IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

"Variability studies in Foxtail millet (*Setaria italica* (L.) Beauv)"

[1] Deshpande, S.R., [2] Prof. Karnewar, S.D., [3]Dr. Karad, S.R., [4]Dr. Ban, Y.G.,

[5]Dr. Rajput, H. J.

[1]Student M. Sc (Agriculture), Dr. Sharadchandra Pawar College of Agriculture, Baramati
[2]Assistant Professor, Department of Agril. Botany, Dr. Sharadchandra Pawar College of Agriculture, Baramati
[3]Maize Breeder, Maize Improvement Project, Kasba Bawada, Kolhapur.
[4]Breeder (Assistant Professor of Botany), AICRP on Small millets, Zonal Agricultural Research Station, Kolhapur.
[5]Breeder, AICRP on Safflower, ZARS, Solapur.

[1]Agricultural Botany (Genetics and Plant Breeding),
[1]Dr.Sharadchandra Pawar College of Agriculture, Baramati, Tal-Baramati, Dist. Pune, Maharashtra, India

Abstract: The present investigation was entitled "Variability studies in Foxtail millet (*Setaria italica* (L.) Beauv)" conducted for estimation of variability. Thirty two genotypes of foxtail millet were collected from Indian Institute of Millet Research Rajendranagar, Hyderabad. Thirty two genotypes were investigated at Agriculture Botany farm at Dr.Sharadchandra Pawar College of Agriculture, Baramati in *Kharif* season 2023. The analysis of variance showed highly significant mean sum of square values for genotypes. Adequate amount of variability was found. The PCV% recorded higher than the GCV%. It revealed that adequate amount of variability present. The characters peduncle length, days to maturity, plant height at maturity (cm), 1000 grain wt., days to 50% flowering, depicted as lowest Genotypic and phenotypic coefficient of variation. High heritability with high genetic advance showed by different characters viz. flag leaf blade length and width (cm), ear head length(cm), grain yield/plant(g), harvest index(%), it reveals that there is presence of additive action of genes so one can use character for further breeding programme.

(Keywords: Variance, Heritability, PCV%, foxtail millet)

I. INTRODUCTION

Foxtail millet (*Setaria italica* (L.) Beauv.), had been grown for decades throughout the world (Nandini and Sridhara 2019). The tiny, pale-coloured grains, which are related to the millet family, are also referred to as Foxtail millet, Italian millet, or dwarf millet because of their unique fox-tail-like shape. Its chromosome number is 2n=2x=18. It is a cereal crop of the C4 type, Self-pollinated but cross-pollination occurs

1.4 to 4 %.In Maharastra, it is referred to as "Kang" or "Rala"(Hariprasanna *et al.*, 2018).

The morphology of foxtail millet is characterized by a single stalk with several inflorescences and a few tillers. The entire plant can reach a height of 120–200 cm, or 2.5–6 ft. The foxtail millet plant, when fully grown, has arc-shaped, silky, hairless leaves and is slender, with tall, green stems. The seed head is a thick, hairy panicle, which is 5–30 cm long. The seed colour ranges from pale yellow to orange, red, brown, or black, depending on the variety. (Moharil *et al.*, 2019)

It is primarily grown in the Indian states of Andhra Pradesh, Karnataka, Telangana, Rajasthan, Maharashtra, Tamil Nadu, Madhya Pradesh and to a lesser extent, Uttar Pradesh. In India, it is cultivated over an area of 0.87 lakh ha. with a total production of about 0.66 lakh tonnes and a productivity of 762 kg/ha during 2015-16. (Prabhakar *et al.*, 2017) According to icrisat.org 2023, foxtail millet holds the second place in terms of millet production around the world, with a yield of about 2166 kg/ha. (Thakre *et al.*, 2023) It is widely regarded as a staple food in China and is used to prepare pancakes, alcoholic beverages, nutritious gruel or soup, noodles, and cereal porridge (Sharma & Keshvan, 2017). Foxtail millet in contrast to rice and wheat, is a whole grain that is rich in nutrients, free of gluten, and contains a significant amount of protein along with a variety of vitamins and minerals (Singh *et al.*, 2020). Studies on genetic variability offer fundamental knowledge of the genetic characteristics of the population, which is used to develop breeding strategies for crop development. (Johanson *et al.*, 1955).

