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Genetical Studies of Mutant Lines in M_3 Generation of Finger Millet (*Eleusine coracana* (L.) Gaertn)

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ABSTRACT

M_3 generation of thirty four mutant lines was developed from genotype Girge local which was irradiated with 500 Gydose of gamma rays which was studied along with three checks *viz*., Dapoli-1, Dapoli-2 and Dapolisafed for estimation of genetic parameters. The genetic parameters viz., Components of variances, coefficient of variations, heritability, genetic advance and genetic advance as per cent of mean were estimated for quantitative and qualitative traits. Significant differences among the entries were studied for all the traits.The estimated data on genetic parameters revealed that genotypic and phenotypic variances were highest for calcium content followed by grain density, indicating highest wide variability for this character. The traits viz., iron content, number of productive tillers, calcium content, straw yield plant $^{-1}$,number of fingers plant^{-1}, and main earhead length were recorded with high GCV and PCV. Higher heritability was observed in the traits *viz*., iron content, calcium content, protein content, number of productive tillers plant^{-1}, main earhead length, main earhead length and number of fingers plant^{-1}. The high genetic advance was estimated for the character, calcium content (92.46 mg/100g) and grain density (11.95). Only calcium content showed high heritability accompanied with high genetic advance among all the studied traits indicates that, most likely their heritability is due to additive gene effects and selection is effective for this trait. The mutant lines *viz*., 18 NMS-12 and 18 NMS-34 were found early flowering and early maturing among the studied mutant lines. Regarding to quality parameters high iron content was observed in mutant lines 18 NMS-24 (23.72 mg/100g) and 18 NMS –18 (22.28 mg/100g). The mutant lines *viz*., 18 NMS-21 (11.05%) and 18 NMS-15 (10.56%) recorded higher protein content. While the lines 18 NMS-10 (360 mg/100g) and 18 NMS-20 (354 mg/100g) recorded higher calcium content. The mutant lines *viz*., 18 NMS-31 and 18 NMS-23 were recorded significantly higher values for yield and yield contributing traits *viz*., grain yield plant^{-1}, weight of earhead plant^{-1}, number of fingers plant^{-1}, main earhead length, grain density and number of productive tillers plant^{-1}. Which may be exploited for commercial purpose after multilocation testing along with suitable check if found promising.

Keywords

Finger millet, Genetic coefficient of variance, Phenotypic coefficient variance, Genetic variability, Heritability, Genetic advance

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Introduction

Finger millet [(*Eleusine coracana* (L) Gaertn] is still considered as staple food in many rainfed hilly and tribal areas of India. It is grown on 1.14 million hectares with total production 1.82 million tonnes and productivity of 1601 Kg/ha. (Anon., 2017-18) in India .In Maharashtra, the largest area under finger millet is found in Konkan region viz., 33 thousand hectares with production 36 thousand tones and productivity 1122 Kg/ha. (Anon., 2018-19). Ragi is commonly called as "Nutritious millet" as the grains are nutritionally superior to many cereals providing fair amount of proteins, minerals, calcium and vitamins in abundance to the people. It is the cheapest and preferred food crop of economically suppressed but physically hard working people. It is appreciated by the people, because it can digest slowly thereby furnish energy for hard work throughout the day.

Finger millet meets the first and most needs of mankind, the energy and hunger satisfaction. It leaves a sense of being well fed to any farmer. The protein of finger millet has been reported to possess a fairly high biological value, which is needed for the maintenance of nitrogen equilibrium of the body. The higher fibre content of finger millet helps in many ways as it prevents constipation, high cholesterol formation and intestinal cancer. Hence, people suffering from diabetics are advised to eat finger millet and other small millets instead of rice (Eswari *et al.,* 2014).

Genetic improvement through conventional breeding approaches depends mainly on the availability of diverse germplasm and presence of enormous genetic variability. Adequate variability is not available in the gene pool to change the plant ideotypes. Estimation of genetic parameters in the context of trait characterization is an essential component in developing high yielding varieties.

Hence, an attempt was made by using mutation breeding to estimate the extent of variation for yield contributing traits in thirty four finger millet mutant lines by studying the genetic parameters like phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance, which may contribute to formulation of suitable selection indices for improvement in this crop. In finger millet where there are very small florets which is very difficult to emasculation and hybridization finger millet where there are very small florets which is very difficult to emasculation and hybridization the mutation breeding has been playing a key role in creating variability (Sawardekar, 2016).

