (*Panicum sumatrense*) is one such traditional group among cereal crops commonly cultivated in the subtropical and tropical areas of the country. Little millet nutritionally superior to rice and wheat, which provides proteins, minerals and vitamins to the poorest of the poor community where the need for such ingredients is the high. Practically devoid of grain storage pests, the little millets have indefinite storage life. 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 [5].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 [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 Little millet to study the genetic parameters like variability, heritability & genetic advance, correlation and path coefficient effects of different yield components on grain yield.

MaterialsandMethods

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 x 10 cm. The fertilizer dose of 60:40:30 kg 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 five quantitative characters *viz.,* plant height, number of productive tillers per plant, days to 50% flowering, days to maturity and grain yield per plot. The data was subjected to statistical analysis and estimates of correlation coefficients were worked out as per [8], direct and indirect effects of yield components on yield were calculated as suggested by [3].

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 and grain 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 (99.00%), days to maturity (98.30%), plant height (82.90%) and grain yield per plot (71.60%). 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 days to 50% flowering and grain 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 [2,4,6,9].

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. Number of productive tillers per plant found to possess significant association in desirable direction with grain yield per plot at genotypic and level [Table-3]. These results were in accordance with the findings of [1,2,4,6,7]. This suggests selecting for the characters with high positive correlation would improve the grain yield in little millet.

Path analysis studies revealed that days to 50% flowering showed true relationship by establishing significant positive association and direct effect on grain yield per plot both at genotypic and phenotypic levels and plant height at genotypic level and number of productive tillers at phenotypic level [Fig-1,2] [Table-4]. These results were in accordance with findings of [1,2,4,6,7]. 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 number of productive tillers per plant, days to 50% flowering and days to maturity.

Table-1 *Analysis of variance (mean sum of squares) for yield and yield component characters in Foxtail Millet (Panicum sumatrense)*

Source of variations	d.f.	Plant height	Number of productive tillers	Days to 50% flowering	Days to maturity	Grain yield
Replications	2	247.629	4.207	0.963	2.667	0.010
Genotypes	17	401.908**	0.590	190.489**	175.765**	0.019**
Error	34	25.850	0.588	0.610	1.019	0.002

**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 Foxtail Millet (Panicum sumatrense)*

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	137.522	121.267	152.933	8.941	8.141	82.90	15.270
2.	Number of productive tillers per plant	4.211	3.600	5.400	18.219	18.207	10.00	0.050
3.	Days to 50% flowering	54.982	40.333	69.333	14.539	14.470	99.00	29.665
4.	Days to maturity	84.000	70.667	101.333	9.165	9.085	98.30	18.555
5.	Grain yield	0.497	0.409	0.662	18.258	15.448	71.60	26.926

Table-3 *Phenotypic and genotypic correlation coefficient in 18 genotypes of Foxtail millet (Panicum sumatrense)*

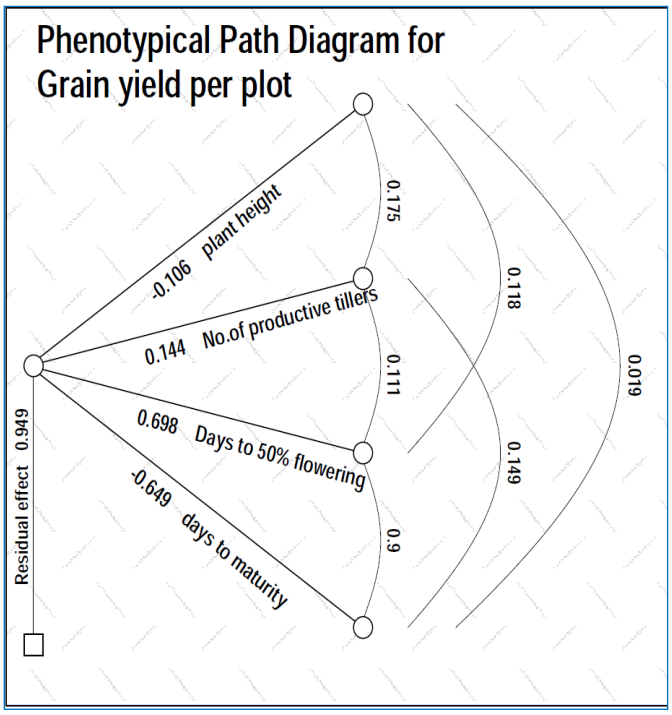
S. No	Characters		Plant height	Number of productive tillers	Days to 50% flowering	Days to maturity	Grain yield
1.	Plant height	r_p	1	0.175	0.118	0.019	-0.011
		r_g	1	4.069**	0.125	0.019	0.024
2.	Number of productive tillers	r_p		1	0.111	0.149	0.107
		r_g		1	3.755**	3.611**	3.065**
3.	Days to 50% flowering	r_p			1	0.899**	0.118
		r_g			1	0.909**	0.127
4.	Days to maturity	r_p				1	-0.007
		r_g				1	-0.002
5.	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

Table-4 *Path coefficients of yield and yield components of Foxtail millet (Panicum sumatrense).*

S. No	Characters		Plant height	Number of productive tillers	Days to 50% flowering	Days to maturity	Grain yield
1.	Plant height	P	-0.106	-0.019	-0.002	-0.002	-0.011
		G	0.357	1.454	0.045	0.045	0.024
2.	Number of productive tillers	P	0.025	0.144	0.016	0.021	0.107
		G	-0.426	-0.105	-0.393	-0.378	3.065**
3.	Days to 50% flowering	P	0.082	0.078	0.698	0.628	0.118
		G	0.100	3.013	0.802	0.730	0.127
4.	Days to maturity	P	-0.012	-0.097	-0.584	-0.649	-0.007
		G	-0.007	-1.297	-0.327	-0.359	-0.002

Bold are direct effects P: Phenotypic path coefficient
Residual effects (P): 0.95 G: Genotypic path coefficient (G): 1.1



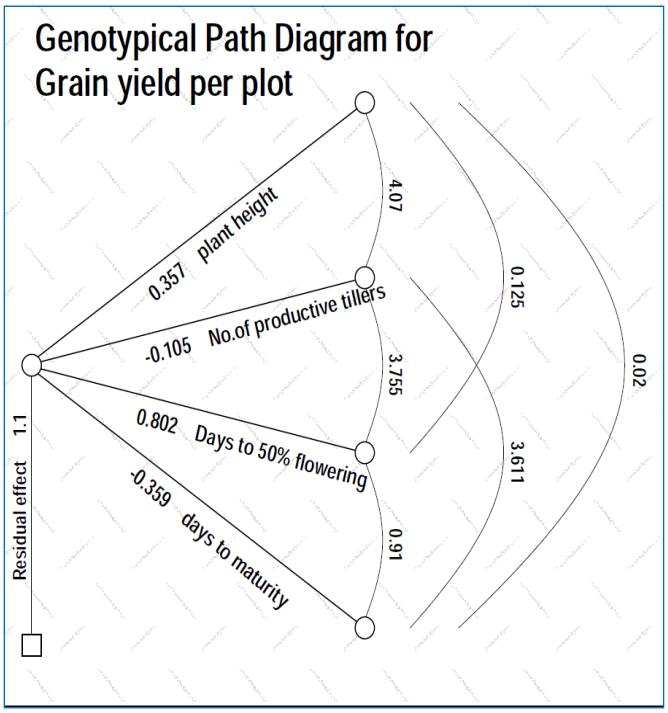


Fig-1&2 Phenotypic and genotypic path diagrams showing cause-effect relationship of yield components with grain yield per plot of little millet.

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Conflict of Interest: None declared

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