II. MATERIALS AND METHODS:

An experiment was conducted at Agriculture, Botany farm of Dr.Sharadchandra Pawar College of Agriculture, Baramati during *Kharif* season 2023. An experimental material composed of 32 germplasms of foxtail millet. The genotypes were collected from Indian Institute of Millet research, Hyderabad. 2 standard checks were involved DHFt 109-3 and SiA 326. Randomzed Block Design was used.30X10 cm. spacing was kept between plant to plant and row to row in two replications. Size of plot was two rows of 3m length.40:20:20 N, P, K dose was recommended for foxtail millet. Days to 50% flowering, length of peduncle (cm), length of panicle(cm), length of flag leaf(cm),width of flag leaf(cm), No. of productive tillers, Days to maturity, height of

plant at maturity(cm), Biological yield(g),grain yield per plant(g), Harvesting index(%), shape of inflorescence, inflorescence bristles ,protein content(mg/100g) and carbohydrate content (mg/100g) of different germplasms observations were recorded. Variability between genotypes was estimated as per suggested by Burton and Devane (1952), and Johnson (1952). ANOVA estimated as per suggested by Panse and Sukhatme (1967).

III. RESULT AND DISCUSSION:

Based on mean performance for days to 50% flowering the genotype FOX 4305(40.05 Days) showed the lowest range for days to 50% flowering than check. For flag leaf blade length, FOX 4305(34.65 cm) followed by FOX 3521(34.25 cm) found at par with check DHFt 109-3(35.65 cm).For flag leaf blade width FOX 4305(2.21 cm) showed highest width of flag leaf as compare to checks. For earhead length FOX 4305 showed the high range of length of earhead (22.80 cm) than check DHFt 109-3.For no. of productive tillers the genotype FOX 4305(1.56),followed by FOX 3516 (1.50) found as at par to check SiA 326(1.60). For length of peduncle (cm) FOX 3516(29.75cm), FOX 3521(29.25) found at par with checks SiA 326 and DHFt 109-3.The genotypes FOX 4305(70.75), FOX 2397(72.25), FOX 3516(71.80) were found as earlier than other genotypes. The genotypes FOX 4305(158.50 cm), FOX 3516(154 cm) had higher plant height at maturity and found at par to check SiA 326(161.50cm).FOX 4305 showed high range of grain yield (7.40 g).The genotype FOX 4305 had maximum 1000 grain wt. (2.72 g).High per cent of harvest index was showed by 4305(48.18%).The genotype FOX 2436 and FOX 2398(14.40 mg/100 g) contain high protein. For carbohydrate genotype FOX 3514 (75.mg/100 g) recorded the high carbohydrate content.

All the characters showed high range of PCV % than GCV%. The characters peduncle length (GCV 4.71 and PCV 8.16%), days to maturity (GCV 4.97 and PCV 9.09%), plant height at maturity (cm)(GCV 5.73 and PCV 8.72%), 1000 grain wt.(GCV 4.47 and PCV 6.68 %), days to 50% flowering(GCV 6.42 and PCV 10.26%), depicted as lowest Genotypic and phenotypic coefficient of variation. No. of productive tillers (GCV 9.26 and PCV 11.98%) showed low GCV% but moderate in PCV %.Similar findings reported by Dharnishkumar *et al.*,(2023),Nirmalakumari and Vetriventhan(2010), Srilatha *et al.*,(2020),Anuradha *et al.*,(2019) for days to maturity and days to 50% flowering for lowest range of GCV and PCV

The characters flag leaf blade length(cm)(GCV 11.45,PCV 13.31 %),Flag leaf blade width(GCV 10.21,PCV 12.95%),Earhead length(GCV 18.13, PCV 19.34%), Grain yield/plant(g)(GCV 16.64,PCV 18.15%),Protein content mg/100g(GCV 11.05,PCV 12.19%),Carbohydrate mg/100g.(GCV14.53,PCV15.36%),Harvest index(GCV10.36, PCV12.76%) depicted as moderate GCV and PCV %.

