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Genetic variability and heritability studies for yield and yield contributing traits in finger millet (*Eleusine coracana* L.) genotypes under sub-montane agroclimatic zone of Maharashtra

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Abstract

The present study was carried out using 24 finger millet accessions in which 20 are genotypes and 4 are local checks (P. Kasari, BFM-8-E, Dapoli-03, P. Nacahni) evaluated for 15 traits at AICRP on small millets, RCSM Govt. College of Agriculture, Kolhapur, Maharashtra, during *khari*f 2025 in randomized complete block design with 2 replications. The objectives were to assess the variability, heritability, and genetic advance for yield and yield contributing traits. Analysis of variance revealed significant differences among genotypes for all traits, indicating presence of sufficient genetic variability. High genotypic and phenotypic coefficients of variation were observed for harvest index, plant height (cm), peduncle length (cm), flag leaf blade length (cm), fodder yield (kg/plot) and grain yield (kg/plot) while earhead length (cm), no. of fingers per ear, days to 50% flowering and days to maturity showed moderate GCV and PCV values. High heritability coupled with high genetic advance as percent of mean was recorded for economically important traits such as grain yield (kg/plot), fodder yield (kg/plot), peduncle length (cm), harvest index and finger width (cm) indicating that these traits are largely governed by additive gene action and can be effectively improved through simple selection. Since there is significant variability observed in all the finger millet genotypes, this could be used for genetic improvement through selection and hybridization.

Keywords: Finger millet, genetic advance, heritability and variability

Introduction

Finger millet (*Eleusine coracana* L.), frequently termed "Ragi" is a self-pollinating allotetraploid monocot ($2n = 4x = 36$, AABB) within the Poaceae family. Its common name reflects the characteristic finger-like branching pattern of its panicle structure. It serves as a vital crop in the arid and semi-arid expanses of Asia and Africa, with major production centered in countries like India, Uganda, Ethiopia, Kenya, and Nepal. It is very adaptable to a wide range of environmental and climatic conditions and thrives at higher elevations than most other tropical cereals and ability to withstand salinity better than most cereals.

Globally, finger millet is the third most vital millet crop after sorghum and pearl millet (Indian Farming (ICAR) article (2025) ^[7]. It represents 20% and 26% of the world's total area covered and production, respectively, making it the most important small millet grown in tropical regions (FAOSTAT, 2020) ^[4]. In India, finger millet ranks first in importance among all small millets with a share of 81% in production (Sajja *et al.* 2025) ^[16]. It is cultivated over an area of more than 11.45 lakh hectares with 16.25 lakh tonnes and 1419 kg/ha of production and productivity, respectively in India. While in Maharashtra, it is cultivated in 74.5 thousand hectares with a production and productivity of 69.30 thousand tonnes and 930 kg/ha, respectively (Ministry of Agriculture and Farmers' Welfare, 2025–26) ^[10].

In Maharashtra, finger millet locally known as *nagli* or *nachni* serves as a staple food and economic backbone for rural communities, particularly within the Sub-Montane Agroclimatic Zone. This agro-ecological region, situated along the eastern foot-slopes of the Sahyadri mountain range, is characterized by heavy monsoon rainfall, undulating topography, and shallow, light-textured, acidic soils with poor moisture retention. While such harsh soil and terrain conditions,

coupled with occasional mid-season dry spells, restrict the performance of most conventional field crops, finger millet stands out for its extraordinary hardness and adaptability. With its deep, fibrous root system, exceptional soil-binding capacity, and high water-use efficiency, it thrives on marginal, sloped lands where other cereals fail. As a result, finger millet serves as a dependable, low-input crop that ensures food and nutritional security for smallholder farming communities across the sub-montane belt. Finger millet is highly nutritious as it is rich source of calcium (344 mg/100 g) and also contains 65-75% carbohydrates, 5-8% protein, 15-20% dietary fibre and 2.5-3.5% minerals (ICAR IIMR, Annual report 2024-25) ^[7]. Due to its gluten free and low fat, it is easy to digest and non-allergic and that is why finger millet is also called “super cereal” (Singh *et al.*, 2023) ^[17]. Broadening the germplasm's genetic base depends entirely on a comprehensive evaluation of the genetic variability present within existing genotypes, as progress through selection and breeding is impossible without underlying variation. When phenotypic and genotypic coefficients of variation (PCV and GCV) are integrated with heritability (h^2) and genetic advance (GA), they provide a reliable framework for assessing selection efficiency, particularly for complex quantitative traits like grain yield. Because yield is inherently complex and cannot be effectively improved through direct phenotypic selection alone, breeding strategies must target highly heritable, yield-correlated secondary traits. Furthermore, evaluating genetic advance allows to quantify the expected genetic gain or progress achievable through targeted selection for a specific trait.

