Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP1: 649-652

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(Special Issue- 1)
2nd International Conference
"Food Security, Nutrition and Sustainable Agriculture - Emerging Technologies"
(February 14-16, 2019)

Characterisation of new germplasm accessions for yield and yield related traits in Foxtail millet [*Setaria italica* (L.) P. Beauv]

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Abstract
Thirty indigenous collections of Foxtail millet were evaluated for assessment of yield and yield related traits during *Kharif* 2016 in ZARS, V.C. Farm, Mandya. Analysis of variance indicated the significant difference among the germplasm evaluated for all the traits. The difference between phenotypic and genotypic coefficient of variations were less for all the traits indicating the less influence of environment on the expression of these traits. High heritability with high genetic advance was observed for number of tillers per plant, flag leaf blade width, flag leaf sheath length, inflorescence length, single plant yield and net plot yield indicating the predominance of additive gene action in the inheritance of these traits, hence simple selection for these traits will be effective. Single plant yield was significantly correlated with flag leaf blade length, flag leaf blade width, inflorescence length, 1000 seed weight and net plot yield both at genotypic and phenotypic level. Path analysis revealed that inflorescence length had high positive direct effect on single plant yield followed by 1000 seed weight both at genotypic and phenotypic level. Hence selection based on these traits will be effective.

Keywords: PCV, GCV, Heritability, Genetic Advance, Phenotypic correlations, genotypic correlations and Path analysis.

Introduction
Foxtail millet [*Setaria italica* (L.) P. Beauv.] is one of the oldest cultivated crop of millets which stands second in the world's total production of millets and is the major staple food for millions of people in southern Europe and Asia. Being climate resilient, foxtail millet offers special features such as short duration, less water and nutrient requirement, resistance to pests and diseases. It is rich in carbohydrates, protein, dietary fibre, minerals such as iron and copper and is an ideal food for diabetic patients. Characterisation of germplasm plays major role in crop improvement as it gives materials to work with in future breeding. Heritability coupled with genetic advance will be helpful in formulating suitable selection procedures. Correlation studies provide information regarding degree of association of component traits with yield while path coefficient analysis will provide information regarding the direct and indirect effects of component traits on yield which helps in the indirect selection of plants for yield. Hence an investigation was undertaken to characterize a set of germplasm lines to estimate the genetic parameters like variability, heritability and genetic advance, correlation and path coefficient effects of various yield components on grain yield.

Material and methods
The present investigation was carried out at the Zonal Agricultural Research Station, V.C. Farm, Mandya during *Kharif* 2016. Randomised Block Design with three replications was followed. Each accession was grown in two rows of one meter length with spacing of 30 x 10 cm. The application of NPK fertilizers was done as per recommended dose. All the cultural practices were carried out as per the package of practices. Observations were recorded on five

randomly selected and separately labelled plants from each genotype for traits *viz*., Days to 50 per cent flowering, plant height, flag leaf blade length, flag leaf blade width, flag leaf sheath length, number of tillers per plant, inflorescence length, 1000 seed weight, single plant yield and net plot yield. Statistical analysis was done as per Burton and Davane (1953) [6] for estimation of GCV and PCV, Lush (1940) [11] for heritability, Johnson *et al*. (1955) [9] for genetic advance, Al-Jibouri *et al*., (1958) [2] for correlation and Dewey and Lu 1959) [7] for path analysis.

Results and Discussion

Analysis of variance indicated significant difference among all the genotypes evaluated for all the ten traits (Table 1). High estimates of phenotypic and genotypic coefficients of variation were obtained for number of tillers per plant, single plant yield and net plot yield which indicate the presence of sufficient variability among the genotypes studied (Table 2). The difference between GCV and PCV was not significant which indicated the little role of environment in trait expression. Heritability indicates the correspondence between phenotype and genotype. In the present investigation, high estimates of heritability were obtained for all the traits studied. However, it is not necessary that a character showing high heritability will also exhibit high genetic advance (Johnson *et al*., 1955) [9]. High heritability coupled with high genetic advance as per cent of mean was observed for traits like number of tillers per plant, flag leaf blade width, flag leaf sheath length, inflorescence length, single plant yield and net plot yield. These results were in agreement with the findings of Nirmalakumari *et al*. (2010) [12], Prasanna *et al*. (2013) [13] Brunda *et al*. (2014) [4] and Jyothsna *et al*. (2016) [10]. High heritability coupled with high genetic advance indicates the predominance of additive gene action governing the expression of these traits. Hence, simple selection will be effective for improving these traits.

