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Genetic Analysis for Yield and Morphological Traits in Finger Millet [*Eleusine coracana* (L.) Gaertn.]

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ABSTRACT: A total of 38 finger millet accessions were evaluated for 12 morphological traits including grain yield at two locations: Hill Millet Research Station, NAU, Waghai, Gujarat and Agricultural Research Station, AAU, Dahod, Gujarat during *Kharif*, 2019, 2020 and 2021. The objectives were to examine the variability, correlation, and path coefficient analysis of morphological traits. High heritability estimates were reported for days to 50% flowering, days to maturity, plant height, number of productive tillers per plant, number of fingers per earhead, main earhead length, finger length, 1000 grain weight, grain yield per plant, straw yield per plant and harvest index indicating low environmental influence on these traits and presence of additive gene action for these traits. The number of fingers per ear head, number of productive tillers per plant, straw yield per plant, grain yield per plant, finger length, harvest index, and main ear head all showed moderate genotypic and phenotypic coefficients of variation, indicating ample scope for variation for these traits and allowing further improvement by selection of these traits. For the traits days to 50% flowering, finger width, days to maturity, plant height, and 1000 grain weight, low genotypic and phenotypic coefficients of variation were found, indicating low variability for these variables. According to DUS testing guidelines, the genotype WN-630 had extremely high finger counts per ear head—10.50, which is >8 (high)—and very long ear head lengths—13.43 cm, which is >12 cm (very long)—based on average performance over three years at various locations. Additionally, in accordance with DUS testing guidelines, the genotype WN-657 displayed very long ear head length, measuring 13.30 cm, which is >12 cm (very long), and long finger length, measuring 13.13 cm, which is >7 cm (extra long). This morphological characteristic, as well as the number of fingers per earhead, main earhead length, and finger length, all contribute directly to the high grain output per plant. As a result, these features might be prioritised during selection to acquire higher genetic benefits. CFMV-2, GNN-6, WN-630, and WN-657 were the highest yielding promising genotypes/varieties among the thirty-eight genotypes in finger millet and can be considered for varietal development and release for further selection.

Keywords: Finger millet, variability, correlation and path coefficient, morphological traits etc.

INTRODUCTION

Finger millet [*Eleusine coracana* (L.) Gaertn.] is a member of the Poaceae family. The cultivated *E. coracana* is a tetraploid (2n = 4X = 36); it resembles *E. indica* (L.) Gaertn. (2n = 18) and *E. africana* (O.) Byrne (2n = 36). It is a significant cereal crop among small millets, ranking third in terms of area and production in the country after sorghum and pearl millet. Finger millet is a valuable food grain crop that is largely grown in rainfed conditions in India. Because of its adaptability to a wide range of geographical areas and agro-ecological variability, finger millet is a more adaptable crop (Patel *et al.,* 2018). Finger millet is a tufted annual crop that matures in 75-160 days and grows to a height of 30-150 cm. Finger millet leaves are grass-like, thin, and capable of forming nodal branches as well as a large number of tillers. The grain is oblong to round and oval in shape, reddish brown in colour, and coarsely corrugated on the surface. Finger millet is a tropical rainfed crop that is ideal for dry farming. The most important tropical grains, like finger millet, are extremely adaptable and flourish at greater elevations.

Finger millet is an essential 'Nutricereals' because to its high nutritional value and storage qualities (Rao and Murlikrishna 2001). Finger millet grains have higher quantities of minerals such as calcium, magnesium, and potassium (Devi *et al.*, 2014). It is also high in amino acids such as methionine, lysine, and tryptophan (Bhatt *et al.*, 2011) and polyphenols (Chandrasekara and Shahidi 2011). Millets are preferred as dietary foods for persons with diabetes and cardiovascular disease due to their high fibre and protein content (Patil *et al.,* 2019).

Finger millet straw is an excellent feed that contains up to 61% total digestible elements.