Materials and Methods

The present investigation was carried out at the Research Farm of Agricultural research station, Shirgaon, Ratnagiri, Dist. Ratnagiri (MS). 34 mutant lines selected from the Girgelocal genotype were used for study. The local finger millet variety Girge local was treated with 500 Gy. during May, 2018.

The effect of gamma rays on yield contributing traitswas studied in M_1 generation. M_1 generation was sown on 25/06/2018 and harvested on October, 2018. M_2 generation was grown during *Rabi,* 2018-2019. Sown on 18/01/2019 and transplanted on 10/02/2019 and selections were made during Ist week of May, 2019.

Individual plants in M_2 generation were selected on the basis of phenotypic characters and harvested separately during *Rabi,* 2018-19. The thirty four selected plant progenies of M_2 plants for growing of M_3 generation were sown along with three checks*viz*., Dapoli-1, Dapoli-2 and DapoliSafed on 25/06/2019 for growing the seedlings.

The 22 days seedlings were transplanted in main field on 17/7/2019. The seedlings were transplanted at the spacing of 20×10 cm. Three rows of each mutant lines of 3m length were transplanted in three replications in Randomized Block Design (RBD). All required package of practices were implemented. The recommended doses of fertilizers were 80 kg N/ha, 40 kg P_2O_5/ha. The nitrogen dose was given in two splits, 40 kg N/ha given as basal dose and 40 kg N/ha was given 30 days after transplanting. All plant protection measures were applied as per need.

Five plants were selected randomly from net plot of each mutant lines and the following observations were recorded viz., days to 50% flowering, days to maturity, weight of earhead (g), main ear head length (cm), plant height (cm), number of productive tillers plant^{-1}, grain density (No. of grains/cm), number of fingers ear^{-1}, grain yield plant^{-1} (g), straw yield plant^{-1} (g), harvest index (%), test weight (g), protein content (%), calcium content (mg/100g) and iron content (mg/100g) traits on morphological fixed mutant lines of M_3 generation.

The mean of all the plants for each trait under each replication was subjected to analysis (Panse and Sukhathme, 1954). The estimate of genotypic variance and phenotypic variance were worked out according to the method suggested by Johnson *et al.,* (1955) using mean square values from the ANOVA table 1.

Phenotypic and genotypic coefficient of variances were calculated based on the method advocated by Burton *et al.,* (1952). Broad sense heritability was estimated as per the method described by Lush (1940) and traits were classified as having high, moderate and low heritability as per the method of Johnson *et al.,* (1955). Genetic advance was estimated according to the method suggested by Johnson *et al.,* (1955), and expressed as percentage of mean. Traits were classified as having high, moderate or low genetic advance as per cent of mean as per the method suggested by Johnson *et al.,* (1955).

Results and Discussion

In the present investigation, various statistical parameters of variability like mean, range, variance components and coefficients of variation, heritability in broad sense, genetic advance and genetic advance as per cent of mean were studied which provide basic information regarding the genetic properties of the population based on which breeding methods are formulated for further improvement of the crop. The analysis of variance showed a wide range of variation and significant differences for all the characters under study (Table 1).

Mean performance for quantitative parameters

The mutant lines *viz*., 18 NMS-23 (11.80 cm) followed by 18 NMS-31 (11.47 cm), 18 NMS-24 (11.20 cm) and 18 NMS-30 (11.20 cm) were found with highest main earhead length. Similar results were recorded by Keerthana *et al.,* (2019), Jyothsna *et al.,* (2016) and Devaliya *et al.,* (2018).

The mutant lines *viz*., 18 NMS-8 (78.67 cm) followed by 18 NMS-27 (80.13 cm), 18 NMS-2 (81.07 cm) were found to be dwarf genotype which is desirable traits for lodging resistance. Similar results were reported by Chavan *et al.,* (2019), Shet *et al.,* (2009), Devaliya *et al.,* (2018) and Keerthana *et al.,* (2019). The mutant lines 18 NMS-23 (2.27), 18 NMS-24 (2.13) and 18 NMS-30 (2.13) recorded significantly higher number of productive tillers plant^{-1}. Similar results were recorded by Muduli and Misra (2008), Jyothsna *et al.,* (2016), Chavan *et al.,* (2019) and Devaliya *et al.,* (2018). The Mutant lines *viz*., 18 NMS-12 (115.67 days), 18 NMS-14, 18 NMS-18 and 18 NMS-27 each with mean 116 days and 18 NMS-17 with 116.67 days maturity duration were said to be early maturing.