In the present investigation, single plant yield was significantly correlated with flag leaf blade length, flag leaf blade width, inflorescence length, 1000 seed weight and net plot yield both at genotypic and phenotypic level (Table3). These are in agreement with the results obtained by Brunda *et al*. (2015) [5] and Prasanna *et al*. (2013) [13] in foxtail millet and Salini *et al.* (2010) [14] in proso millet. It suggests that selection for these traits indirectly improve the grain yield. Path coefficient analysis revealed that inflorescence length and 1000 seed weight had significant positive and direct contribution to single plant yield at genotypic and phenotypic level indicating that these traits directly influence the grain yield (Fig. 1, Table 4). This is in accordance with the findings of Hawlader and Hamid (1988) [8] in foxtail millet, Bezaweletaw *et al*. (2006) [3] in finger millet, Abuali *et al*. (2012) in Pearl millet and Brunda *et al*. (2015) [5] in foxtail millet. It indicates that selection for inflorescence length and 1000 seed weight will improve grain yield.

Table 1: Analysis of variance for yield and yield related traits in foxtail millet genotypes

Source of variation	Degrees of freedom	Days to 50 per cent flowering	Plant height (cm)	No.of tillers per plant	Flag leaf blade length (cm)	Flag leaf blade width (cm)	Flag leaf sheath length (cm)	Inflorescence length (cm)	1000 seed weight (g)	Single plant yield(g)	Net Plot yield (Kg)
Replication	2	0.010	107.10	0.28	11.737	0.006	0.073	1.03	0.008	3.82	0.008
Genotypes	30	44.34**	374.53**	8.56**	36.513**	0.20**	10.58**	21.63**	0.28**	106.91**	0.034**
Error	60	0.010	44.21	.01	5.752	0.02	0.22	2.25	0.012	7.84	0.005
LSD at 5 %		0.16	10.85	0.52	3.92	0.21	0.79	2.45	0.17	4.57	0.12
SE m±		0.06	3.77	0.18	1.36	0.08	0.27	0.86	0.06	2.29	0.06

** Significant at P= 0.05

Table 2: Estimation of mean and genetic parameters of ten quantitative traits in foxtail millet germplasm lines

Characters	Mean	Range	V_P	V_G	PCV%	GCV%	H (%)	Genetic advance as per cent mean
Days to 50 per cent flowering	50.80	18	14.79	14.77	7.57	7.56	99	15.58
Plant height(cm)	122.70	54.69	154.31	110.11	10.16	8.58	71.4	14.93
No. of tillers per plant	4.19	7.04	2.91	2.82	40.80	40.09	96.5	81.15
Flag leaf blade length (cm)	30.45	13.25	16.01	10.25	13.14	10.52	64.1	17.34
Flag leaf blade width(cm)	2.15	1.06	0.08	0.06	13.04	11.53	78.1	21.01
Flag sheath length(cm)	13.03	8.69	3.68	3.45	14.72	14.25	78.1	28.44
Inflorescence length(cm)	18.71	11.51	8.71	6.46	15.77	13.58	74.2	24.10
1000 seed weight(g)	3.80	0.94	0.10	0.09	8.36	7.91	89.4	15.42
Single plant yield(g)	26.70	23.23	40.80	32.95	23.92	21.50	89.88	39.81
Net plot yield(Kg)	0.47	0.46	0.015	0.009	26.36	21.16	80.26	34.98

Table 3: Estimates of Phenotypic and genotypic correlation coefficients of yield and yield related traits in foxtail millet genotypes