In general, genetic variability, heritability and genetic advance are pre-requisites for breeding program and provide opportunity to plant breeder for selecting high yielding genotypes or to combine or transfer genes having desirable traits. Heritability and genetic advance are important factors to determine the success of selection in breeding programs. Improvement in any crop usually involves exploiting the genetic variability in specific traits. Simultaneous improvement of these traits depends on the nature and degree of association between traits. Heritability is of interest to plant breeders primarily as a measure of the value of selection for a particular character in various types of progenies and as an index of transmissibility. If the percentage is large, the character is heritable but if it is small, environment is correspondingly prominent in the character expression (Hayes *et al.*, 1955). There is a great genetic variation among varieties and germplasm of finger millet. Besides the availability of genetic diversity, their characterization is essential for the effective utilization in the crop improvement (Goswami *et al.,* 2015). This study was conducted for these reasons in order to analyse variability using several indicators such as phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability, and genetic progress. To determine the real contribution of each character to yield, the correlation must be divided into direct and indirect effects using path analysis. As a result, path analysis would aid in determining appropriate selection criteria for increasing productivity.

Grain yield is a complex character that is influenced by a wide range of other component characteristics. Knowledge of the relationship between yield and other biometric factors, as well as among component traits, aids in enhancing selection efficiency. As a result, the first stage in plant breeding is to investigate and identify plants for the genetic variation accessible in breeding materials, which is critical for a successful crop improvement programme (Negi *et al.,* 2017; Sharma *et al.,* 2022). As a result, the current study will be carried out to evaluate germplasm accessions, measure variability, and investigate the link between yield and its contributing traits in finger millet.

MATERIAL AND METHODS

The current investigation on genetic analysis for yield and morphological traits in finger millet was carried out during *kharif*, 2019, 2020 and 2021 at Hill Millet Research Station, NAU, Waghai and Agricultural Research Station, AAU, Dahod which is located at 20° 46’ N, 20° 50' N latitude and 73° 29' E, 75° 18' E longitude and an altitude of 145 m and 280 m above MSL. The experiment was carried out in a randomized complete block design (RCBD) with three replications consisted of 38 genotypes along with checks. The set of 25 finger millet promising lines selected from the 680 diverse lines which are collected from local areas as well as from NBPGR-CRP-AB experiments. The recommended package of practices was followed during crop growth period to raise a good crop. The observations on 11 quantitative traits *viz*., Days to 50% flowering, Days to maturity, Plant height (cm), Number of productive tillers per plants, Number of fingers per earhead, Main earhead length (cm), Finger length (cm), Finger width (cm), Grain yield per plant (g), Straw yield per plant (g), 1000 grain weight (g) were recorded on five randomly selected plants from each genotype in each replication were used to record observations for morphological characters.

Genetic variability analysis of each quantitative trait was carried out using different variability parameters. Phenotypic, genotypic and environmental variances were estimated according to the methods suggested by Johnson *et al.* (1955[a]) and Phenotypic and genotypic coefficient of variation were calculated using formulae suggested by Cockerham (1963), whereas estimation of heritability and expected genetic advance were computed using the formula according to Allard (1960) and Johnson *et al.*(1955[b]), respectively. Analysis of covariance for all possible pairs of fourteen characters was carried out using the procedure of Panse and Sukhatme (1978) for each family. The path analysis suggested by Dewey and Lu (1959) was adopted for each genotype separately in order to partition between variables with seed yield into direct and indirect effects of all the variables on yield.

RESULT AND DISCUSSION

Analysis of Variance. The analysis of variance indicating the mean sum of squares for all the twelve characters studied, are summarised in Table 1. The genotypic differences were highly significant for all twelve variables, indicating a great level of genetic variability across the genotypes tested in this study, implying plenty of room for improvement in yield and other morphological characteristics.

Mean Performance. The mean performance of all thirty-eight genotypes for twelve characteristics is shown in Table 5. The variability parameters such as mean, range, genotypic, phenotypic, and environmental variances for twelve characters are shown in Table 2. In a similar manner, Table 3 displays the genotypic and phenotypic coefficients of variation for each character. According to the mean table, out of 38 genotypes, CFMV-2 is the highest yielding, followed by GNN-6, WN 630, and WN 657.