Similar results were recorded by Chavan *et al.,* (2019), Singamsetti *et al.,* (2018) and Jyothsna *et al.,* (2016).The mutant lines *viz*., 18 NMS-10 (81.33 days), 18 NMS-12 (81.33 days), 18 NMS-11 (82.33 days) and 18 NMS-34 (82.67 days) were recorded with less number of days to 50 per cent flowering. Similar results were recorded by Shet *et al.*, (2009), Chavan *et al.*, (2019), Jyothsna *et al.*, (2016) and Devaliya *et al.*, (2018). The mutant lines *viz*., 18 NMS-1 (17.27 g/plant), 18 NMS-2 (16.27 g/plant) and 18 NMS-22 (16.20 g/plant) were found with numerically higher straw yield plant^{-1} and found good for fodder purpose.

Similar results were recorded by Anuradha and Patro (2019), Prashantha *et al.*, (2018) and Joel *et al.*, (2005).The higher test weight was observed in mutant line *viz*., 18 NMS-26 (2.99g) followed by 18 NMS-2 (2.93g), 18 NMS-13 (2.85g), 18 NMS-9 (2.83g). Similar results were recorded by Shet *et al.*, (2009), John (2006) and Devaliya *et al.*, (2018). The mutant lines *viz*., 18 NMS-23 (7.26) followed by 18 NMS-15 (7.07 and 18 NMS-31 (6.80) were recorded with highest numbers of fingers plant^{-1}.

Similar results were recorded by Aviya and Mullainathan (2018) and Muduli and Misra (2008). The higher weight of earhead was seen in mutant line *viz*., 18 NMS-31 (9.40g/plant), 18 NMS-23 (9.33g/plant), 18 NMS-32 and 18 NMS-24 each with mean value 9.20g/plant and 18 NMS-27 (9.13g/plant). Similar range for weight of earhead plant^{-1} was recorded by Lad *et al.*, (2018), Prashantha *et al.,* (2018) and Subramanya *et al.,* (2019).

The mutant lines *viz*., 18 NMS-31 (8.33 g/plot) followed by 18 NMS-23 (8.27 g/plant), 18 NMS-30 (8.10 g/plant), 18 NMS-16 (8.0 g/plant) and 18 NMS-24 (7.97 g/plant) were found high yielding among all the mutant lines. Similar results were also reported by Mohitepatil (2007), Anuradha and Patro (2019), Muduli and Misra (2008), Devaliya *et al.,* (2018) and Das *et al.,* (2017).

The mutant lines *viz*., 18 NMS-9 (39.40%), 18 NMS-31 (39.13 %), 18 NMS-24 (38.75 %) and 18 NMS-32 (38.72 %) were recorded with significantly higher harvest index. Similar results were reported by John (2006),Prashantha *et al.*, (2018) and Lad *et al.*, (2018).The mutant lines *viz*., 18 NMS-23 (91.67 grains/cm), 18 NMS-22 (86.33 grains/cm), 18 NMS-16 (81.67 grains/cm) and 18 NMS-31 (77.67) were recorded with high grain density. Similar results were recorded by Mohitepatil (2007) and Ambhavane *et al.*, (2015).

Mean performance for quality parameters

The mutant lines *viz*., 18 NMS-21 (11.05), 18 NMS-15 (10.56%), 18 NMS-32 (10.35%) and 18 NMS-27 (10.33%) recorded significantly higher protein content. similar results were recorded by Jawale *et al.,* (2019), Chavan *et al.*, (2019), Devaliya *et al.*, (2018) and Das *et al.*, (2017).The mutant line *viz*., 18 NMS-24 (23.72 mg/100g), 18 NMS-7 (22.83 mg/100g) and 18 NMS-18 (22.28 mg/100g) were recorded with higher iron content.

Similar values were recorded by Jawale *et al.*, (2019), KaziTahsin *et al.*, (2017) and Chavan *et al.,* (2019). The mutant line *viz*., 18 NMS-

10 (360 mg/100gm), 18 NMS-20 (354 mg/100g) and 18 NMS-14 (351.33 mg/100g) were recorded with higher calcium content. Similar range and general mean were recorded by Jawale *et al.*, (2019), Chavan *et al.*, (2019) andDas *et al.*, (2017).

