RESEARCH ARTICLE

GENETIC VARIABILITY AND HERITABILITY STUDIES FOR YIELD AND QUALITY TRAITS IN WHITE AND BROWN FINGER MILLET (*ELEUSINE CORACANA* (L.)

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Abstract: The present investigation was conductedto assess the nature and magnitude of genetic variability for yield and quality related traitsin 64 genotypes of finger millet for 25 parametersduring*Kharif*, 2020 at Agricultural College Farm, Bapatla, Andhra Pradesh. The analysis of variance for square lattice design reported the existence of significant difference among the genotypes for all traits. The genotypic coefficient of variation for all the characters studied was less than phenotypic coefficient of variation indicating the influence of environment in shaping these traits. Moderate to high variability and high heritability accompanied with high genetic advance as per cent of mean were observed for 22 characters indicating the predominance of additive gene action in manifestation of these traits,and hence improvement can be anticipated by simple selection.

Keywords: Finger millet, Genetic advance as per cent of mean, Heritability, Variability

INTRODUCTION

Millets also known as nutricereals are small seeded cereals which are widely grown as cereal crops or grains of fodder and human food. Finger millet locally known as "Ragi" or "Madua" *(Eleusinecoracana* (L.)) is the most important among small millets and has the potentialities to be exploited to meet the need of dry land farmers. It is a self pollinated, allopolyploid crop, native of Africa with chromosome number 2n=4x=36. The grain belongs to Poaceae which originated in Ethiopia and the sub-family Chloridodeae (Pradeep &Sreerama, 2015; Sood *et al*., 2016; Ramashia *et al*., 2018). Different cultivars of finger millet grain exist: brown, light brown and white (Devi *et al*., 2014; Kumar *et al*., 2016), with grain colour used as the distinct means of cultivar differentiation. The white cultivars have been developed mainly for the baking industry, the brown and light brown types used for porridge while the brown cultivar is utilised for brewing traditional opaque beer in Southern Africa (Sood *et al*., 2017). Finger millet is an important crop in terms of its nutritional and pharmaceutical attributes. Anusha*et al*. (2020) recorded protein content (2.6-9.2%), calcium content (228.3-626.7 mg/100g), iron content (1.9-4.2 mg/100g) and zinc content (0.9-3.5 mg/100g) in 30 finger millet genotypes. Phenolic acids and tannins are considered as main polyphenols present in finger millet, while flavonoids are reported to be available in small amounts.. Tannins in the outer layer of the grain, serves as a physical barrier to fungal invasion (Devi *et al*., 2014) and plays an important role in the biological function of plants and humans. According to Thomson (1993) and Shibairo *et al*. (2014), tannins which were once considered as antinutrients, are now considered as nutraceuticals as they can contribute to antioxidant activity which is an important factor in healthy aging and prevention of metabolic diseases.

Knowledge on the magnitude of variability present in a crop species for different traits is of utmost importance as it provides the basis for effective selection. The phenotype of a character is the result of interaction between genotype and environment. Partitioning of phenotypic variability into heritable and non-heritable components is essential to get a true indication of the genetic variation of the trait. Heritability measures the relative amount of the heritable portion of variability. Consistency in the performance of selection in succeeding generations depends on the magnitude of heritable variation present in relation to phenotypic variation. Basic information on heritability is a pre-requisite for planning any breeding programme. Genetic advance indicates the amount of progress that could be expected with selection for a particular character. Estimates of heritability along with estimates of genetic advance are more useful in selection method rather than heritability or genetic advance alone (Johnson *et al*., 1955).

MATERIALS AND METHODS

The present study on 64 finger millet genotypes (41 brown seeded and 23 white seeded) including three checks was carried out during *Kharif*, 2020 at Agricultural College Farm, Bapatla, Andhra Pradesh. The experiment was carried out in 8*8 square lattice design with two replications.

All the recommended package of practices and need based plant protection measures were adopted to raise a healthy crop. The data was collected on five

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randomly selected plants per genotype for 25 parameters *viz.*.,days to 50% flowering, days to maturity, plant height, flag leaf blade length, flag leaf blade width, SCMR at 30 days, SCMR at 45 days, number of productive tillers per plant, number of fingers per earhead, finger length, finger width, earhead length, peduncle length, harvest index, test weight, seed protein content, seed calcium content, seed phosphorus content, seed iron content, seed zinc content, seed manganese content, seed copper content, tannin content , antioxidant activity and grain yield per plant. However, days to 50 per cent flowering and days to maturity was recorded on plot basis. PCV, GCV values were classified as described by Sivasubramanian and Menon (1973). Heritability in the broad sense was categorized as per the classification given by Johnson *et al.*, (1955).

RESULTS AND DISCUSSION

Genetic variability, Heritability and Genetic advance

Exploiting the genetic variability present within the population is the principle behind every successful crop improvement programme. Presence of adequate genetic variability provides an opportunity for plant breeder to select desirable genotypes for breeding procedures ,*viz.* hybridization. The analysis of vaiance for square lattice design revealed that there is an existence of significant difference among the genotypes for all traits studied which further indicates the presence of wide spectrum of variability among germplasm. The results regarding analysis of variance are presented in Table 1.The major descriptive statistics such as, mean, range and coefficient of variation (CV %), of 64 genotypes for 25 traits are calculated and depicted in Table 2. The results of GCV,PCV, broad sense heritability and genetic advance as percent of mean are represented in Table 3.