According to DUS testing guidelines, the genotype WN-630 had extremely high finger counts per earhead—10.50, which is >8 (high)—and very long earhead lengths—13.43 cm, which is >12 cm (very long)—based on average performance over three years at various locations. According to DUS testing guidelines 2017, the genotype WN 657 also displayed very long ear head length of 13.30 cm, which is >12 cm (very long), and long finger length of 13.13 cm, which is >7 cm (extra long) (Fig. 1). This morphological characteristic, including the number of fingers per earhead, the length of the primary earhead, and the finger length, directly contributes to the high grain output per plant (Patil *et al.*, 2018 and 2022).

Table 1: Analysis of variance for twelve traits in thirty-six genotypes of Finger millet.

Source of variation	Degree of freedom	DF	DM	PH	PTP	FPE	MEL	FL	FW	TW	GY	SY	HI
Replication	2	6.40	30.73	32.21	0.05	0.27	0.32	0.91	0.003	0.001	1.32	4.22	7.47
Genotypes	35	258.03**	301.37**	185.44**	0.85**	5.85**	3.57**	2.95**	0.02**	0.07**	5.32**	45.42**	40.87**
Error	70	22.23	40.39	29.48	0.16	0.41	0.19	0.32	0.01	0.004	0.68	4.10	6.48
S.Em.±	-	2.72	3.67	3.13	0.24	0.37	0.25	0.33	0.05	0.04	0.48	1.17	1.47
C.D at 5 %	-	7.68	10.35	8.84	0.66	1.04	0.71	0.92	0.14	0.11	1.35	3.30	4.15
C.D at 1 %	-	10.19	13.74	11.74	0.88	1.38	0.95	1.23	0.18	0.14	1.79	4.38	5.50
C.V %	-	5.12	5.02	4.52	14.40	9.41	4.85	7.88	10.12	2.44	9.98	8.64	9.66

*significant at 5% level and **significant at 1% level

DF	Days to 50 % flowering	PTP	No. of productive tillers per plant	FL	Finger length (cm)	GY/P	Grain yield per plant (g)
DM	Days to maturity	FPE	Number of fingers per earhead	FW	Finger width (cm)	SY/P	Straw yield per plant (g)
PH	Plant height (cm)	MEL	Main ear head length (cm)	TW	1000-Grain weight (g)	HI	Harvest index (%)

Table 2: Range, mean and components of variance for twelve traits in thirty-six genotypes of Finger millet.

Sr. No.	Characters	Range	Mean	Component of variance		
				Genotypic	Phenotypic	Environmental
1.	Days to 50% flowering	67.60-112.5	92.04	78.60	100.83	22.23
2.	Days to maturity	105.30-145.5	126.55	87.00	127.38	40.39
3.	Plant height (cm)	92.50-136.5	120.13	51.99	81.47	29.48
4.	Number of productive tillers per plant	1.80-3.9	2.83	0.23	0.39	0.16
5.	Number of fingers per earhead	**5.1-10.50**	8.79	1.81	2.22	0.41
6.	Main earhead length (cm)	**6.77-13.43**	10.03	1.13	1.32	0.19
7.	Finger length (cm)	**5.4-13.13**	9.19	0.88	1.20	0.32
8.	Finger width (cm)	0.69-1.03	0.84	0.005	0.012	0.007
9.	1000-Grain weight (g)	2.38-3.07	2.69	0.023	0.027	0.004
10.	Grain yield per plant (g)	5.25-10.86	8.29	1.54	2.23	0.68
11.	Straw yield per plant (g)	14.85-33.25	23.43	13.77	17.87	4.10
12.	Harvest index (%)	19.65-34.2	26.35	11.46	17.94	6.48

Table 3: Genotypic and phenotypic coefficient of variation, heritability, genetic advance and genetic advance as per cent of mean for twelve traits in thirty-six genotypes of Finger millet.