Component of variations

Maximum phenotypic variance for M_3 generation was found for calcium content followed by grain density, plant height and iron content. Similarly, maximum genotypic variance was observed in calcium content followed by grain density, iron content and plant height. Similar results were recorded by Chavan B. R. *et al.*, (2019), John (2006) and Devaliya *et al.*, (2018).

Coefficient of variances

The high GCV and PCV were observed for the traits viz., iron content, number of productive tillers, calcium content, number of fingers plant^{-1}, Straw yield plant $^{-1}$ and main earhead length. While moderate GCV and PCV were observed for traits grain yield and straw yield.

All these traits indicate additive effect showing scope for selection. Similar results were recorded by Shet *et al.*, (2009), Jawale *et al.*, (2019), Chavan *et al.*, (2019), Keerthana *et al.*, (2019), John (2006), Devaliya *et al.*, *(*2018), Suryanarayana *et al.*, (2014), Jyothsna *et al.*, (2016), Muduli and Misra (2008) and Das *et al.*, (2017).

Genetic advance as per cent of mean

The higher (more than 20%) values of genetic advance as percentage of mean was reported for the traits *viz.*, iron content, number of productive tillers plant^{-1}, calcium content (mg/100g), main earhead length, protein content (%) and number of fingers plant^{-1}.The lower (less than 10%) value for genetic advance as per cent of mean was recorded for the traits *viz.*, days to maturity, days to 50% flowering, plant height, test weight and weight of earhead plant^{-1}. The moderate (10-20%) value for genetic advance as per cent of mean was recorded for the traits *viz.*, grain density, straw yield plant^{-1}, grain yield plant^{-1} and harvest index. Similar values were recorded by Ambavne *et al.*, (2015), Jawale *et al.*, (2019), Keerthana *et al.*, (2019), John (2006), Devaliya *et al.*, *(*2018) and Muduli and Misra (2008). The mutant lines *viz.*, 18 NMS-12 (81.33 days to 50% flowering and 115.67 days to maturity) and 18 NMS-34 (82.67 days to 50% flowering and 117.67 days to maturity) were found early flowering and early maturing than all the studied mutant lines. The mutant lines *viz.*, 18 NMS-31 and 18 NMS-23 recorded significantly higher values for yield and yield contributing traits *viz.*, grain yield plant^{-1}, weight of earhead plant^{-1}, number of fingers plant^{-1}, main earhead length, grain density and number of productive tillers plant^{-1} and were also recorded with numerically higher harvest index.

Regarding to quality parameters the mutant lines *viz.*, 18 NMS-21 (11.05%) and 18 NMS-15 (10.56%) recorded higher protein content. Calcium content analysis revealed that the mutant lines 18 NMS-10 (360 mg/100g) and 18 NMS-20 (354 mg/100g) recorded higher calcium content. High iron content was observed in mutant lines 18 NMS-24 (23.72 mg/100g) and 18 NMS-18 (22.28 mg/100g).The moderate (10-20%) value for genetic advance as per cent of mean was recorded for the traits *viz.*, grain density, straw yield plant^{-1}, grain yield plant^{-1} and harvest index.

Table.1 Analysis of variance (ANOVA) for the different characters studied in M_3 generation of Finger millet

Sr. No.	Characters	Mean Sum of Squares		
		Replications	Treatments	Error
1	Plant height (cm)	11.15	114.39*	79.51
2	Main earhead length (cm)	4.19	8.15**	0.924
3	No. of productive tillers plant^{-1}	0.034	0.319**	0.034
4	Days to 50% flowering	63.85	33.43*	20.62
5	Days to maturity	33.12	20.86*	10.97
6	Test weight (g)	0.004	0.082*	0.052
7	No of fingers plant^{-1}	0.261	2.254**	0.334
8	Straw yield plant^{-1} (g)	5.99	8.98**	1.94
9	Weight of earhead plant^{-1} (g)	0.712	1.75**	0.700
10	Grain yield plant^{-1} (g)	1.656	2.10**	0.770
11	Harvest Index (%)	1.2021	38.61**	11.42
12	Grain density (No. of grains cm^{-1})	36.01	287.70**	76.71
13	Protein content (%)	0.484	5.430**	0.392
14	Calcium content (mg/100g)	608.12	7777.91**	496.77
15	Iron content (mg/100g)	5.82	72.15**	1.41

* Significant for 5% level of significance ** Significant for 1% level of significance