Materials and Methods

The experiment was laid out in randomized complete block design (RCBD) with two replications at AICRP on small millets, Botany Farm, Rajashree Chhatrapati Shahu Maharaj Government College of Agriculture, Kolhapur during *Kharif* 2025. The experimental material consists of 24 finger millet accessions including four local checks which were collected from different states of India which are mentioned in Table 1. The size of the plot was 2.40 x 4.00 m. The spacing between the rows was 30 cm and 10 cm between plants. There were 8 rows per entry. All the recommended agronomic packages of practices were followed during the entire crop period. In each replication, five random plants were chosen and observations were recorded on 15 yield and yield contributing characters viz., days to 50% flowering, plant height (cm), flag leaf blade length (cm), flag leaf blade width (cm), peduncle length (cm), ear length (cm), finger length (cm), finger width (cm), finger number on main ear, number of productive tillers per plant, days to maturity, thousand grain weight (g), fodder yield (kg/plot), grain yield (kg/plot) and harvest index.

The analysis of variance for each character was calculated as per the standard statistical procedure given by Panse and Sukhatme (1978) ^[11]. Phenotypic and genotypic coefficients of variation (PCV and GCV) were computed as per Burton (1952) ^[2]. Heritability in broad sense was computed as per Hanson (1956) ^[6]. Heritability and genetic advance were categorized into low, medium and high as per Johnson *et al.* (1955) ^[8].

Table 1: List of accessions and check varieties used in the experiment

Sr. No.	Name of Genotype	Sr. No.	Name of Genotype
1	FM-01	13	FM-13
2	FM-02	14	FM-14
3	FM-03	15	FM-15
4	FM-04	16	FM-16
5	FM-05	17	FM-17
6	FM-06	18	FM-18
7	FM-07	19	FM-19
8	FM-08	20	FM-20
9	FM-09	21	P. Kasari (check)
10	FM-10	22	BFM-8-E (check)
11	FM-11	23	Dapoli-3 (check)
12	FM-12	24	P. Nachani (check)

Results and Discussion
Analysis of Variance

The analysis of variance (ANOVA) revealed highly significant differences ($p < 0.01$) among the 24 finger millet genotypes across all 15 evaluated traits, indicating substantial underlying genetic variability (Table 2). Ranking the traits by the magnitude of their genotypic mean sum of squares (MSS), plant height exhibited the highest variation at 205.69, followed by harvest index at 79.11, flag leaf blade length at 34.65, days to maturity at 22.80, peduncle length at 19.60, and days to 50% flowering at

15.23. Moderate genotypic variance was observed for straw yield (3.357 kg/plot), ear head length (2.732 cm), number of fingers per earhead (2.31), grain yield (1.052 kg/plot), and number of productive tillers (0.75). The lowest variation was recorded in finger length (0.69 cm), 1000-grain weight (0.336 g), flag leaf blade width (0.12 cm), and finger width (0.114 cm). Overall, genotypic variance consistently predominated across all traits, and minimal replication variance confirmed uniform trial conditions, demonstrating that these characters are primarily genetically governed and suitable for direct selection.

Table 2: Analysis of variance for mean sum of squares for various characters in finger millet genotypes

Sr. No.	Characters	Mean Sum of Square		
		Replication	Genotype	Error
		1	23	23
1	Days to 50% flowering	0.52	15.23	1.96
2	Days to maturity	1.69	22.8	6.64
3	Plant Height (cm)	31.04	205.69	22.38
4	Number of productive tillers	0.01	0.75	0.08
5	Ear head length (cm)	0.27	2.732	0.0678
6	Number of fingers per earhead	0.04	2.31	0.18
7	Finger length (cm)	0.04	0.69	0.04
8	Finger width (cm)	0.001	0.114	0.003
9	Peduncle length (cm)	0.25	19.6	0.53
10	Flag leaf blade length (cm)	0.68	34.65	4.33
11	Flag leaf blade width (cm)	0.02	0.12	0.01
12	1000 Grain weight (g)	0.004	0.336	0.019
13	Grain yield (kg/plot)	0.002	1.052	0.025
14	Straw yield (kg/plot)	0.099	3.357	0.081
15	Harvest Index (%)	3.781	79.108	3.222