Sr. No.	Characters	GCV%	PCV%	Genetic advance	Genetic advance (% of mean)	Heritability (Broad sense %)
1.	Days to 50% flowering	9.633	10.91	16.125	17.521	77.956
2.	Days to maturity	7.371	8.919	15.878	12.547	68.294
3.	Plant height (cm)	6.002	7.513	11.865	9.877	63.813
4.	Number of productive tillers per plant	16.973	22.057	0.761	26.906	59.217
5.	Number of fingers per earhead	19.837	21.956	2.507	36.919	81.626
6.	Main earhead length (cm)	11.755	12.718	2.021	22.382	85.432
7.	Finger length (cm)	13.024	15.222	1.651	22.955	73.205
8.	Finger width (cm)	8.664	13.32	0.097	11.608	42.304
9.	1000-Grain weight (g)	5.607	6.115	0.285	10.593	84.093
10.	Grain yield per plant (g)	14.997	18.015	2.131	25.717	69.296
11.	Straw yield per plant (g)	15.839	18.042	6.712	28.644	77.068
12.	Harvest index (%)	12.848	16.073	5.576	21.158	63.902

PCV and GCV Estimates. For the majority of the traits, the values of the phenotypic coefficient of variation were larger than the genotypic coefficient of variation, showing the importance of environmental factors. For the traits, namely, number of fingers per earhead, number of productive tillers per plant, straw production per plant, grain yield per plant, finger length, harvest index, and main earhead length, there was moderate genotypic and phenotypic coefficient of variation. These findings showed that the features under examination had a wide range of variance, allowing for further enhancement through the selection of particular traits. For such traits, Saundaryakumari and Singh (2015) also observed moderate genotypic and phenotypic coefficients of variation for finger length, number of fingers per earhead, number of productive tillers per plant, main earhead length, grain yield per plant, and straw yield per plant in finger millet, as well as Patil *et al.* (2018); Patil *et al.* (2022) for panicle length in little millet. Days to 50% flowering, finger width, days to maturity, plant height, and 1000 grain weight all have genotypic and phenotypic coefficients of variation that are lower than expected, indicating that these features are less variability for these traits. Suryanarayana *et al.* (2014) also obtained identical results for days to 50% flowering and days to maturity while Patil *et al.* (2017) observed for plant height in small millet and Devaliya *et al.* (2018) reported for days to 50% flowering, days to maturity, plant height, and 1000 grain weight in finger millet. In the current study, the differences between PCV and GCV for the characters days to 50% flowering, days to maturity, plant height, number of fingers per earhead, main earhead length, finger length, and 1000 grain weight were lower, indicating a negligible role of environment in the expression of traits, making phenotypic selection a viable method for improving these traits.

Heritability and genetic advance estimates. High heritability estimates were observed for days to 50% flowering, days to maturity, plant height, number of productive tillers per plant, number of fingers per earhead, main earhead length, finger length, 1000 grain weight, grain yield per plant, straw yield per plant, and harvest index, indicating that these characters are less influenced by environmental fluctuations and are largely governed by additive genes, implying that selection could be beneficial for improving such morphological traits. Similarly in finger millet high heritability for all the characters reported by Suryanarayana *et al.* (2014); Ulaganathan and Nirmalakumari (2014); Bisht *et al.* (2015); Negi *et al.* (2017). The number of fingers per earhead, productive tillers per plant, grain yield per plant, straw yield per plant, main earhead length, finger length, and harvest index were all found to have high genetic advance expressed as a percentage of the mean, while the days to 50% flowering, the days to maturity, and the 1000 grain weight were found to have moderate genetic advance. Plant height, however, had only shown modest genetic advancement when expressed as a proportion of the mean. For finger width, moderate heritability estimates were found, indicating a higher environmental influence on these traits' expression.

In the current study, traits such as number of fingers per earhead, number of productive tillers per plant, main earhead length, finger length, grain yield per plant, straw yield per plant, and the harvest index showed high heritability and high genetic advance, indicating that these characters were governed by additive gene action. As a result, there are good chances that these traits could be improved through direct selection. A high heritability value associated with a low genetic progress as a percentage of mean was observed for plant height, indicating the dominance of non-additive gene activity in the expression of this trait. Therefore, for significant improvement, breeders should employ appropriate methodology to use both additive and non-additive gene action simultaneously. Days to 50% flowering, days to maturity and 1000 grain weight all shown high heritability along with moderate genetic advance as a percentage of mean. The genotypes under study were diverse with enormous genetic potential, and further improvement in this trait is possible by using a simple selection technique in crop improvement of the finger millet crop. High heritability accompanied by moderate genetic advance as percentage of mean indicated that the genotypes under study were diverse with immense genetic potential. These results were in accordance with Suryanarayana *et al.* (2014); Jyothsna *et al.* (2016), Mahanthesha *et al.* (2017); Singamsetti *et al.* (2018); Patel *et al.* (2020).