Similar findings were reported by Srilatha *et al.,(*2020), Brunda *et al.,(*2014), Shingane *et al.,(*2017), Amarnath *et al.,(*2018) for moderate GCV and PCV % of earhead length, protein content, and grain yield.

The highest genetic advance showed by the carbohydrate (21.91%) Similar results found by Thakre *et al.*,(2023).Moderate genetic advance reported for plant height at maturity(13.79%).Whereas lowest genetic

advance reported for days to 50% flowering(4.98%),flag leaf blade length and width(7.44,0.38%), earhead length(7.26%), no. of productive tillers(0.25%), peduncle length(1.98%), days to maturity(2.90%), days to maturity(5.67%), biological yield(2.21%), grain yield(2.23%), 1000 grain wt.(0.20%), harvest index(8.68%), protein content(3.15%).

Similar results were found by Kavya *et al.,* (2016) for low range of genetic advance for no. of productive tillers, flag leaf blade length and width, peduncle length, earhead length, 1000 grain wt., protein content. Similar findings revealed by Thakre *et al.,* (2023)for lowest range of genetic advance for days to 50% flowering, no. of productive tillers, grain yield/plant, 1000 grain wt., and protein content.

The high genetic advance as per cent of mean was reported in the characters earhead length(cm)(44.85%), followed by grain yield/plant(g)(40.28%), carbohydrate content(36.30%), flag leaf blade length(26.03%), flag leaf blade width(21.26%), harvest index(%)(22.22%).

Similar results were found by Dharnishkumar *et al.,* (2023) for high genetic advance as percent of mean for grain yield/plant. Rammana *et al*., (2022) for earhead length, flag leaf blade width,grain yield/plant. Kavya *et al.,* (2017) for earhead length, grain yield/plant. Thakre *et al.,(2023)* for grain yield/plant and carbohydrate content mg/100 gm.

High heritability with high genetic advance reported for flag leaf blade length and width (cm), ear head length(cm), grain yield/plant(g), harvest index(%).High heritability with high genetic advance as per cent of mean shows additive gene action. So breeder can use such characters for further direct selection process. Medium heritability but low genetic advance as per cent of mean reported for peduncle length(cm).Whereas medium heritability with moderate genetic advance as per cent of mean reported for days to 50 %flowering, biological yield/plant, no. of productive tillers.

Similar findings were reported by Anand *et al*.,(2020) for flag leaf blade length, flag leaf blade width(cm),panicle length(cm).Dharnishkumar *et al*.,(2023) for earhead length(cm), grain yield(g), Ramana *et al*.,(2022) for flag leaf blade width(cm),earhead length(cm), grain yield/plant(g) for high heritability with high genetic advance as percent of mean.

Table no. 1 Analysis of variance (M.S.S) for fourteen characters of thirty two *Setaria italica* genotypes.

Sr. No.	Characters	Replication	Genotypes	Error
	DF	**1**	**32**	**31**
1	Days to 50 % flowering	192.43	32.29*	14.10
2	Flag leaf blade length(cm)	41.23	25.21**	3.75
3	Flag leaf blade width(cm)	0.29	0.089**	0.020
4	Earhead length(cm)	10.98	18.41**	1.19
5	No. of productive tillers/plant	0.100	0.040**	0.010
6	Peduncle length(cm)	28.87	6.76*	3.37
7	Days to maturity	314.7	66.96*	36.10
8.	Plant height at maturity(cm)	298.3	209.9**	83.35
9	Biological yield/plant(g)	7.46	3.23**	0.841
10	Grain yield/plant (g)	2.39	1.85**	0.16
11	1000 grain weight(g)	0.006	0.041**	0.015
12	Harvest Index (%)	26.51	41.28**	8.47
13	Protein Content (mg/100g)	0.82	3.84**	0.37
14	Carbohydrate Content (mg/100g)	36.32	162.9**	9.00

***, ** denotes significant at 5 and 1 per cent, respectively.**

Table no.2 Estimates of variability parameters for grain yield and yield contributing characters in thirty two *Setaria italica* genotypes.