Based on mean values which are mentioned in Table 3 and Table 4, the range for days to 50% flowering varied from 53.00 days (P. Kasari) to 63.50 days (FM-09) with a mean of 59.60 days; days to maturity ranged from 99.00 days (FM-13) and 110.00 days (P. Nachani) with a mean of 104.65 days; plant height ranged from 98.63 cm (FM-09) to 133.60 cm (FM-02) with a mean of 118.99 cm, number of productive tillers per plant varied from 3.40 (FM-09) to 6.13 (FM-02 and FM-07) with a mean of 5.11; number of fingers per earhead ranged from 5.40 (FM-09) to 9.40 (FM-02) with a mean of 7.43, while earhead length range varied from 6.85 cm (FM-15 and FM-16) to 10.80 cm (Dapoli-3) with a mean of 8.36 cm; peduncle length had 7.48 cm (FM-16) to 16.88 cm (FM-14) with a mean of 12.91 cm; flag leaf blade length and width ranged from 27.40 cm (FM-15) to 41.90 cm (FM-14) with a mean of 33.04 cm and from 0.55 cm (FM-13) to 1.33 cm (FM-08) with a mean of 0.91 cm, respectively. Finger length ranged from 4.97 cm (FM-10) to 7.23 cm (FM-02) with a mean of 5.77 cm, finger width ranged from 0.52 cm (FM-10) to 1.32 cm (FM-02) with a mean of 0.86 cm, 1000 grain weight ranged from 2.35 g (FM-10) to 3.98 g (FM-02) with a mean of 3.33 g whereas fodder yield per plot varied from 1.72 kg/plot (FM-16) to 6.61 kg/plot (FM-14) with a mean of 4.77 kg/plot, harvest index varied from 15.75% (FM-08) to 41.67% (BFM-8-E) with an average of 31.11% and grain yield per plot ranged 0.88 kg/plot (FM-16) to 3.03 kg/plot (FM-02) with an average of 2.06 kg/plot.

Parameters of Genetic Variability

Various genetic variability parameters, including the range of variation, variance components, estimates of genotypic coefficients of variation (GCV) and phenotypic coefficients of variation (PCV), broad-sense heritability, genetic advance (GA) and expected genetic advance as a percentage of the mean, were estimated and are summarized in Table 3. Assessment of variability forms the basis of a successful breeding programme aimed at improving yield and quality attributes. Hence, estimation of genotypic and phenotypic coefficients of variation is necessary to understand the nature and magnitude of variation.

Coefficients of Variation

Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are important measures used to assess the magnitude of variability present in a population. Estimates of PCV, GCV and heritability help predict the effectiveness of selection and the expected genetic improvement in a trait.

PCV ranged from 5.34% to 132.34% and GCV ranged from 4.76% to 121.98%. High GCV and PCV was recorded for harvest index (121.98%, 132.34%), followed by plant height (77.02% and 95.84%), peduncle length (72.59% and 77.13%), flag leaf blade length (45.88% and 59.00%), fodder yield per plot (34.36% and 36.07%) and grain yield per plot (24.99% and 26.21%). Hence, for these characters most of the variability is genetic and environmental effects are small. Similar results were reported by Raulwar *et al.* (2025) ^[15] for fodder and grain yield per plot; Hansalia *et al.* (2024) ^[5] for harvest index; Meera *et al.* (2021) for peduncle length. Moderate GCV and PCV was observed for earhead length (16.74% and 15.93%), number of fingers per earhead (16.75% and 14.30%) and days to 50 per cent flowering (14.43% and 11.14%), and days to maturity (14.07% and 7.72%). These conclusions were in accordance with Prajawala *et al.* (2025) for earhead length, days to 50% flowering and days to maturity; Hansalia *et al.* (2024) ^[5] for number of fingers per earhead. Low PCV and GCV was recorded for productive tillers per plant (8.08% and 6.57%), finger width (6.85% and 6.47%), finger length (6.34% and 5.63%), flag leaf blade width (7.00%, 5.84%) and thousand seed weight (5.34% and 4.76%), indicating relatively narrow variation for these traits. These results are in accordance with previous reports of Ulaganathan and Nirmalakumar *et al.* (2014) ^[18] for finger width; Prajawala *et al.* (2025) for thousand seed weight; Bhagyasri *et al.* (2025) ^[1] for flag leaf blade width and Patel *et al.* (2025) ^[12] for productive tillers per plant.