Path Analysis. Through the use of path analysis at the genotypic level, direct and indirect effects were computed in order to obtain a clear picture of how different component traits interact with yield. The primary earhead length, days to 50% blooming, straw production per plant, finger width, and harvest index all had significant positive direct effects on grain yield. These characteristics therefore proved to be the major contributors to grain yield per plant. The findings of Nirmalakumari *et al.* (2010) for days to 50% flowering and Priyadharshini *et al.* (2011) for harvest index, days to 50% flowering, and main earhead length; Das *et al.* (2013) for finger width; Kumar *et al.* (2014) for straw yield per plant and harvest index; Jadhav *et al.* (2015) for days to 50% flowering and days to 50% flowering, straw yield per plant are in agreement with this result.

In general, the indirect effects of all traits were modest and inconsequential, including plant height, productive tillers per plant, finger width, and 1000-grain weight. Days to 50% flowering, days to maturity, number of fingers per earhead, primary ear head length, finger length, straw yield per plant, and harvest index all had positive indirect effects. Morphological traits such as the number of fingers per earhead, main earhead length, and finger length all contribute directly to the high grain yield per plant. As a result, indirect selection on these characters will result in improved respective characters and, ultimately, grain yield.

Table 4: Direct and indirect effects of twelve causal variables on grain yield per plant in thirty eight genotypes of Finger millet.

Characters	DF	DM	PH	PTP	FPE	MEL	FL	FW	TW	SY/P	HI	Grain yield Correlation Coefficient
DF	**0.2442**	-0.2708	-0.0054	-0.0107	0.1088	0.1892	-0.2564	0.0001	-0.0024	0.7345	-0.6586	0.072^{NS}
DM	0.2552	**-0.2591**	-0.0052	0.0002	0.1054	0.2038	-0.3155	0.0002	-0.0039	0.7656	-0.6362	0.110^{NS}
PH	0.0356	-0.0363	**-0.0371**	-0.0136	0.0386	0.0558	-0.0983	0.0004	-0.0265	0.7446	-0.2303	0.433^{**}
PTP	0.0283	0.0006	-0.0055	**-0.0926**	0.0322	-0.0549	0.0905	0.0001	-0.0492	-0.0835	0.5217	0.388^{**}
FPE	-0.1211	0.1245	0.0065	0.0136	**-0.2193**	-0.0466	0.1382	-0.0004	-0.0204	-0.5409	0.8668	0.201^{*}
MEL	0.0996	-0.1138	-0.0045	0.0110	0.0220	**0.4641**	-0.4775	0.0001	0.0019	0.0525	0.0837	0.139^{NS}
FL	0.1209	-0.1578	-0.0071	0.0162	0.0585	0.4278	**-0.5180**	0.0004	0.0003	0.3664	-0.1127	0.195^{*}
FW	0.0034	-0.0197	-0.0072	-0.0045	0.0401	-0.0002	-0.1077	**0.0021**	-0.0253	0.4186	-0.0191	0.281^{**}
TW	0.0039	-0.0067	-0.0065	-0.0302	-0.0296	-0.0060	0.0010	0.0004	**-0.1509**	0.2077	0.8175	0.800^{**}
SY/P	0.1295	-0.1433	-0.0200	0.0056	0.0857	0.0176	-0.1371	0.0006	-0.0226	**1.3846**	-0.9592	0.342^{**}
HI	-0.1045	0.1071	0.0056	-0.0314	-0.1236	0.0252	0.0379	0.0001	-0.0802	-0.8631	**1.5388**	0.512^{**}

Residual effect = 0.0561; (Bold figures = Direct effects); ** ¬Significant at 1% level; * Significant at 5% level

DF	Days to 50 % flowering	PTP	No. of productive tillers per plant	FL	Finger length (cm)	GY/P	Grain yield per plant (g)
DM	Days to maturity	FPE	Number of fingers per earhead	FW	Finger width (cm)	SY/P	Straw yield per plant (g)
PH	Plant height (cm)	MEL	Main ear head length (cm)	TW	1000-Grain weight (g)	HI	Harvest index (%)