		Days to 50 per cent floweringX1	Plant height (cm) X2	No. of tillers per plant X3	Flag leaf blade length (cm) X4	Flag leaf blade width (cm) X5	Flag leaf sheath length (cm)X6	Inflorescence length (cm) X7	1000 seed weight (g) X8	Single plant yield (g) X9	Net plot yield (Kg) X10
X1	P	1.000	0.424**	-0.031	-0.092	-0.326**	0.075	-0.231*	-0.174	-0.151	-0.138
	G	1.000	0.505**	-0.031	-0.114	-0.371**	0.078	-0.270**	-0.183	-0.155	-0.139
X2	P		1.000	-0.329**	-0.070	-0.035	0.275**	-0.027	0.011	0.009	0.046
	G		1.000	-0.394**	-0.025	-0.068	0.330**	-0.057	-0.007	-0.005	0.054
X3	P			1.000	0.208*	0.039	0.040	0.075	0.083	0.098	0.068
	G			1.000	0.285**	0.047	0.043	0.068	0.084	0.098	0.069
X4	P				1.000	0.736**	0.013	0.655**	0.672**	0.720**	0.719**

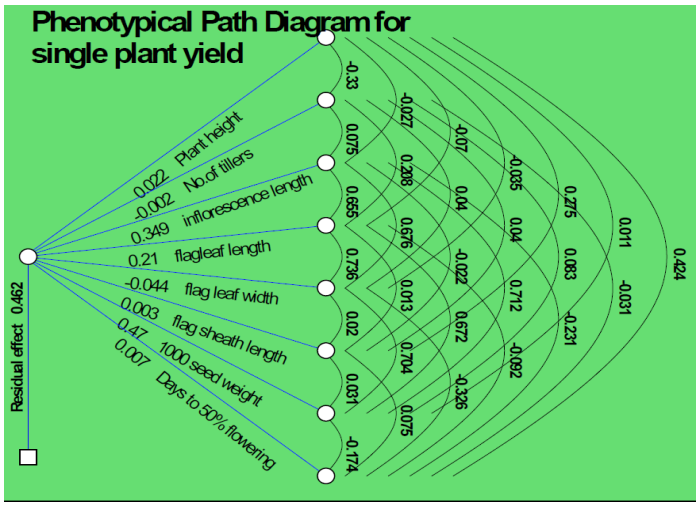
	G				1.000	0.879**	0.007	0.978**	0.903**	0.955**	0.897**
X5	P					1.000	0.020	0.676**	0.704**	0.675**	0.661**
	G					1.000	0.018	0.843**	0.856**	0.773**	0.748**
X6	P						1.000	-0.022	0.031	0.018	0.015
	G						1.000	-0.078	0.025	0.011	0.016
X7	P							1.000	0.712**	0.789**	0.789**
	G							1.000	0.863**	0.904**	0.918**
X8	P								1.000	0.828**	0.806**
	G								1.000	0.876**	0.853**
X9	P									1.000	0.961**
	G									1.000	0.988**
X10	P										1.000
	G										1.000

Significant at P = 0.01, P= phenotypic level, G= genotypic level

Table 4: Estmates of direct and indirect effects of yield components on single plant yield in foxtail millet genotypes based on phenotypic path analysis.