The number of days to 50% flowering ranged from 46.50 days (IC0477184) to 84.50 days (IC474206) with a mean value of 64.72 days. Six genotypes namely, IC0477198(49.50), IC0477035(47.50), IC0476946(48.50), IC0476586(47.00), IC0477010(49.50) and IC0476831(49.50) showed earliness in flowering on par with IC0477184(46.50), genotype with minimum days to 50 % flowering, indicating the importance of these genotypes in breeding programmes for development of early duration finger millet varieties. In the present investigation, values for days to maturity varied from 78.50 days (IC0477184) to 111.50 days (IC474206) with a mean value of 93.92 days. The genotype, IC0477184, showed minimum days to 50 % flowering and days to maturity. Six genotypes namely, IC0477198 (80.50), IC0477035 (79.50), IC0476946 (79.50), IC0476586 (79.00), IC0477010 (80.00) and IC0476831 (80.50) showed earliness in maturity on par with IC0477184 (78.5), when compared with three checks implying the usefulness of these genotypes in crop improvement programmes especially in drought environmental conditions for avoiding the terminal drought. The mean values for plant height varied from 70.55 cm (IC474433) to 114.40 cm (IC0477035) with a mean of 91.25 cm. Plant height is an important growth parameter as tall plants can be used for fodder purpose while dwarf plants with lodging resistance can be preferred for developing lodging resistant varieties in crop improvement programmes. The flag leaf blade length ranged from 17.90 cm (IC0476988) to 47.85 cm (VR950) with a mean of 31.01 cm. The flag leaf blade width ranged from 0.52 cm (IC0477198) to 1.45 cm (Vakula) with a mean of 1.05 cm. The SCMR at 30 days varied from 30.35 (IC0587945) to 50.95 (IC0587970) with a mean of 40.41. Regarding SCMR at 45 days, variation ranged from 32.25 (IC0587945) to 56.95 (IC0587970) with a mean of 44.64. Genotype IC0587970 recorded higher SCMR value at both 30 days and 45 days revealing the importance of this genotype for testing under moisture stress condition for stay green character or terminal drought tolerance. In present study, number of productive tillers per plant varied from 2.05 (IC0477842, IC0477184) to 4.90 (VR1034) with a mean of 3.19 . When compared to three checks, the genotypes IC0477211-X (4.75), IC0477628 (4.80), IC0477272 (4.75) and VR1034 (4.90) had recorded more productive tillers making these genotypes suitable to be used in plant breeding programmes, owing to the fact that when number of productive tillers increase, there will be subsequent increase in earhead number that results in higher grain yield. In the present investigation,, number of fingers per earhead ranged from 4.10 (IC0476560) to 13.05 (IC0477211-X) with a mean of 8.78 .When compared to three checks, the genotypes IC0477211-X (13.05), IC0477628 (12.70), IC0477272 (12.75), VR1034 (12.75), IC0477680(12.20) and VR1029(12.25) had recorded more number of fingers per earhead suggesting that these genotypes are desirable to be used in plant breeding programmes, owing to the fact that when number of fingers per earhead increases, there will be substantial increase in grain yield. In the present study , finger length ranged from 4.2 cm (IC0477206) to 9.6 cm (IC0477680) with a mean of 6.75 cm. When compared to three checks, the genotypes IC0477211-X (9.3 cm), IC0477484 (9.05 cm), IC0477272 (9.15 cm), IC0477628(9.2 cm), VR1034 (9.3 cm), IC0477680 (9.6 cm) and VR1029 (12.25 cm) had recorded long fingers suggesting that these genotypes are highly preferred to be used in plant breeding programmes as long fingers leads to increase in grain yield. In the present study, finger width varied from 0.45 cm (IC0476560) to 1.70 cm (IC0477628) with a mean of 1.10 cm. The genotypes IC0477680 (1.60 cm), IC0477272 (1.60 cm), IC0477628 (1.70 cm), and IC0477211-X (1.60 cm) along with check variety Hima (1.60 cm) had recorded wide fingers indicating that these genotypes can be chosen as parents in crop improvement programmes as high finger width directly influences grain yield. Earhead length is also an important yield contributing trait . Genotypes with longer earhead is desirable as it results in increase in grain yield. The range of earhead length varied from 5.40 cm (IC0476560) to 13.20 cm (IC0477272) with a mean of 8.39 cm. The genotypes IC0477680 (12.10 cm), IC0477272 (13.20 cm), IC0477628 (12.50 cm), and IC0477211-X (12.60 cm) and VR1034 (12.50 cm) showed more earhead length compared to three check varieties indicating that these genotypes are best suited to be used as parents in breeding programmes as genotypes with long earheads are desirable to obtain higher grain yield. The range of peduncle length varied from 6.65 cm (IC0473950) to 23.61cm (IC0476860) with a mean of 13.68 cm. In the present study, harvest index varied from 19.50 % (IC0477842, IC474231) to 39.5% (Hima) with a mean of 30.10 %. In the present investigation, result obtained for test weight ranged from 1.70 g (IC0476560) to 3.30 g (IC0477484) with a mean of 2.64 g. The variation for seed protein content ranged from 2.7 % (IC0476988, IC0476467) to 12.2 % (VR1016) with a mean of 7.8%. Protein is vital for normal functioning of the body and facilitates body repair and metabolism. White seeded genotypes recorded protein content ranging from 9.85% to 12.2%, while the brown seeded genotypes showed protein content ranging from 2.7% to 9.5% revealing that the white seeded genotypes had higher protein content compared to brown seeded genotypes. The results obtained for seed calcium content varied from 279.05 mg/100g (IC0477385) to 639.26 mg/100g (VR1023) with a mean of 442.99 mg/100g. Calcium aids in development of bones in growing children and also helps in strengthening and maintaining bone health and teeth in adults. Calcium rich diet is always essential for prevention of osteoporosis. In plants, the calmodulin protein is a calcium binding protein which plays an important role in plant growth regulation, development as well as biotic and abiotic stress resistance. In the present investigation, seed phosphorus content ranged from 0.11% (IC0476467) to 0.33% (VR939) with a mean of 0.23%. Phosphorus is an important component in life-critical compounds including adenosine triphosphate (ATP), the molecule that is the energy currency of the body. Phosphorus is an important component of nucleic acids (DNA and RNA), known as the building blocks of the genetic code. Furthermore, the metabolism of lipids (fats) relies on phosphorus, and it is also an important component of lipid-containing structures like cell membranes and nervous system. White seeded genotypes registered higher phosphorus content varying from 0.24% to 0.32%, while the brown seeded genotypes showed phosphorus content varying from 0.11% to 0.24% highlighting that the white seeded genotypes had higher phosphorus content compared to brown seeded genotypes. The results obtained for seed iron content ranged from 2.05 mg/100g (IC0476988) to 6.45 mg/100g (VR942) with a mean of 4.34 mg/100g. Iron is an essential element for blood production and helps to overcome the condition called anaemia. Higher seed iron content was exhibited by white seeded genotypes ranging from 4.85 to 6.45 mg/100g , while the brown seeded genotypes exhibited seed iron content from 2.05mg/100g to 4.45mg/100g implying that the white seeded genotypes is rich in iron when compared to brown seeded genotypes. In the present study, seed zinc content ranged from 1.15 mg/100g (IC0476988) to 3.75 mg/100g (IC474231) with a mean of 2.41 mg/100g. Zinc is an important micronutrient that aids in body immunity. Seed zinc content was observed higher in white seeded genotypes ranging from 2.85mg/100g to 3.75 mg/100g , while the brown seeded genotypes showed seed zinc content from 1.15 mg/100g to 2.76 mg/100g suggesting that the white seeded genotypes is rich in zinc content when compared to brown seeded genotypes. In the present study, seed copper content varied from 0.85 mg/100g (IC0477385) to 2.95 mg/100g (IC473948) with a mean of 1.85 mg/100g. Copper is an important micronutrient that helps in sustaining energy levels, preventing premature aging and aids in hormone balance. White seeded genotypes had higher copper content ranging from 2.15 mg/100g to 2.95 mg/100g compared to the brown seeded genotypes that exhibited seed copper content from 0.85 mg/100g to 1.95 mg/100g implying that the white seeded genotypes had higher copper content than brown seeded genotypes. In the present study, seed manganese content varied from 0.55 mg/100g (IC0587948) to 3.45 mg/100g (VR950) with a mean of 2.03 mg/100g. Manganese is an essential micronutrient that helps in formation of connective tissue, fat and carbohydrate metabolism, calcium absorption and blood sugar regulation. White seeded genotypes had higher manganese content ranging from 2.55mg/100g to 3.45 mg/100g compared to the brown seeded genotypes that exhibited seed manganese content from 0.55 mg/100g to 2.45 mg/100g implying that the white seeded genotypes had higher manganese content than brown seeded genotypes. Tannin content ranged from 0.03 CE% (IC474065, IC474221, IC473983, VR1016) to 3.09 CE% (Sri Chaitanya) with a mean of 1.35 CE%. Tannins in the outer layer of the grain, serves as a physical barrier to fungal invasion (Devi *et al*., 2014) and plays an important role in the biological function of plants and humans. The compound also contributes to the antioxidant activity which has been an important factor in healthy aging and the prevention of metabolic disease (Shibairo *et al*., 2014). Brown seeded genotypes had higher tannin content ranging from 0.19 CE% to 3.09 CE % compared to the white seeded genotypes that exhibited tannin content from 0.025 CE% to 0.055 CE% . The results obtained for antioxidant activity varied from 12.45% DPPH activity (VR1016) to 99.25% % DPPH activity (Srichaitanya) with a mean of 60.63% DPPH activity. Higher antioxidant activity was exhibited by brown seeded genotypes ranging from 59.65% to 99.25% while the white seeded genotypes showed antioxidant activity varying from 12.45% to 25.35%. The mean values for this grain yield per plant showed a range from 10.20 g (IC0477206) to 35.25 g (IC0477272) with average of 21.43 g. When compared to three checks, IC0477272 (35.25), IC0477211-X (34.6) , IC0477628(34.45) and VR1034 (34.45) recorded higher grain yield, highlighting the fact that these genotypes are best suited to be used as parents in breeding programme.