Heritability

The estimates of broad-sense heritability exhibited considerable variation among the traits studied (Table 3). Heritability ranged from 54.88% for days to maturity to 95.84% for plant height. High heritability estimates were observed for plant height (80.37%), number of productive tillers per plant (81.26%), earhead length (95.16%), number of fingers per ear (85.35%), peduncle length (94.12%), flag leaf blade length (77.77%), flag leaf blade width (83.47%), finger length (88.77%), finger width (94.35%), days to 50 per cent flowering (77.24%), 1000-seed weight (89.21%), grain yield (95.36%), fodder yield (95.26%) and harvest index (92.17%). In contrast, days to maturity exhibited comparatively moderate heritability (54.88%).

High heritability observed for economically important traits such as grain yield, fodder yield, earhead length, peduncle length, finger length, finger width and 1000-seed weight suggest the presence of substantial heritable variation, thereby increasing the

probability of obtaining desirable genetic gain through selection. These traits can therefore be considered reliable selection criteria for developing high-yielding finger millet genotypes. In contrast, the comparatively lower heritability recorded for days to maturity indicates that this character is influenced to a greater extent by environmental factors. Hence, selection for this trait should preferably be based on multi-location or multi-season evaluation to achieve more consistent improvement.

Genetic advance

The estimates of genetic advance (GA) and genetic advance as per cent of mean (GAM) exhibited considerable variation among the traits studied (Table 3). Among the field traits, the highest genetic advance was recorded for plant height (24.09), followed by harvest index (16.60), flag leaf blade length (9.64), peduncle length (8.34), days to 50 per cent flowering (6.36), days to maturity (5.91), fodder yield (3.51), earhead length (3.16), number of fingers per ear (2.67), grain yield (1.97), finger length (1.51), number of productive tillers per plant (1.47), 1000-seed weight (1.06), finger width (0.64) and flag leaf blade width (0.59). Genetic advance as per cent of mean (GAM) ranged from 5.65% for days to maturity to 95.56% for grain yield. Moderate to high GAM was recorded for plant height (20.25%), finger length (26.12%), number of productive tillers per plant (28.71%), flag leaf blade length (29.17%), 1000-seed weight (31.70%), number of fingers per ear (35.99%), earhead length (37.80%), harvest index (53.37%), peduncle length (64.59%), flag leaf blade width

(64.97%), fodder yield (73.55%), finger width (74.91%), and highest for grain yield (95.56%).

In contrast, comparatively low GAM was observed for days to 50 per cent flowering (10.67%) and days to maturity (5.65%).

Assessment of heritability provides an idea into the extent to which a trait is governed by genetic factors and plays a crucial role in determining its response to selection. When combined with the genetic advance as per cent of mean, heritability estimates become more useful in predicting gain under selection than heritability estimate alone. High heritability along with high genetic advance as per cent of mean (GAM) was observed for grain yield, fodder yield, harvest index, earhead length, finger width, peduncle length, thousand seed weight, finger length, number of fingers per earhead, flag leaf blade width, number of productive tillers per plant, plant height and flag leaf blade length. This pattern indicates the predominance of additive gene action controlling these traits, suggesting that phenotypic selection would be effective for their improvement. Similar conclusions were reported by Bhagyasri *et al.* (2025) ^[1] for finger length, finger width, earhead length, number of productive tillers per plant, thousand seed weight; Priyadharshini *et al.* (2011) ^[14] for plant height, number of fingers per earhead, harvest index; Ulaganathan and Nirmalakumar *et al.* (2014) ^[18] for flag leaf blade length, flag leaf blade width; Meera *et al.* (2021) for peduncle length; Raulwar *et al.* (2025) ^[15] for fodder and grain yield per plot.