	Days to 50 per cent flowering	Plant height(cm)	No. of tillers per plant	Flag leaf blade length (cm)	Flag leaf blade width (cm)	Flag leaf sheath length (cm)	Inflorescence length (cm)	1000 seed weight (g)
Days to 50 per cent flowering	**0.0072**	0.0030	-0.0002	-0.0007	-0.0023	0.0005	-0.0017	-0.0012
Plant height(cm)	0.0094	**0.0221**	-0.0073	-0.0015	-0.0008	0.0061	-0.0006	0.0002
No. of tillers per plant	0.0001	0.0007	**-0.0020**	-0.0004	-0.0001	-0.0001	-0.0002	-0.0002
Flag leaf blade length (cm)	-0.0193	-0.0147	0.0437	**0.2101**	0.1545	0.0028	0.1377	0.1412
Flag leaf blade width(cm)	0.0143	0.0015	-0.0017	-0.0323	**-0.0440**	-0.0009	-0.0297	-0.0309
Flag leaf sheath length (cm)	0.0003	0.0009	0.0001	0.0000	0.0001	**0.0034**	-0.0001	0.0001
Inflorescence length (cm)	-0.0808	-0.0093	0.0261	0.2289	0.2363	-0.0078	**0.3494**	0.2489
1000 seed weight(g)	-0.0817	0.0052	0.0391	0.3161	0.3309	0.0144	0.3350	**0.4702**
Single plant yield(g)	-0.1506	0.0094	0.0978	0.7202	0.6747	0.0184	0.7898	0.8284

Residual effect = 0.4625



Phenotypic path diagram showing cause – effect relationship of yield components with yield

References

1. Abuali AI, Abdelmulla AA, Idris AS. Character Association and Path Analysis in Pearl Millet (*Pennisetum glaucum* L.). American. J Exp. Agric. 2014; 2(3):370-381.
2. Al-Jibouri HA, Miller PA, Robinson HF. Genetic and environmental variances and co-variances in an upland cotton cross of interspecific origin. Agron. J. 1958; 50:633-636.
3. Bezaweletaw K, Sripichitt P, Wongyai W, Hongtrakul V. Genetic Variation, Heritability and Path-Analysis in EthiopianFinger Millet [*Eleusine coracana* (L.) Gaertn] Landraces. *Kasetsart* J., 2006; 40:322-334.
4. Brunda SM, Kamatar MY, Naveenkumar KL, Hundekar R. Study of Genetic Variability, Heritability and Genetic Advance in Foxtail Millet in both Rainy and Post Rainy Season. IOSR. J Agric. Vet. Sci. 2014; 7(11):34-37.
5. Brunda SM, Kamatar MY, Hundekar R, Naveenkumar KL. Studies on correlation and path analysis in foxtail millet genotypes [*Setaria italica* (L.) P. B.]. Green

Farming. 2015; 6(5):966-969.
6. Burton CW, Devane EH. Estimating heritability in tall Fesene (*Festuca arundinacea*) from replicated clonal material. Agron. J. 1953; 45:478-481.
7. Dewey DR, Lu HK. A correlation and path coefficient analysis of components of created wheat grass seed production. Agron. J. 1959; 51(3):515-518.
8. Hawlader MSH, Hamid MA. Path coefficient analysis for components of grain yield in foxtail millet (*Setaria italica* Beauv.). Bangladesh J Plant Breed. Genet. 1988; 1(1-2):84-87.
9. Johnson HW, Robinson HF, Comstock RE. Estimation of genetic variability and environmental variability in soybean. Agron. J. 1955; 47:314-318.
10. Jyothsna S, Patro TSSK, Rani YS, Neeraja B, Ashok S, Triveni U. Studies on genetic variability and inter-relationship between grain yield and its components in foxtail millet (*Setaria italica*). Int. J Agric. Sci. 2016; 8(5):1015-1017.
11. Lush JL. Intra-sire correlation on regression of offspring on dams as a method of estimating heritability of characters. Proc. American. Soc. Animal. Produc., 1940; 33:292-301.
12. Nirmalakumari A, Vetriventhan M. Characterization of foxtail millet germplasm collection for yield contributing traits. Electronic J Plant Breed. 2010; 1(2):140-147.
13. Prasanna PL, Murthy JSVS, Ramakumar PV, Rao VS. Studies on correlation and path analysis in exotic Genotypes of Italian millet [*Setaria italica* (L.) Beauv]. Electronic J Plant Breed. 2013; 4(1):1080-1085.
14. Salini K, Nirmalakumari A, Muthiah AR, Senthil N. Evaluation of proso millet (*Panicum miliaceum* L.) germplasm collections. Electronic J Plant Breed. 2010; 1(4):489-499.