Sr.No.	Character	Mean	Range Minimum	Maximum	GCV%	PCV%	ECV%	Heritability h^2 (Broad sense)(%)	Genetic Advance	Genetic Advance as % of mean
1.	Days to 50% flowering	46.94	40.05	53.60	6.42	10.26	8.00	39.20	4.98	10.61
2	Flag leaf blade length(cm)	28.58	23.65	35.65	11.45	13.31	6.77	74.10	7.44	26.03
3	Flag leaf blade width(cm)	1.81	1.58	2.29	10.21	12.95	7.96	62.20	0.38	21.26
4	Earhead length(cm)	16.18	12.25	23.25	18.13	19.34	6.75	87.80	7.26	44.85
5	No. of productive tillers	1.32	1.05	1.65	9.26	11.98	7.59	59.80	0.25	18.92
6	Peduncle length(cm)	27.57	24.95	33.20	4.71	8.16	6.66	33.40	1.98	7.19
7	Days to maturity	78.90	69.70	88.30	4.97	9.09	7.61	29.90	5.67	7.19
8	Plant height at maturity	138.81	126.45	165.00	5.73	8.72	6.57	43.20	13.79	9.93
9	Biological yield(g)	14.16	12.15	17.20	7.72	10.07	6.47	58.70	2.21	15.62
10	Grain yield/plant(g)	5.53	4.40	7.95	16.64	18.15	7.24	84.10	2.23	40.28
11	1000 grain wt.(g)	2.53	2.25	2.79	4.47	6.68	4.96	44.80	0.20	7.91
12	Harvest index (%)	39.06	32.83	49.86	10.36	12.76	7.45	65.90	8.68	22.22
13	Protein(mg/100g)	11.91	9.80	14.40	11.05	12.19	5.15	82.10	3.15	26.43
14	Carbohydrate(mg/100g)	60.37	50.20	76.35	14.53	15.36	4.97	89.50	21.91	36.30

IV. CONCLUSION:

Based on the analysis of variance all characters showed high significant differences in mean sum of square values so there is high magnitude of variability present in between different characters of foxtail millet.

The characters showed high PCV % than GCV% it can concluded that the characters were highly influenced by an environment. High heritability with high genetic advance showed by different characters viz. flag leaf blade length and width (cm), ear head length(cm), grain yield/plant(g), harvest index (%) it reveals that there is presence of additive action of genes so one can use character for further breeding programme. So character can be selected for improvement of yield components.

Some characters showed medium heritability it means that there is presence of both additive and non- additive gene actions. Lowest genetic advance reported for days to 50% flowering, flag leaf blade length and width, earhead length, no. of productive tillers, peduncle length, days to maturity, days to maturity, biological yield, grain yield, 1000 grain wt., harvest index, protein content it can be concluded that trait is less influenced by genetic means but it is greatly influenced by an environment.

High heritability with high genetic advance reported for flag leaf blade length and width (cm), ear head length(cm), grain yield/plant(g), harvest index(%).So high heritability with high genetic advance as per cent of mean shows additive gene action. So breeder can use such characters for further direct selection process.

V. REFERENCES:

Amarnath, K., Prasad, A.D., Reddy, C. (2017) Character association and path analysis in foxtail millet genetic resources (*Setaria italica* (L.) Beauv). *International Journal of Chemical Studies,* **6**(5):3174-3178.

Anand, G., Thamizhmani, S. and Vanniarajan (2020) Genetic variability, correlation and path analysis in foxtail millet (*Setaria italica* (l.) beauv) germplasm for yield contributing traits.*International Journal of Current Research,* **12** (11):14814-14819.

Ayesha Md, D. Ratna B., Dayal.,J.Prasad B. and Rao V.S. (2019) Studies on Correlation and Path Analysis for Grain Yield and Quality Components in Foxtail Millet[*Setaria italica* (L.)Beauv.]*International Journal of Current Microbiology and Applied Sciences,* **8**(4): 2173-2179

Brunda,S.M.,.Kamatar,M.Y.,Naveenkumar,K.L.,Hundekar ,R.and Somya,H.H.(2015) Evaluation of the Foxtail Millet (*Setaria italica*)Genotypes for grain yield and Biophysical Traits. *Journal of Global Biosciences***, 4**(5):2142-2149

Burton, G.W., (1952) Quantitative Inheritance in Grases Proc.6th *International Grassland Congress,* 1:227- 33

Dewey, D. R. and Lu, K. H., (1959), A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal*, **51** (9): 515 518.