In the present study the phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters studied implying the influence of environment in shaping these traits. The values of phenotypic co-efficient of variation varied from 10.64 % to 89.93 %. The highest magnitude of phenotypic coefficient of variation was recorded by tannin content (89.93 %), followed by antioxidant activity (53.99%) and seed manganese content (45.71%). The values of genotypic coefficient of variation obtained in respect of various yield and quality attributes ranged from 9.11% to 89.77%. The highest magnitude of genotypic coefficient of variation was recorded by tannin content (89.77 %), followed by antioxidant activity (53.53%) and seed manganese content (45.34%).

Moderate PCV and GCV values were recorded for traits such as days to 50 percent flowering, days to maturity, flag leaf blade length, flag leaf blade width, SCMR at 30 days, test weight that indicates the presence of moderate variation for these traits among the genotypes studied. Higher PCV and GCV values were registered for productive tillers per plant, fingers per earhead, finger length, finger width, earhead length, peduncle length, seed protein content, seed calcium content, seed phosphorus content, seed iron content, seed zinc content, seed copper content, seed manganese content, tannin content and antioxidant activity revealing sufficient variation among genotypes studied. Similar results were reported by Prashantha*et al.* (2018), Keerthana *et al.* (2019) and Anusha *et al.*.(2020).

The heritability values for different characters ranged from 87.70% to 97.60 %. Genetic advance as per cent of mean ranged from 16.06% to 98.13 %. Antioxidant Activity (98.13%) recorded the highest genetic advance followed by seed manganese content(92.67 %) and tannin content (92.50).High heritability accompanied with high genetic advance as per cent of mean were observed for characters *viz.*, days to 50% flowering, plant height, flag leaf blade length, flag leaf blade width ,number of productive tillers per plant, number of fingers per earhead, finger length, finger width, earhead length peduncle length, test weight, harvest index, grain yield per plant, protein content, calcium content, phosphorus content, iron content, zinc content, copper content, manganese content, tannin content and antioxidant activity indicating the predominance of additive gene action in manifestation of above traits. Therefore, direct phenotypic selection can be exercised for improvement of above traits.

The remaining traits *viz.*, days to maturity, SCMR at 30 days, SCMR at 45 days, showed high heritability and moderate genetic advance as per cent of mean indicating the operation of both additive and non-additive gene action which further signifies that mass selection, progeny selection or any modified selection procedure should be undertaken to exploit the additive gene effects instead of simple selection.These results were similar with Anuradha*et al.* (2018), Singamsetty*et al.* (2018) and Aralikatti*et al.* (2020).

CONCLUSION

Based on above results, it can be concluded that brown seeded genotypes such as ICO477628, IC0477211-X, IC0477272 and IC0477680 and white seeded genotypes such as VR1034 and VR1029 recorded higher mean values for yield and yield attributing traits compared to three checks signifying the importance of these genotypes for yield improvement in breeding programmes.In general white seeded genotypes showed higher mean values for all nutritional traits than brown seeded genotypes. Among white seeded genotypes higher mean values was recorded for VR1016 for protein content,VR1023 for calcium content,VR939 for phosphorous content ,VR942 for iron content ,IC474231 for zinc content, IC473948 for copper content and VR950 for manganese content highlighting the importance of these genotypes in nutritional breeding programmes.For tannin and antioxidant activity, brown seeded genotypes were superior than white seeded genotypes.Higher antioxidant activity in finger millet helps in prevention of excessive oxidation by neutralizing the free radicals that can cause cancer and can also clean up toxins from kidney and liver. Among brown seeded genotypes, Sri Chaitanya, IC0477680, IC0476988, IC0477014, IC0477211-X recorded higher mean values for tannin content and antioxidant activity suggesting the importance of these genotypes to be used in breeding programmes to develop varieties of pharmaceutical importance and are of immense health benefits.