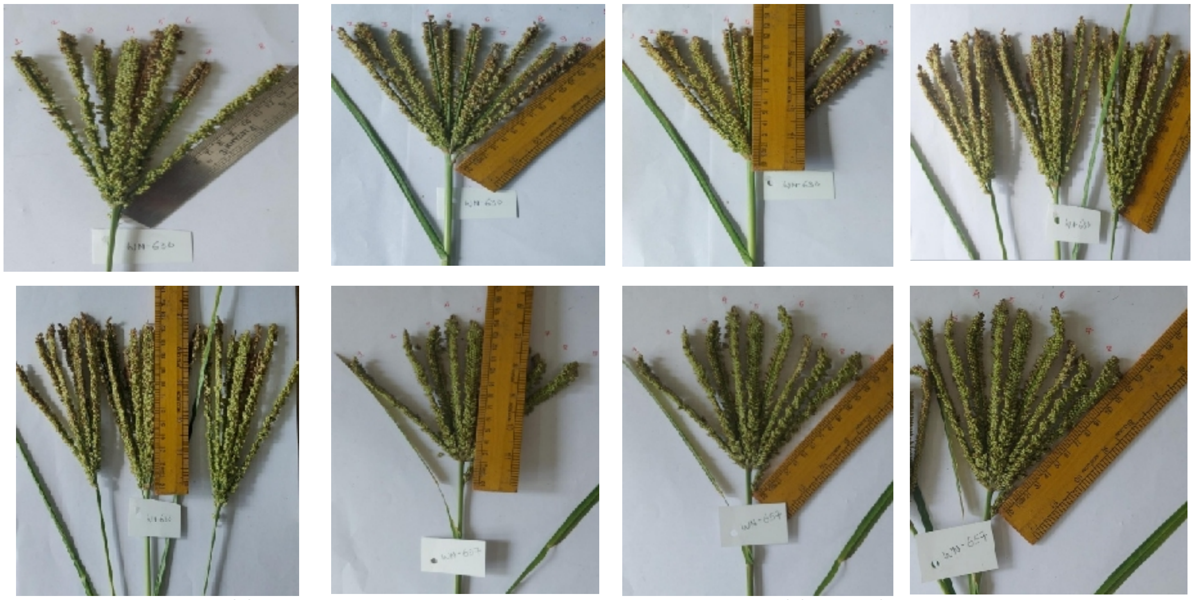

Fig. 1. Number of fingers per earhead, main earhead length and length of finger of WN-630 and WN-657.

Table 5: Mean values over three years at two locations (Waghai and Dahod) for yield and morphological traits in finger millet.