Table.2 Estimates of phenotypic (σ2p), genotypic (σ2g) and environmental (σ2e) variance for M_3 generation of Finger millet

Sr. No.	Characters	σ^2p	σ^2g	σ^2e
1	Plant height (cm)	85.80	14.29	71.51
2	Main earhead length (cm)	3.33	2.41	0.924
3	No. of productive tillers plant^{-1}	0.130	0.094	0.036
4	Days to 50% flowering	24.89	4.27	20.62
5	Days to maturity	14.27	3.30	10.97
6	Test weight (g)	0.062	0.01	0.052
7	No of fingers plant^{-1}	0.974	0.640	0.334
8	Straw yield plant^{-1} (g)	4.29	2.34	1.94
9	Weight of earhead plant^{-1} (g)	1.05	0.35	0.70
10	Grain yield plant^{-1} (g)	1.21	0.44	0.77
11	Harvest Index (%)	20.48	9.06	11.42
12	Grain density (No. of grains cm^{-1})	147.04	70.33	76.71
13	Protein content (%)	2.07	1.68	0.392
14	Calcium content (mg/100g)	2923.82	2427.05	496.77
15	Iron content (mg/100g)	24.99	23.58	1.41

Table.3 Estimates of genetic parameters for various characters of M_3 generation of Finger millet

Sr. No	Characters	Mean	Range		PCV (%)	GCV (%)	Heritability (%)	Genetic Advance	Genetic Advance as % of mean
			Min.	Max.					
1	Plant height (cm)	88.46	74.07	109.33	10.47	4.27	16.66	3.18	3.59
2	Main earhead length (cm)	8.68	5.40	11.80	21.03	17.87	72.27	2.72	31.30
3	No. of productive tillers plant^{-1}	1.58	1.13	2.27	22.75	19.36	72.43	0.54	34.95
4	Days to 50% flowering	87.47	79.33	93.00	5.70	2.36	17.17	1.76	2.02
5	Days to maturity	120.09	115.67	125.00	3.15	1.51	23.12	1.80	1.50
6	Test weight (g)	2.65	2.31	2.99	9.37	3.81	16.50	0.085	3.18
7	No of fingers plant^{-1}	5.52	3.20	7.27	17.87	14.49	65.74	1.34	24.21
8	Straw yield plant^{-1} (g)	13.83	10.27	17.27	14.97	11.07	54.67	2.33	16.87
9	Weight of earhead plant^{-1} (g)	8.28	6.53	9.40	12.39	7.15	33.34	0.70	8.51
10	Grain yield plant^{-1} (g)	6.90	4.40	8.33	15.98	9.67	36.60	0.83	12.06
11	Harvest Index (%)	33.38	26.32	39.40	13.56	9.02	44.26	4.13	12.36
12	Grain density (No. of grains cm^{-1})	66.18	45.67	91.67	18.32	12.67	47.83	11.95	18.05
13	Protein content (%)	8.62	6.25	11.05	16.70	15.04	81.05	2.40	27.88
14	Calcium content (mg/100g)	284.29	196.67	360.00	19.02	17.33	83.01	92.46	32.52
15	Iron content (mg/100g)	16.49	7.41	23.72	30.32	29.45	94.34	9.72	58.92

Plate.1 Earheads of high yielding mutant lines 18 NMS – 31 and 18 NMS – 23

Finger type – Round short

Finger type – Straight

Finger type – Short straight

Finger type – Round

Finger type – Round long

Finger type – long straight

Plate.2 Variation in Fingers of studied mutant lines

Heritability in broad sense

Higher heritability (more than 60%) was observed in the traits *viz.*, iron content, calcium content, protein content, number of productive tillers plant^{-1}, main earhead length, main earhead length and number of fingers plant^{-1}.The moderate (30–60%) heritability was observed in traits *viz*., straw yield plant^{-1}, grain density, harvest index and weight of earhead plant^{-1}.The lower (less than 30%) heritability was estimated in trait, grain yield plant^{-1} followed by test weight, plant height, days to 50% flowering and Days to maturity. Similar results were recorded by Jawale *et al.*, (2019) and Chavan *et al.*, (2019), Keerthana *et al.*, (2019, John (2006), Devaliya *et al.*, *(*2018) and Das *et al.*, (2017).

Genetic advance

The high genetic advance estimated was for the character, calcium content (92.46) and grain density (11.95). Similar results were recorded by Jawale *et al.*, (2019), Chavan *et al.*, (2019), John (2006), Devaliya *et al.*, (2018) and Muduli and Misra (2008).