Table 1. Analysis of variance for 25 morpho-physiological and biochemical characters studied in finger millet (*Eleusinecoracana* (L.))

	Source of variation	df	Peduncle length (cm)	Harvest Index (%)	Test weight (g)	Seed protein content (%)	Seed calcium content (mg /100g)	Seed phosphorus content (%)	Seed iron content (mg /100g)	Seed zinc content (mg /100g)	Seed copper content (mg /100g)	Seed manganese content (mg /100g)	Tannin content (% CE)	Antioxidant Activity (% DPPH Activity)	Grain yield per plant (g)
			Mean sum of squares												
1	Replications	1	0.114	45.125	0.048	0.005	16.213	0.000	0.003	0.002	0.001	0.050	0.005	36.838	-0.005
2	Treatments (unadjusted)	63	30.665 **	74.611 **	0.419 **	13.621 **	25419.180**	0.005 **	2.658 **	1.231 **	0.540 **	1.703 **	2.932 **	2126.78 **	110.14**
3	Blocks within Repllicated (adj)	14	1.326	11.411	0.091 *	0.065	1170.302	0.000	0.042	0.005	0.009	0.014	0.009 *	21.147	5.399
4	Error (r.c.b.)	63	1.195	11.347	0.057	0.055	756.663	0.000	0.052	0.005	0.009	0.014	0.005	17.978	7.193
5	Total	127	15.805	42.99	0.236	6.784	12984.99	0.003	1.344	0.613	0.272	0.852	1.457	1064.229	58.207

Source of variation	df	Days to 50 percent flowering	Days to maturity	Plant height (cm)	Flag leaf blade length (cm)	Flag leaf blade width (cm)	SCMR at 30 days	SCMR at 45 days	Productive tillers per plant	Fingers per earhead	Finger length (cm)	Finger width (cm)	Earhead length (cm)
		Mean sum of squares											
Replications	1	1.977	3.554	0.797	6.798	0.002	0.224	0.078	0.010	0.009	0.003	0.000	0.721
Treatments (unadjusted)	63	280.957 **	223.850 **	258.714 **	66.421 **	0.073 **	41.931 **	39.128 **	1.815 **	10.192 **	4.910 **	0.282**	9.925 **
Blocks within Repllicated (adj)	14	11.577	33.358	57.059	2.943	0.003	10.812	11.018	0.100	0.193	0.301	0.004	0.131
Error	63	13.517	34.013	37.487	2.501	0.003	6.305	6.047	0.063	0.323	0.354	0.003	0.192
Total	127	146.094	127.944	146.941	34.243	0.038	23.930	22.410	0.932	5.216	2.611	0.141	5.025

* Significant at 5% level ** Significant at 1% level

Table 2. Mean performance for 25 characters under study in 64 genotypes of finger millet (*Eleusinecoracana*(L.))