Table 3: Estimation of genetic variability for yield and its ancillary traits of Finger millet genotypes

Sr. No.	Traits	Mean	Range		GCV%	PCV%	h ² (bs)	GA	GAM (%)
			Min.	Max.					
1	PH	118.99	98.63	133.60	77.02	95.84	80.37	24.09412	20.25
2	NPTP	5.11	3.40	6.13	6.57	8.08	81.26	1.4657581	28.71
3	EL	8.36	6.85	10.80	15.93	16.74	95.6	3.1608256	37.80
4	NFPE	7.43	5.40	9.40	14.30	16.75	85.35	2.6730357	35.99
5	PL	12.91	7.48	16.88	72.59	77.13	94.12	8.3367602	64.59
6	FLBL	33.04	27.40	41.90	45.88	59.00	77.77	9.6388564	29.17
7	FLBW	0.91	0.55	1.33	5.84	7.00	83.47	0.591631	64.97
8	FL	5.77	4.97	7.23	5.63	6.34	88.77	1.5071601	26.12
9	FW	0.86	0.52	1.32	6.47	6.85	94.35	0.6418479	74.91
10	DTF	59.60	53.00	63.50	11.14	14.43	77.24	6.3566869	10.67
11	DTM	104.65	99.00	110.00	7.72	14.07	54.88	5.9112752	5.65
12	TSW	3.33	2.35	3.98	4.76	5.34	89.21	1.0557938	31.70
13	GY	2.06	0.88	3.03	24.99	26.21	95.36	1.9652727	95.56
14	FY	4.77	1.72	6.61	34.36	36.07	95.26	3.506436	73.55
15	HI	31.11	15.75	41.67	121.98	132.34	92.17	16.601857	53.37

GCV – Genotypic coefficient of variance, PCV - Phenotypic coefficient of variance, h² – heritability, GA – Genetic advance, GAM – Genetic advance as % of mean, PH - Plant height (cm),

NPTP - No. of Productive tillers/plant, EL - Earhead Length(cm), PL - Peduncle Length(cm), FLBL - Flag Leaf Blade Length(cm), FLBW - Flag Leaf Blade Width(cm), NFPE - No. of Fingers/ Earhead,

FL - Finger Length(cm), FW - Finger Width (cm), DTM – Days to Maturity, DTF - Days to 50% Flowering, TSW – 1000 Seed Weight(g), GY – Grain Yield (kg/plot), FY – Fodder yield (kg/plot), HI – Harvest index

Table 4: Mean Performance of Finger millet genotypes for yield and its ancillary traits

Genotypes	PH	NPTP	EL	NFPE	PL	FLBL	FLBW	FL	FW	DTF	DTM	TSW	GY	FY	HI
FM-01	111.50	4.80	8.40	7.30	16.39	38.20	0.87	5.72	1.21	60.50	107.00	3.30	2.29	5.04	31.28
FM-02	133.60	6.13	9.80	9.40	14.28	39.00	1.05	7.23	1.32	54.50	100.50	3.98	3.03	6.58	31.48
FM-03	125.08	5.20	7.05	8.35	16.01	39.60	1.24	5.38	0.68	59.00	104.50	3.55	2.48	5.70	30.31
FM-04	110.40	4.90	7.10	7.10	15.63	35.20	1.13	5.85	0.82	60.00	104.00	3.38	2.00	4.60	30.35
FM-05	115.80	5.50	7.65	7.40	16.45	37.15	1.12	6.03	0.79	61.00	106.00	3.31	2.05	4.72	30.33
FM-06	113.70	5.20	7.35	7.20	9.48	29.30	1.25	5.43	0.98	59.00	102.50	3.20	2.00	4.96	28.77
FM-07	131.50	6.13	9.45	8.90	14.90	32.50	0.75	6.73	0.71	57.00	99.50	3.58	2.97	5.16	36.51
FM-08	107.90	4.30	10.45	5.75	7.93	28.60	1.33	5.09	0.58	63.00	106.50	3.08	1.01	5.37	15.75
FM-09	98.63	3.40	9.80	5.40	15.53	27.60	1.14	5.01	0.61	63.50	108.50	3.04	0.94	2.51	27.42
FM-10	108.85	4.93	7.95	5.88	9.28	29.20	1.26	4.97	0.52	62.50	107.50	2.35	1.03	2.27	31.22