Dharnishkumar M., Suthamathi P., Gnanamalar R.P., Renuka R., Sathiya K.,Vaithiyalingan M. and Hemalatha G. (2023). Genetic Variability Studies in Foxtail millet (*Setaria italica* L.). *Biological Forum – An International Journal,* **15**(9): 212-216.

Hariprasanna, K. (2016). Foxtail Millet-Nutritional importance and cultivation aspects. *Indian Farming*, **65**(12):25–29.

Johnson, H. W., Robinson, H. F. and Comstock, R. E. (1955).Estimates of genetic and environmental variability in soybeans. *Agronomy journal*, **47**(7): 314-318.

Kavya, P., M. Sujatha, S.R. Pandravada and Hymavathi, T.V. (2017). Variability Studies in Foxtail Millet [*Setaria italica* (L.) P. Beauv]. *International Journal of Current Microbiology Applied Science*, **6**(9): 955-960.

Moharil, M. P., Ingle, K. P., Jadhav, P. V., Gawai, D. C., Khelurkar, V. C., & Suprasanna,

P. (2019). Foxtail millet (*Setaria italica* L.): Potential of smaller millet for future breeding. In J. Al- Khayri, S. Jain, & D. Johnson (Eds.). *Advances in plant breeding strategies: Cereals* (pp. 133–163).

Nandini, K.M. and Sridhara, S. (2019) Response of Growth, Yield and Quality Parameters of Foxtail Millet Genotypes to Different Planting Density. *Int J Curr Microbiol App Sci*, **8**(02): 1765-1773.

Nirmalakumari, A. and Vetriventhan, M. (2010) Characterization of foxtail millet germplasm collections for yield contributing traits *Electronic Journal of Plant Breeding.* **1**(2): 140-147.

Pallavi, L.N., R Venkatesh, B Jalandar Ram and Suresh BG (2020) Studies on correlation and path coefficient analysis in foxtail millet [*Setaria italica* (L.) Beauv] *International Journal of Chemical Studies*, **8**(6):
1941-1946

Panse, V. G. and Sukhatme, P. V. (1954). Statistical methods for agricultural workers. *Statistical methods for agricultural workers*

Prabhakar., Prabhu C., Boraih G.B, Bhat S., Nandini C Tippeswamy K. V, Manjunath H.A(2017). Improved Production Technology in Foxtail millet. ICAR-AICRP on small millets.

Ramana D.V.,Chandra Mohan Reddy C.V.,Haritha T. and Khayum Ahammed S. (2022). Blast Screening and Genetic variability Studies for Yield and Yield Contributing Characters in Foxtail Millet (*Setaria italica* (L.). Biological Forum- An International Journal, **14**(4):1032-1039

Sharma,N. and Keshavan, N. (2017)Foxtail millet: Properties, processing, health benefits, and uses. ResearchGate.

Shingane S, Gomashe S, Ganapathy KN, Patil JV. Genetic variability and association analysis for grain yield and nutritional quality in foxtail millet (2017). *Int J Bioresource Stress Manage***. 7**(6):1239-1243.

Singh R.K., Muthamilarasan .M. and Prasad,M.,(2020) Foxtail Millet: An Introduction ,ResearchGate

Singh, R.K., B.D.(1979) Biometrical methods in Quantitative Genetics Analysis. Kalyani Publishers, Ludhiana and Delhi.

Srilatha J, Haritha T, Reddy CVCM and Ramesh, D. (2020) Genetic variability studies for yield and nutritional traits in foxtail millet (*Setaria italica* (L.) Beauv).*Journal of Pharmacology and Phytochemistry*, 9(6): 596-600

Thakre, A.R., Mote, M.S., Ban, Y.G., Wagh, K.A., Kamble, M.S. and Karad, S.R. (2023) Study of genetic variability, heritability and genetic advance in foxtail millet (Setaria italica (L.) Beauv). *The Pharma Innovation Journal*, **12** (12):2073-2077