S. No.	Genotype	DFF	DM	PH (cm)	FLL (cm)	FLW (cm)	SCMR at 30 days	SCMR at 45 days	PT	FE	FL (cm)	FW (cm)	EL (cm)	PL (cm)	H.I (%)	TW (g)	Pro (%)	Ca (mg /100g)	P (g /100g)	Fe (mg /100g)	Zn (mg /100g)	Cu (mg /100g)	Mn (mg /100g)	TA (% CE)	AOA (% DPPH Activity)	GYPP (g)
1	Sri Chaitanya	78.50	106.50	110.65	32.40	1.13	40.15	42.90	2.50	7.50	6.05	0.85	7.40	9.15	30.50	2.70	7.25	427.25	0.22	3.45	1.55	2.15	1.45	**3.09**	**99.25**	21.25
2	Vakula	76.50	104.50	90.20	36.10	**1.45**	38.15	42.20	2.60	9.40	6.50	1.20	8.40	8.95	31.50	2.75	5.65	488.50	0.17	2.35	1.45	1.45	0.85	2.20	82.14	21.50
3	Hima	84.00	110.50	101.05	35.80	1.19	37.50	46.35	4.70	12.15	9.05	1.60	11.85	16.25	**39.50**	3.20	11.25	592.70	0.31	5.55	3.15	2.55	2.55	0.15	24.25	33.15
4	IC0477198	49.50	80.50	93.15	32.25	**0.52**	38.45	40.15	4.50	11.05	8.70	1.55	11.60	12.15	37.50	3.05	6.21	281.10	0.14	3.27	1.67	1.35	0.75	1.79	78.55	31.15
5	IC0587945	56.00	85.50	85.20	30.55	0.88	**30.35**	**32.25**	3.70	9.70	7.60	1.30	8.85	17.25	32.50	3.00	5.35	483.15	0.18	4.15	2.76	1.55	1.75	2.48	88.05	22.60
6	IC0476797	69.00	98.00	102.55	30.55	1.18	37.75	39.50	3.05	9.35	6.05	1.05	8.50	9.80	31.50	2.75	6.30	479.00	0.22	4.25	1.25	1.85	1.45	2.79	92.55	21.45
7	IC0477385	51.50	82.50	88.05	41.90	1.39	40.15	43.40	3.70	9.70	7.40	1.30	8.75	12.20	32.50	3.05	4.25	**279.05**	0.22	4.15	2.75	**0.85**	2.04	1.13	72.85	22.60
8	IC0587948	76.50	104.50	93.45	33.80	1.05	35.45	38.15	3.50	9.55	7.30	1.30	8.65	18.20	31.50	2.85	6.05	457.40	0.21	4.15	2.15	1.75	**0.55**	1.09	71.15	22.25
9	IC0477680	65.50	95.50	89.60	28.15	0.92	39.25	43.95	4.65	12.20	**9.60**	1.60	12.10	9.65	38.50	3.20	7.75	303.35	0.22	4.35	2.45	1.55	2.36	3.04	98.65	33.20
10	IC0476988	68.50	97.50	90.95	**17.90**	0.75	35.65	39.55	3.60	9.55	7.40	1.25	8.70	9.20	31.50	2.85	**2.70**	311.75	0.17	**2.05**	**1.15**	1.05	0.65	2.88	94.85	22.35
11	IC0477014	55.50	84.50	95.95	35.10	1.03	39.10	41.30	3.65	9.65	7.60	1.30	8.75	12.55	32.50	2.95	6.20	311.40	0.23	3.25	1.55	1.35	0.75	2.95	98.85	22.60
12	IC0506462	51.00	82.00	77.15	30.90	1.15	38.00	39.05	4.60	11.15	8.80	1.55	11.85	8.45	38.50	3.05	6.65	479.30	0.22	4.15	1.65	1.95	2.45	2.28	83.55	32.75
13	IC0477211-X	62.50	91.50	109.25	33.90	1.05	41.00	45.50	4.75	**13.05**	9.30	1.60	12.60	14.15	38.50	3.20	4.20	503.30	0.23	4.35	1.65	2.15	1.65	2.92	94.44	34.60
14	IC0506461	63.50	92.50	106.40	30.85	1.28	43.10	45.95	4.40	10.40	8.40	1.45	11.15	16.40	37.50	3.05	6.20	492.30	0.23	3.35	1.55	1.45	1.25	2.09	81.33	29.35
15	IC0476922	56.50	86.00	93.90	28.45	0.90	37.10	40.10	3.90	9.75	7.80	1.35	9.20	13.20	33.50	2.95	6.05	503.10	0.24	2.35	1.25	1.15	1.35	2.58	89.12	24.60
16	IC0477752	62.50	91.50	109.70	33.80	1.18	35.75	39.20	4.55	11.15	8.80	1.55	11.80	13.25	38.50	3.05	5.25	455.60	0.17	2.85	1.65	1.55	0.85	1.88	79.71	32.70
17	IC0477469-X	52.00	83.50	81.80	27.60	0.78	48.95	52.80	4.30	10.20	8.15	1.50	10.20	13.75	36.50	3.05	3.85	297.15	0.22	4.05	1.65	2.05	2.05	1.58	76.05	27.60
18	IC0477599	64.50	94.50	72.10	27.20	0.95	39.95	43.15	3.70	9.55	7.30	1.25	8.70	9.85	31.50	2.85	7.75	335.35	0.22	4.15	2.75	1.85	1.35	2.67	92.05	22.25
19	IC0476467	63.50	93.50	102.70	39.75	1.08	36.55	38.25	4.10	9.90	8.05	1.50	9.55	10.20	34.50	2.95	2.75	327.20	**0.11**	4.25	2.15	1.35	1.15	0.19	59.65	26.05
20	IC0477484	65.50	95.00	103.05	43.25	1.18	35.50	37.95	4.70	12.10	9.05	1.55	11.85	12.60	38.50	**3.30**	4.35	343.35	0.12	4.15	1.55	1.85	1.05	2.38	86.05	33.05
21	IC0477035	47.50	79.50	**114.40**	31.45	0.78	47.00	49.30	2.30	6.80	5.40	0.65	6.20	15.10	23.50	2.20	8.35	281.90	0.12	3.35	2.65	1.65	1.75	2.68	91.22	14.15
22	IC0477467	62.00	91.00	82.25	30.60	1.03	47.30	49.20	2.25	6.65	5.25	0.70	6.05	11.40	23.50	2.15	7.40	503.00	0.24	2.25	1.25	1.15	0.65	1.41	74.13	14.05
23	IC0476946	48.50	79.50	101.65	29.10	0.85	45.15	48.65	3.70	9.45	7.05	1.25	8.60	12.25	31.50	2.85	6.40	321.00	0.24	4.35	2.55	1.65	2.15	1.16	71.74	22.10
24	IC0476560	53.50	84.00	81.20	19.15	0.68	38.35	46.30	2.20	**4.10**	4.60	**0.45**	**5.40**	15.60	20.50	**1.70**	8.05	305.00	0.23	4.05	2.35	1.45	1.15	1.29	73.13	10.60
25	IC0476586	47.00	79.00	75.20	23.15	0.61	39.10	45.40	4.05	9.90	8.10	1.50	9.80	7.15	34.50	2.95	5.55	328.50	0.22	3.95	1.55	1.75	1.05	1.19	72.74	26.20
26	IC0477184	**46.50**	**78.50**	88.85	28.95	1.18	36.65	43.85	**2.05**	6.50	5.05	0.65	5.80	11.15	23.50	2.05	8.05	296.50	0.22	3.45	1.45	1.35	1.85	2.68	92.23	13.80