FM-11	129.33	5.93	7.35	8.50	8.84	34.30	0.86	5.71	0.53	59.00	104.50	3.77	2.95	4.72	38.47
FM-12	123.70	5.13	7.70	7.60	14.75	32.20	1.02	5.95	1.14	58.50	104.00	3.50	1.60	5.81	21.60
FM-13	116.05	5.20	8.30	7.10	8.59	31.90	0.55	5.56	0.71	57.50	99.00	2.54	1.72	4.72	26.70
FM-14	117.60	5.23	7.10	7.50	16.88	41.90	0.64	5.89	0.81	58.50	101.50	3.70	1.82	6.61	21.61
FM-15	104.60	5.00	6.85	5.83	9.65	27.40	0.89	5.29	0.56	61.00	106.00	3.03	0.96	1.85	34.37
FM-16	101.98	3.90	6.85	5.75	7.48	28.20	1.09	5.11	0.68	62.00	109.00	2.45	0.88	1.72	33.63
FM-17	120.90	5.13	7.65	7.15	14.19	28.60	0.89	5.37	1.14	62.50	109.50	3.49	2.42	5.45	30.76
FM-18	124.48	5.30	9.50	8.18	14.40	36.40	0.79	6.40	1.05	60.00	104.00	3.54	2.71	5.59	32.65
FM-19	122.43	5.03	8.25	7.73	14.63	32.50	0.64	6.59	1.12	62.50	109.00	3.60	1.93	4.61	29.50
FM-20	129.13	5.43	8.85	8.55	13.84	30.40	0.62	6.01	0.89	57.50	99.50	3.65	2.85	4.64	38.05
P.Kasari (C)	123.50	5.10	8.70	8.03	13.33	33.10	0.69	5.86	0.97	53.00	100.50	3.53	2.01	6.13	24.77
BFM-8-E (C)	133.00	5.63	8.45	8.30	15.54	34.80	0.63	6.38	0.90	56.50	103.50	3.58	2.98	4.16	41.67
Dapoli-3 (C)	121.13	4.90	10.80	7.40	10.25	29.80	0.82	5.11	0.70	58.00	105.00	3.35	1.80	2.65	40.45
P.Nachani (C)	131.00	5.20	9.35	8.00	11.59	35.10	0.64	5.83	1.16	63.00	110.00	3.50	2.95	4.64	38.88
MEAN	118.99	5.11	8.36	7.43	12.91	33.04	0.91	5.77	0.86	59.60	104.65	3.33	2.06	4.77	31.11
CV	3.98	5.44	3.11	5.75	5.93	6.30	7.27	3.51	6.72	2.35	2.46	4.16	7.69	5.99	5.77
C.D. 5%	6.92	0.40	0.38	0.62	1.12	3.05	0.15	0.30	0.08	2.05	3.77	0.20	0.19	0.41	2.63
S.E.	3.35	0.19	0.18	0.30	0.54	1.47	0.07	0.14	0.04	0.99	1.82	0.10	0.39	0.20	1.27

PH - Plant Height (cm), NPTP - No. of Productive tillers/plant, EL - Earhead Length(cm), NFPE - No. of Fingers/ Earhead, PL - Peduncle Length(cm), FLBL - Flag Leaf Blade Length(cm), FLBW - Flag Leaf Blade Width(cm), FL - Finger Length(cm), FW - Finger Width (cm), DTM - Days to Maturity, DTF - Days to 50% Flowering, TSW - 1000 Seed Weight(g), GY - Grain Yield(kg/plot), FY - Fodder yield(kg/plot), HI - Harvest index

In contrast, high heritability coupled with low genetic advance as a percent of mean was recorded for days to 50% flowering and days to maturity, indicating significant environmental influence and non-additive gene action governing this trait, thereby limiting the scope of direct phenotypic selection. Similar findings were reported by Ulaganathan and Nirmalakumar *et al.* (2014)^[18].

Conclusion

This evaluation of 24 finger millet genotypes under the sub-montane agroclimatic conditions of Maharashtra revealed significant genetic variability across all 15 studied quantitative traits. The predominance of genotypic variance over environmental effects highlights a strong genetic basis for character expression. High broad-sense heritability coupled with high genetic advance as a percentage of mean was observed for grain yield, fodder yield, harvest index, earhead length, peduncle length, finger width, and 1000-seed weight. This combination confirms that these economically important traits are governed primarily by additive gene action and can be effectively improved through direct phenotypic selection. Conversely, phenological traits such as days to 50% flowering and days to maturity exhibited lower genetic advance as a percentage of mean, indicating non-additive gene influence and environmental sensitivity.

The identified genetic variation and superior high-yielding genotypes particularly FM-02 and FM-07 serve as valuable genetic resources for future finger millet breeding programs. These findings provide a concrete basis for selecting elite parents in future hybridization programs aimed at developing high-yielding, climate-resilient cultivars tailored to the sub-montane region.

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