Sr. No.	Genotypes	DF	DM	PH	PTP	FPE	MEL	FL	FW	TW	GY	SY	HI
1.	WN-561	105.67	141.33	122.20	2.20	7.77	10.17	7.73	0.83	2.58	6.75	26.66	20.18
2.	WN-562	97.00	135.33	119.20	2.83	8.13	8.97	7.27	0.73	3.04	9.61	24.52	30.80
3.	**WN 630**	**77.00**	**129.67**	**123.47**	**2.90**	**10.50**	**13.43**	**12.87**	**0.87**	**2.54**	**10.05**	**18.53**	**34.20**
4.	WN-572	89.00	119.67	129.93	2.77	6.53	9.33	6.60	0.80	2.73	7.42	22.40	24.98
5.	WN-575	92.00	124.00	130.00	3.57	7.20	9.03	6.60	0.80	2.64	9.61	26.64	26.37
6.	WN-577	91.00	123.67	111.53	2.33	5.53	9.47	7.00	0.73	2.55	6.75	21.04	24.32
7.	**WN 657**	**92.33**	**128.33**	**127.07**	**1.97**	**9.63**	**13.30**	**13.13**	**0.93**	**2.60**	**9.98**	**26.01**	**22.91**
8.	WN-592	84.00	115.67	120.67	3.57	5.17	6.77	5.40	0.77	2.53	6.55	24.02	21.45
9.	WN-583	86.00	120.33	121.67	3.60	10.00	8.50	6.53	0.70	2.74	9.97	22.82	30.56
10.	WN-586	99.67	134.33	122.00	2.83	5.70	9.90	7.93	0.77	2.47	6.94	19.42	26.37
11.	WN-587	87.00	119.67	92.00	2.33	8.17	8.77	6.07	0.67	2.38	5.20	15.45	25.29
12.	WN-599	86.33	118.67	111.87	1.83	9.23	8.67	7.20	0.77	2.79	8.16	18.17	31.05
13.	WN-601	99.67	133.67	123.73	2.73	6.20	9.63	7.20	0.80	2.64	7.49	19.04	28.26
14.	WN-609	106.00	142.67	114.40	3.10	6.93	10.07	8.07	0.83	2.56	6.96	17.55	29.03
15.	WN-664	87.00	122.67	126.60	2.80	7.07	9.67	7.73	0.97	3.06	9.84	24.64	28.56
16.	VL 322	90.00	123.33	123.87	3.27	5.73	10.10	8.33	0.83	2.75	8.85	22.27	28.43
17.	VL 389	68.67	106.67	106.13	2.60	7.97	7.80	6.27	0.87	2.68	7.36	14.82	33.21
18.	PRS 38	84.00	117.00	136.40	2.07	8.40	9.13	7.13	0.87	2.50	8.84	24.16	26.80
19.	VL 400	99.00	137.33	119.07	2.97	6.10	11.43	10.27	0.87	2.55	8.80	27.27	24.38
20.	PR 1506	102.33	145.00	123.47	2.43	5.93	9.93	8.27	0.83	2.67	8.89	28.15	24.01
21.	VL 408	85.67	118.00	128.80	3.33	7.83	8.77	6.93	0.80	2.84	8.53	19.43	30.54
22.	PR 1731	99.00	132.00	126.47	2.13	5.47	10.43	8.80	0.90	2.51	8.21	28.40	22.44
23.	OEB 610	96.67	129.33	112.40	3.80	5.10	7.73	6.27	1.03	2.62	6.91	20.54	25.22
24.	VR 1152	100.00	140.33	117.87	2.27	5.77	7.63	6.87	0.87	2.73	8.19	25.66	24.10
25.	KMR 710	112.00	145.00	120.73	2.87	6.47	6.90	6.13	0.93	2.75	8.87	33.22	21.15
26.	**GPU 45(NC)**	85.67	118.67	123.67	2.90	6.23	8.10	6.13	0.73	2.55	7.11	22.79	23.84
27.	**VL 352(NC)**	67.67	105.33	117.80	2.23	8.33	7.07	5.73	1.03	2.58	7.16	23.77	23.43
28.	**GPU 67(NC)**	90.00	122.67	118.40	2.23	5.90	8.13	6.67	0.77	2.76	8.73	25.52	25.44
29.	**PR 202(NC)**	88.33	121.00	131.73	3.33	5.60	7.33	6.13	0.80	2.71	9.29	24.27	27.73
30.	**GN-3(LC)**	94.00	127.67	120.40	2.57	5.63	8.93	7.13	0.77	2.64	6.76	27.69	19.64
31.	**GN-4(LC)**	96.33	130.33	116.87	2.73	5.80	9.17	7.33	0.73	2.78	7.34	26.37	21.78
32.	**GN-5(LC)**	95.00	131.33	117.33	3.07	5.87	9.73	8.53	0.93	2.70	8.40	26.10	24.34
33.	**GN-8(LC)**	83.00	109.00	111.80	3.27	6.33	9.40	7.33	0.83	2.75	9.84	25.45	27.91
34.	**GNN-7(LC)**	93.67	130.33	119.33	3.40	6.07	9.27	7.47	0.87	2.78	9.86	24.19	28.97
35.	**GNN-6 (LC)**	**97.33**	**129.33**	**119.40**	**3.53**	**6.00**	**9.40**	**7.27**	**0.93**	**2.87**	**10.42**	**23.33**	**30.81**
36.	**CFMV-2(NC)**	**95.33**	**127.33**	**119.40**	**3.47**	**6.53**	**10.07**	**7.33**	**0.90**	**3.03**	**10.87**	**23.22**	**30.24**
37.	**CFMV-1(NC)**	88.35	121.50	130.73	3.35	5.65	7.35	6.15	0.85	2.75	9.30	22.20	28.70
38.	**Phule Nachani(LC)**	84.65	115.65	120.65	2.95	6.34	8.20	5.14	0.76	2.56	8.14	21.88	22.96