S. No.	Genotype	DFF	DM	PH (cm)	FLL (cm)	FLW (cm)	SCMR at 30 days	SCMR at 45 days	PT	FE	FL (cm)	FW (cm)	EL (cm)	PL (cm)	H.I (%)	TW (g)	Pro (%)	Ca (mg /100g)	P (g /100g)	Fe (mg /100g)	Zn (mg /100g)	Cu (mg /100g)	Mn (mg /100g)	TA (% CE)	AOA (% DPPH Activity)	GYPP (g)
27	IC0477272	62.50	92.00	97.30	30.00	0.98	38.55	43.55	4.75	12.75	9.15	1.60	**13.20**	9.20	38.50	3.15	7.40	496.90	0.14	2.25	1.65	1.85	2.25	0.69	67.25	**35.25**
28	IC0477004	51.50	82.50	89.55	30.10	1.18	40.40	44.40	2.20	5.70	4.70	0.55	5.70	12.15	20.50	2.00	5.50	288.50	0.21	4.45	2.05	1.75	0.85	0.53	64.54	10.65
29	IC0476588	50.50	81.00	74.95	29.10	0.95	50.85	55.65	2.15	5.10	4.25	0.60	5.50	19.20	21.00	1.80	8.30	317.00	0.21	4.35	2.55	1.65	2.15	0.55	65.65	10.25
30	IC0477010	49.50	80.00	76.15	25.20	0.88	45.20	47.95	2.25	6.75	5.30	0.65	6.05	15.15	23.50	2.20	9.50	316.50	0.23	4.45	2.65	1.75	2.25	3.04	96.45	14.20
31	IC0476831	49.50	80.50	85.90	30.10	1.38	37.15	46.35	2.20	5.55	4.70	0.55	5.60	18.20	20.50	1.90	5.40	488.75	0.23	2.35	1.35	1.15	0.75	2.95	95.15	10.60
32	IC0476903	63.50	93.50	86.85	22.20	0.90	43.15	48.50	2.65	9.45	6.70	1.25	8.50	23.60	30.50	2.80	7.45	335.50	0.14	4.25	2.35	1.55	2.35	2.80	93.55	21.65
33	IC0476860	63.51	93.50	86.84	22.20	0.90	43.15	48.51	2.64	9.44	6.69	1.25	8.49	**23.61**	30.00	2.81	7.46	335.49	0.14	4.26	2.36	1.55	2.36	2.81	93.55	21.65
34	IC0587970	70.50	98.50	108.75	24.10	0.99	50.95	56.95	2.80	9.50	6.70	1.30	8.60	9.45	31.50	2.80	6.20	327.00	0.17	2.85	1.55	1.85	1.65	1.98	79.85	21.75
35	IC0477628	60.50	89.00	96.70	37.65	1.17	39.90	46.00	4.80	12.70	9.20	**1.70**	12.50	19.25	38.50	3.20	7.20	328.50	0.23	3.95	1.55	1.15	0.65	2.95	98.15	34.45
36	IC0477493	64.50	94.50	92.70	26.25	1.05	45.25	53.50	2.35	7.40	5.85	0.85	7.30	22.85	28.50	2.40	7.40	319.00	0.21	4.15	2.35	1.45	1.25	2.39	85.15	19.85
37	IC0477206	72.50	100.50	78.15	33.20	1.00	30.80	39.20	2.20	4.85	**4.20**	0.60	5.45	11.40	20.50	1.80	3.75	495.00	0.23	4.05	1.55	1.25	1.85	0.32	62.22	**10.20**
38	IC0476709	61.00	90.00	71.30	28.15	0.89	38.15	46.35	2.25	7.05	5.45	0.75	6.40	12.70	24.50	2.30	7.60	503.60	0.21	4.35	2.45	1.55	2.15	2.95	95.15	14.85
39	IC0477654	59.50	88.00	76.75	28.25	0.65	32.05	45.95	3.30	9.45	7.20	1.25	8.60	7.75	31.50	2.90	7.45	344.60	0.22	4.05	2.65	1.25	2.05	2.95	98.75	22.15
40	IC0478036	69.00	98.00	78.90	24.70	1.18	38.25	42.70	2.15	5.80	4.80	0.55	5.70	15.25	20.50	2.00	3.45	336.90	0.22	3.35	2.75	1.35	1.55	0.89	70.60	10.75
41	IC0477842	69.00	98.00	82.80	33.15	1.05	43.65	45.65	**2.05**	5.20	4.30	0.60	5.45	10.20	**19.50**	1.80	4.80	343.60	0.24	2.35	1.25	1.25	0.65	2.59	89.71	10.25
42	IC0477261	63.50	93.50	102.00	24.10	0.95	35.15	46.15	2.15	6.45	7.65	1.40	9.05	14.20	32.50	3.00	4.70	320.70	0.19	5.55	2.25	1.95	0.85	2.39	85.45	23.70
43	IC474231	84.50	110.50	91.05	32.75	1.18	41.10	43.95	2.15	5.45	4.50	0.55	5.60	11.80	**19.50**	1.90	10.90	528.50	0.25	6.15	**3.75**	2.15	3.45	0.05	22.15	10.50
44	IC474207	80.50	108.50	89.25	27.75	1.05	48.75	49.45	2.25	6.80	5.30	0.70	6.20	14.35	23.50	2.20	11.15	539.00	0.27	5.55	3.25	2.35	3.25	0.05	23.00	14.20
45	IC473983	80.00	108.00	95.15	28.80	1.15	48.25	51.90	2.30	6.55	5.15	0.65	5.85	17.70	23.50	2.05	10.00	527.70	0.28	5.15	2.85	2.25	3.15	**0.03**	12.80	13.85
46	IC473948	83.50	110.50	86.30	29.15	0.95	44.40	45.70	2.15	5.75	4.80	0.55	5.65	12.25	20.50	2.00	11.35	539.00	0.28	5.45	3.45	**2.95**	2.55	0.05	24.35	10.75
47	IC474206	**84.50**	**111.50**	73.15	35.85	1.25	43.95	47.70	2.20	5.50	4.45	0.60	5.60	16.40	20.50	1.90	10.95	585.00	0.28	4.75	3.65	2.35	3.35	0.05	23.85	10.50
48	IC474433	82.50	109.50	**70.55**	36.95	1.15	40.95	42.55	3.35	9.50	7.30	1.25	8.60	13.30	31.50	2.85	10.85	528.50	0.25	5.85	3.15	2.25	3.35	0.04	21.23	22.20
49	IC474226	79.99	107.98	91.23	27.35	1.10	36.14	43.10	3.50	9.55	7.30	1.31	8.60	12.40	32.00	2.85	10.70	520.86	0.28	6.45	3.65	2.85	2.85	0.06	25.35	22.28
50	IC473950	77.50	105.50	76.55	28.10	1.18	41.80	48.60	2.25	6.80	5.25	0.65	6.05	**6.65**	23.50	2.20	9.85	599.00	0.27	6.15	3.55	2.45	3.15	0.04	13.25	14.20
51	IC473989	77.50	105.50	96.30	25.20	1.08	38.60	42.90	2.35	7.45	5.60	0.85	7.30	14.40	29.50	2.50	10.40	523.00	0.27	5.75	3.55	2.75	3.35	0.06	25.15	20.60
52	IC473994	82.50	109.50	100.35	25.75	1.26	37.40	45.50	3.25	9.50	7.05	1.25	8.55	14.20	31.50	2.85	10.55	520.80	0.28	5.25	3.35	2.35	3.35	0.05	23.75	22.05
53	IC474065	80.49	108.48	96.23	27.69	1.15	36.44	46.30	2.55	9.35	6.10	1.15	8.50	18.30	31.50	2.80	11.70	521.11	0.25	5.75	3.25	2.65	2.65	**0.03**	23.75	21.43