The genotypic and phenotypic variances were found highest for calcium content followed by grain density, indicating highest wide variability for this character. Similar results were recorded by Chavan B. R. *et al.*, (2019), John (2006) and Devaliya *et al.*, (2018). Calcium content showed high heritability accompanied with high genetic advance indicates that, most likely their heritability is due to additive gene effects and selection may be effective Jawale *et al.*, (2019) and Chavan *et al.*, (2019).

The traits *viz*., main earhead length, number of productive tillers plant^{-1}, number of fingers plant^{-1}, protein content and iron content exhibited high heritability and low genetic advance, indicates non additive gene action and selection for such traits may not be rewarding Suryanarayana *et al.*, (2014), Jyothsna *et al.*, (2016).

The traits *viz*., main earhead length, number of productive tillers plant^{-1}, number of fingers plant^{-1}, protein content and iron content exhibited high heritability and low genetic advance, indicates non additive gene action and selection for such traits may not be rewarding Devaliya *et al.*, *(*2018) and Muduli and Misra (2008). Low heritability accompanied with low genetic advance was showed in the traits *viz*., plant height, days to 50 % flowering, days to maturity and test weight indicates that, these characters were highly influenced by environment, Chavan *et al.*, (2019), John (2006). The mutant lines *viz*., 18 NMS-31 and 18 NMS-23 recorded significantly higher values for yield and yield contributing traits *viz*., grain yield, weight of earhead plant^{-1}, number of fingers plant^{-1}, main earhead length, grain density and number of productive tillers plant^{-1} which may be exploited for commercial purpose after multilocation testing along with suitable check if found promising.

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References

Ambavane, A. R., Sawardekar, S. V., Sawantdesai, S. A. and Gokhale, N. B. 2015. Studies on mutagenic effectiveness and efficiency of gamma rays and its effect on quantitative traits in finger millet (*Eleusine coracana* L. Gaertn).*J. Rad. Res. Appl. Sci.*,8: 120-125.

Anonymous, 2017-18. Annual progress report, ICAR-AICRP on small millets, Bengaluru. Page 1-3.

Anonymous, 2018-19. Statistical data on field crops, Maharashtra Statistics Department, Pune.

Anuradha, N. and Patro, T. S. S. K. 2019.Genetic variability, heritability and genetic advance in foxtail millet breeding lines.*Intern. J. Chem. Stu.*7(3):

2967-2969.

Aviya, K. and Mullainathan, L. 2018. Studies on effects of induced mutagenesis on quantitative characteristics of finger millet (*Eleusine coracana* (l.) Gaertn.)Var- co 13 in M_2 and M_3 generations.*Intern. J. contemporary studies*,.3(4): 1-6.

Burton, G. W. 1952. Quantitative inheritance in grass. Proceedings of 6^{th} *International Grass land Congress*,1: 277–283.

Chavan, B. R., Jawale, L. N., Chavan, T. A. and Shinde, A. V. 2019.Studies on genetic variability for yield and yield contributing traits in finger millet *Eleusine coracana* (L.)Gaertn.*Int. J. Curr. Microbiol. App. Sci.*,8(9): 2276-2281.

Das, R., Pandravadal, S. R. and Harikrishnan, P. J. 2017. Estimation of grain nutrient and their association with grain yield in finger millet [*Eleusine coracana* (l.) Gaertn].*Plant Archives*,17(1): 241-246.

Devaliya, S. D., Singh, M., Intawala, C. G. and Bhagora, R. N. 2018. Genetic Variability Studies in Finger Millet (*Eleusine coracana* (L.) Gaertn.*Int. J. Pure App. Biosci.*,6 (1): 1007-1011.

Eswari, K., G. Gogulan, K. A., Prathab, H. and Sakila, M. 2014. Development of Early Maturing Mutants in Finger Millet.*Res. J. Agril. Forestry Sci.* 2(6), 1-9.

Himanshu, Chauhan, M., Sonawane, S. K. and Arya, S. S. 2018. Nutritional and nutraceutical properties of millets. *Clinical J. Nut.Dietetics.*,1(1): 1-10.

Jawale, L. N., Bhave,S. G., Deshmukh, J. D. and Dhutmal, R. R. 2019.Genetic variability for quality traits in finger millet (*Eleusine coracana* (L.) Gaertn).*Int. J. Chem. Studies.*,7(2):1625-1628.