DF	Days to 50 % flowering	PTP	No. of productive tillers per plant	FL	Finger length (cm)	GY/P	Grain yield per plant (g)
DM	Days to maturity	FPE	Number of fingers per earhead	FW	Finger width (cm)	SY/P	Straw yield per plant (g)
PH	Plant height (cm)	MEL	Main ear head length (cm)	TW	1000-Grain weight (g)	HI	Harvest index (%)

CONCLUSIONS

There is enough variation among the thirty-eight genotypes under study, according to the analysis of variance for all the traits, which revealed variations between the genotypes evaluated. CFMV-2, GNN-6, WN-630, and WN-657 were identified as promising genotypes based on per se performance since they exhibited increased grain yield per plant. According to DUS testing guidelines, the genotype WN-630 revealed very high finger counts per earhead (10.5, which is >8 (high) and very long earhead lengths (13.43, which is >12 cm (very long) also, the genotype WN 657 also exhibited very long ear head length of 13.30 cm, which is >12 cm (very long), and long finger length of 13.13 cm, which is >7 cm (extra long). Thus, the high grain yield per plant is directly attributed to these morphological traits. These genotypes could be further assessed in order to isolate morphological and high yielding traits for improved genotype selection techniques.

For the traits, namely, number of fingers per earhead, number of productive tillers per plant, straw yield per plant, grain yield per plant, finger length, harvest index, and main earhead length, there was moderate genotypic and phenotypic coefficient of variation. High heritability coupled with high to moderate genetic advance expressed as a percentage of mean for traits such as number of fingers per earhead, number of productive tillers per plant, main earhead length, finger length, grain yield per plant, straw yield per plant, harvest index, days to 50% flowering, days to maturity, and 1000 grain weight can be attributed to additive gene action, and these traits have high selective value. Number of fingers per earhead, productive tillers per plant, grain yield per plant, straw yield per plant, main earhead length, finger length, and harvest index all showed strong genetic advance expressed as a percentage of the mean, demonstrating the presence of additive gene action for these traits. This suggested that the genotypes for these attributes had a high degree of variability. High heritability estimates were observed for days to 50% flowering, days to maturity, plant height, number of productive tillers per plant, main earhead length, finger length, 1000 grain weight, grain yield per plant, straw yield per plant, and harvest index, indicating the existence of sufficient heritable variation and suggesting that selection based on phenotypic value could be useful for isolating better types. The high grain yield per plant is directly influenced by morphological characteristics like number of fingers per earhead, length of the primary earhead, and length of the finger. Harvest index, straw yield per plant, primary earhead length, days to 50% flowering, and finger width were all found to have a positive direct effect on grain yield per plant according to path coefficient analysis. Therefore, these characteristics were thought to be the most significant morphological factors, and proper emphasis should be provided while trying to increase yield in finger millet. The investigation on genetic analysis for yield and morphological traits in finger millet came to the following conclusion that the most significant component characters for increasing grain yield per plant are number of productive tillers per plant, number of fingers per earhead, main earhead length, straw yield per plant, and harvest index. As a result, these traits should be taken into consideration as selection criteria for increasing grain and fodder yield in finger millet.

FUTURE SCOPE

Finger millet is important small millet grown in India. It is a staple food in many hilly regions of the country. It is produced for both grain and forage purposes. According to DUS testing guidelines, the genotype WN-630 had extremely high finger counts per ear head 10.50, which is >8 (high) and very long ear head lengths 13.43 cm, which is >12 cm (very long) also, the genotype WN-657 displayed very long ear head length, measuring 13.30 cm, which is >12 cm (very long), and long finger length, measuring 13.13 cm, which is >7 cm (extra long) based on average performance over three years at various locations. In this context, these both the genotypes will may be use by the breeders as a promising parent in finger millet crop improvement programmes.

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