S. No.	Genotype	DFF	DM	PH (cm)	FLL (cm)	FLW (cm)	SCMR at 30 days	SCMR at 45 days	PT	FE	FL (cm)	FW (cm)	EL (cm)	PL (cm)	H.I (%)	TW (g)	Protein (%)	Ca (mg /100g)	P (g /100g)	Fe (mg /100g)	Zn (mg /100g)	Cu (mg /100g)	Mn (mg /100g)	TA (% CE)	AOA (% DPPH Activity)	GYPP (g)
54	IC474220	79.50	107.50	80.50	28.05	1.08	40.95	42.10	2.45	7.50	6.05	1.05	7.50	12.20	31.50	2.65	10.25	559.00	0.26	6.25	3.15	2.55	2.55	0.05	21.45	21.25
55	IC474221	82.00	109.00	90.45	33.80	1.19	42.10	47.65	3.75	9.80	5.10	0.65	5.75	12.20	23.50	2.05	10.80	527.00	0.28	5.55	3.45	2.35	3.15	**0.03**	12.55	13.75
56	VR950	55.50	84.50	78.30	**47.85**	1.05	35.25	40.55	3.65	9.70	7.60	1.30	8.75	10.25	32.50	2.95	9.85	592.70	0.30	4.85	3.25	2.35	**3.45**	0.06	25.15	22.45
57	VR1038	50.99	81.98	106.34	29.80	1.35	42.64	43.65	3.55	9.55	7.60	1.25	8.70	17.15	32.50	2.90	11.95	620.61	0.28	6.05	3.35	2.26	2.85	0.04	16.65	22.33
58	VR1034	52.00	83.00	105.85	37.75	1.24	42.50	44.80	**4.90**	12.75	9.30	1.55	12.50	18.55	38.50	3.20	10.15	527.25	0.25	5.15	3.05	2.25	2.55	0.04	15.55	34.45
59	VR1024	67.00	96.00	90.00	42.05	1.33	40.75	42.25	2.55	9.40	6.10	1.15	8.40	18.40	31.50	2.80	11.15	633.25	0.32	6.25	2.85	2.75	3.25	0.04	14.15	21.45
60	VR942	77.50	105.50	91.65	34.30	1.20	34.65	39.00	3.20	9.45	7.20	1.30	8.55	18.05	29.50	2.85	10.45	559.25	0.31	**6.45**	3.45	2.35	3.15	0.04	13.44	22.10
61	VR1023	56.49	85.98	106.89	40.10	1.05	42.04	43.85	4.05	10.05	8.10	1.50	9.75	17.25	35.00	2.95	10.65	**639.26**	0.30	5.25	2.85	2.17	2.65	0.05	22.35	26.13
62	VR939	54.00	84.00	91.25	31.15	0.95	42.90	42.90	2.40	7.50	5.85	0.85	7.30	13.15	29.50	2.60	10.20	557.00	**0.33**	4.85	3.05	2.45	3.25	0.04	15.85	20.85
63	VR1029	56.00	85.00	97.55	35.20	1.18	47.40	47.40	4.70	12.25	9.15	1.55	11.85	8.30	38.50	3.20	10.00	599.00	0.29	4.85	2.85	2.15	2.55	0.04	14.15	33.15
64	VR1016	55.50	84.50	109.55	38.30	0.88	43.30	43.50	2.45	8.45	6.20	1.05	7.60	14.65	31.50	2.70	**12.20**	519.75	0.30	4.75	3.05	1.25	3.35	**0.03**	**12.45**	21.35
Range Lowest		46.50	78.50	70.55	17.90	0.52	30.35	32.25	2.05	4.10	4.20	0.45	5.40	6.65	19.50	1.70	2.70	279.05	0.11	2.05	1.15	0.85	0.55	0.03	12.45	10.20
Range Highest		84.50	111.50	114.40	47.85	1.45	50.95	56.95	4.90	13.05	9.60	1.70	13.20	23.60	39.50	3.30	12.20	639.26	0.33	6.45	3.75	2.95	3.45	3.09	99.25	35.25
Mean		64.72	93.92	91.26	31.01	1.05	40.41	44.64	3.20	8.78	6.75	1.11	8.40	13.69	30.11	2.65	7.80	442.99	0.23	4.35	2.42	1.84	2.03	1.35	60.63	21.43
S.E±		2.60	4.12	4.33	1.12	0.04	1.78	1.74	0.18	0.40	0.42	0.04	0.31	0.68	2.38	0.17	0.37	19.45	0.01	0.16	0.09	0.08	0.08	0.05	0.40	1.90
C.D. (5%)		7.35	11.65	12.24	3.16	0.11	5.02	4.91	0.50	1.14	1.19	0.12	0.88	1.91	6.73	0.48	1.04	54.98	0.02	0.45	0.25	0.24	0.23	0.14	1.12	5.36

DFF- Days to 50 per cent flowering, DM- Days to maturity, PH- Plant height, FLL- Flag leaf blade length, FLW- Flag leaf blade width, EL- Earhead length, PL Peduncle length, PT- Productive tillers per plant, FE- Fingers per earhead , FL- Finger length, FW- Finger width, H.I- Harvest index ,TW-Test weight, Pro- Seed protein content, Ca- Seed calcium content, P- Seed phosphorus content, Fe- Seed iron content, Zn- Seed zinc content, Cu- Seed copper content, Mn- Seed manganese content, TA- Tannin content, AOA- Antioxidant activity, GYPP- Grain yield per plant.

S.No. 4 to 42- Brown seeded genotypes , 43 to 64- White seeded genotypes

Sri Chaitanya, Vakula- Brown seeded check variety Hima- White seeded check variety

Table 3. Estimates of genetic parameters for grain yield and quality components in finger millet (*Eleusinecoracana* (L.))