Joel, A. J., Kumaravadivel, N., Nirmalakumari,N., Senthil,N., Mohanasundaram,K., Raveendran, T. S. and Mallikavangamudi, V. 2005.A high yielding Finger millet variety CO (Ra) 14. *Madras Agric. J.*,92(7-9):375-380.

John, J. A., Kumaravadivel, N., Nirmalakumari, A., Senthil, N., Mohanasundaram, K., Raveendran, T. S. and Mallikavangamudi 2005.A high yielding Finger millet variety CO (Ra)-14.*Madras Agric. J.*, 92 (7-9):375-380.

Johnson, H. W., Robinson, H. F. and Comstock, R. E. 1955.Estimates of genetic and environmental Variability in soya beans.*Agronomy J.*,47:314-318.

Jyothsna, S., Patro,T. S. S. K., Ashok,S., Sandhya, R. Y. and Neeraja, B. 2016. Studies on Genetic Parameters, Character Association and Path Analysis of Yield and its Components in Finger Millet (*EluesineCoracana* L. Gaertn).*Int. J. Theo. App. Sci.*,8(1): 25-30.

Kazi, T. and Auti, S.G. 2017.Screening of higher mineral containing finger millet landraces from Maharashtra.*Int. J. of Food Sci. and Nutri.*,2(3) 21-25.

Keerthana, K., Chitra,S., Subramanian,A., Nithila, S.and Elangovan, M. 2019, Studies on genetic variability in finger millet [*Eleusine coracana*(L.) Gaertn] genotypes under sodic conditions.*E. J. Plant Breeding*, 10(2): 566-569.

Lad, D. B., Bhagat, A. A. and Mahalle, P. U. 2018. Assessment of Genetic Variability for Yield and Yield Attributing Traits in Finger Millet (*Eleusine coracana* L. Gaertn.). *Intern. J. Sci. Res.*, 8(10):2319-7064.

Lush, J. L. 1940.Intra-sire correlation and regression of offspring on dams as a method of estimating heritability of characters.*Proc. Ame. Soc. Anim. Prod.*,33: 293-301.

Mohitepatil, D. P. 2007. Variability, correlation and path analysis in Finger millet (*Eleusine coracana* Gaertn.).

Thesis submitted to Dr. B. S. K. K. V., Dapoli.

Muduli, K. C. and Misra, R. C. 2008.Mutagenic response and induced macromutation in Finger millet *(Eleusine coracana (L.)*Gaertn.).*Intern. J. Agric. Sci*.4(1):146-151.

Panse, V. G and Sukhatme,P. V. 1954. *Statistical methods for Agricultural workersI.C.A.R*., New Delhi.

Prashantha, B. N., Gowda,T. H., Gangaprasad,S., Nataraju, S. P.and Veeranna, H. K. 2018. Genetic variability studies for yield and yield contributing traits in finger millet [*Eleusine coracana* (L.) Gaertn] genotypes.*J. Farm Sci. Spl. Issue*.,31(5):527-531.

Sawardekar, S. V. 2016. Study of M_5 Generation of Finger Millet (*Eleusine coracana* L. Gaertn.)Promissing Mutants with Quaity Parameters.*J. Agric. Res. Technol*., 41(2): 224-228.

Shet, R. M., Gireesh,C., Jagadeesha,N., Lokesh,G. Y. and Gowda, J. 2009.Genetic Variability in Segregating Generation of Interspecific Hybrids of Finger Millet (*Eleusine coracana* (L.)Gaertn.).*Environment Eco*.,27(3):1013—1016.

Singamsetti, A., Patro,T. S. S. K., Anuradha, N.and Divya, M. 2018. Studies on Genetic Variability for Yield and Yield Attributing Traits in Finger millet (*Eluesine coracana* L. Gaertn).*Int. J. Curr. Microbiol. App. Sci.*, 7: 90-95.

Subramanya, S. A. E., Phadnis, S.and Ravikumar, R. L. 2019. Genetic variability of diverse cultivated finger millet [*Eleusine coracana* (l.) Gaertn] genotypes. *Intern. J. Genetics*. 11(12): 680-683.

Ulaganathan, V and Nirmalakumari, V. 2014. Genetic Variability and Correlation Studies For Quantitative Traits in Finger Millet *(Eleusine coracana*L. Gaertn) Germplasm. *Intern.Quarterly J. Env. Sci*., 6: 21-25.

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