S. No	Character	Range		Mean	Coefficient of variation		Heritability (Broad sense) (%)	Genetic advance	Genetic advance as % ofmean
		Minimum	Maximum		GCV (%)	PCV (%)			
1	Days to 50% flowering	46.50	84.50	64.72	17.86	18.74	90.80	22.70	35.07
2	Days to maturity	78.50	111.50	93.92	10.37	12.09	73.60	17.22	18.33
3	Plant height (cm)	70.55	114.40	91.26	11.52	13.33	74.70	18.72	20.51
4	Flag leaf blade length(cm)	17.90	47.85	31.01	18.23	18.93	92.70	11.21	36.16
5	Flag leaf blade width(cm)	0.51	1.45	1.05	17.84	18.64	91.50	0.36	35.15
6	SCMR at 30 days	30.35	50.95	40.41	10.44	12.15	73.90	7.47	18.49
7	SCMR at 45 days	32.25	56.95	44.64	9.11	10.64	73.20	7.16	16.06
8	Number of productive tillers plant	2.05	4.90	3.20	29.28	30.32	93.30	1.86	58.25
9	Number of fingers per earhead	4.10	13.05	8.78	25.29	26.10	93.90	4.43	50.47
10	Finger length(cm)	4.20	9.60	6.75	22.34	24.02	86.60	2.89	42.83
11	Finger width(cm)	0.45	1.70	1.11	33.65	34.05	97.60	0.75	68.49
12	Earhead length(cm)	5.40	13.20	8.40	26.26	26.77	96.20	4.45	53.06
13	Peduncle length(cm)	6.65	23.60	13.69	28.04	29.16	92.50	7.60	55.57
14	Harvest Index (%)	19.50	39.50	30.11	18.67	21.77	73.60	9.93	33.01
15	Test weight (g)	1.70	3.30	2.65	16.06	18.40	76.10	0.76	28.87
16	Seed protein content (%)	2.70	12.20	7.80	33.37	33.51	99.20	5.34	68.48
17	Seed calcium content (mg/100g)	279.05	639.26	442.99	25.06	25.82	94.20	222.04	50.12
18	Seed phosphorous content (%)	0.11	0.33	0.23	22.48	22.95	95.90	0.10	45.35
19	Seed iron content (mg/100g)	2.05	6.45	4.35	26.25	26.77	96.20	2.30	53.04
20	Seed zinc content (mg/ 100g)	1.15	3.75	2.42	32.37	32.51	99.10	1.60	66.41
21	Seed copper content (mg/100g)	0.85	2.95	1.84	27.75	28.20	96.90	1.04	56.27
22	Seed manganese content (mg/100g)	0.55	3.45	2.03	45.34	45.71	98.40	1.87	92.67
23	Tannin content (CE%)	0.02	3.09	1.35	89.77	89.93	99.70	1.25	92.50
24	Antioxidant activity (% DPPH	12.45	99.25	67.63	53.53	53.99	98.30	59.50	98.13
25	Grain yield per plant(g)	10.20	35.25	21.43	33.47	35.73	87.70	13.84	64.59

PCV- Phenotypic coefficient of variation; GCV- Genotypic coefficient of variation

Moderate to high variability and high heritability accompanied with high genetic advance as per cent of mean were observed for characters *viz.,* days to 50% flowering, plant height, flag leaf blade length, flag leaf blade width ,number of productive tillers per plant, number of fingers per earhead, finger length, finger width, earhead length peduncle length, test weight, harvest index, grain yield per plant, protein content, calcium content, phosphorus content, iron content, zinc content, copper content, manganese content, tannin content and antioxidant activity indicating the operation of additive gene action in manifestation of above traits which can be exploited through simple selection procedures. The remaining traits *viz.,* days to maturity, SCMR at 30 days, SCMR at 45 days, showed high heritability and moderate genetic advance as per cent of mean highlighting the operation of both additive and non-additive gene action which further signifies that mass selection, progeny selection or any modified selection procedure should be practised for the effective exploitation of additive gene effects instead of simple selection.

REFERENCES

Anuradha, N., Satyavathi, C.T., Bharadwaj, C., Sankar, M and Lakshmipathy, T. (2018). Association of agronomic traits and micronutrients in pearl millet. *International Journal of Chemical Studies.* 6 (l): 181-184.

Anusha, U., Vijayalakshmi, B., Anuradha, N., Patro, T,S.S.K and Sekhar, V. (2020). Studies on genetic variability for yield and quality traits in finger millet (*Eleusinecoracana*L. Gaertn).*International Journal of Current Microbiology and Applied Sciences.* 9 (9): 1-9.

Aralikatti, P.M and Chaturvedi, H.P. (2020). Genetic variability, heritability and genetic advance studies in finger millet (*Eleusinecoracana* (L.) Gaertn) cultivars under foothill condition of Nagaland. *Journal of Plant Development Sciences.* 12(7): 411-416.

Devi, P.B., Vijayabharathi, R., Sathyabama, S., Malleshi, N.G and Priyadarisini, V.B. (2014). Health benefits of finger millet (*Eleusinecoracana*L) polyphenols and dietary fibre – review. *Journal of Food Science and Technology.* 6(6): 1021-1040.

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

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

Kumar, A., Metwal, M., Kaur, S., Gupta, A. K., Puranik, S and Singh S. (2016). Nutraceutical value of finger millet [*Eleusinecoracana* (L.) Gaertn.], and their improvement using genomics approaches. *Frontiers in Plant Science.* 7: 934-1033.

Pradeep, P. M and Sreerama, Y. N. (2015). Impact of processing on the phenolic profiles of small millets: Evaluation of their antioxidant and enzyme inhibitory properties associated with hyperglycemia. *Food Chemistry,* 9, 455-463.

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 [*Eleusinecoracana* (L.) Gaertn] genotypes. *Journal of Farm Sciences.*31 (5): 527-531.

Ramashia, S. E., Gwata, E. T., Taylor, M.S., Anyasi, T. A. and Jideani, A.I.O. (2018). Some physical and functional properties of finger millet (*Eleusinecoracana*) obtained in sub-Saharan Africa. *Food Research International.* 104. 113-118.

Shibairo, S.I., Nyongesa, O., Onwonga, R and Ambuko, J. (2014). Variation of nutritional and anti-nutritional contents in finger millet (*Eleusinecoracana* (L.) Gaertn) genotypes. *Journal of Agriculture and Veterinary Science.* 7(11): 6-11.

Singamsetty, 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 (*Eleusinecoracana* L. Gaertn). *International Journal of Current Microbiology and Applied Sciences.* 7: 90-95.

Sivasubramanian, P and Menon, P.M. (1973). Inheritance of short stature in rice. *Madras Agricultural Journal.* 60: 1129-1133.

Sood, S., Kant, L and Pattnayak, A. (2017). Finger millet [*Eleusinecoracana*(L.) Gaertn.]: a minor crop for sustainable food and nutrition. Mini Review. *Asian Journal of Chemistry.* 29 (4). 707-710.

Sood, S., Kumar, A., Babu, B.K., Gaur, V.S., Pandey, D., Kant, L. and Pattnayak, A. (2016). Gene, discovery and advances in finger millet [*Eleusinecoracana*(L.) Gaertn.] genomics-An important nutri-cereal of future. *Frontiers in Plant Science.*7. 1-17.

Thompson, L.U. (1993). Potential health benefits and problems associated with anti nutrients in foods. *Food Research International Journal.* 26: 131-149.