~~Study of~~ Genetic V~~v~~ariability for Y~~y~~ield and Y~~y~~ield A~~a~~ttributing T~~t~~raits in Finger Millet (*Eleusinecoracana*L. Gaertn) under Irrigation in Central India

ABSTRACT

The present investigation was carried out to assess the genetic variability, heritability, genetic advance, correlation coefficient ~~analysis~~ and path coefficient analys~~is~~esis in eighteen finger millet genotypes for seventeen yield and its contributing traits during the *Kharif*~~,~~ season of 2022, at ~~Field~~ the e~~E~~xperimental station of ~~tion Centre, Department of Genetics and Plant Breeding,~~ Naini Agricultural Institute in ~~, Sam Higginbottom University of Agriculture Technology and Sciences,~~ Uttar Pradesh, Central India. The experimental design was a ~~in~~rR~~R~~andomized complete bB~~B~~lock ~~Design~~ with each genotype in 3 replications. The analysis of variance for mean sum of squares due to genotypes showed significant differences for all the 17 quantitative characters. The genotypes showed the highest mean performance for seed yield per plantIE 175 (13.42) followed by IE 165 (12.42), IE 169 (11.17), IE 136 (11.01). Whereas, genotypic and phenotypic coefficient of variation were found high for number of ears per plant and harvest index. ~~high~~High heritability coupled with high genetic advance as percent of mean were~~as~~ observed for days to 50% flowering, plant height, finger length, ear head length, test weight. Moreover, s~~Correlation coefficient revealed that s~~eed yield per plant exhibited significant and positive correlations with number of fingers per ear, number of ears per plant, biological yield per plant, harvest index at both genotypic and phenotypic levels. It came out from the pP~~P~~ath cC~~C~~oefficient aA~~Ann~~nalysis ~~has revealed~~ that traits like number of fingers per ear, number of ears per plant, biological yield per plant, and harvest index exhibitpositive and direct effect on seed yield per plant at both genotypic and phenotypic levels. Hence, the selection of genotypes based on the above-mentioned characters will be useful for crop improvement in Finger millet.

Keywords: ~~Finger Millet, Genetic variability,~~ Phenotypic Correlation, Genotypic Correlation, ~~coefficient,~~ Path ~~Coefficient~~ analysis, Genetic Advance, Heritability.

INTRODUCTION

Finger millet(*Eleusinecoracana*Gaertn L.) is an important millet crop that belongs to the family: Poaceae, subfamily: Chloridoideae,with chromosome number 2n = 36. It is commonly known by various names such as ragi, nachani, and African millet. Finger millet is primarily cultivated in arid and semiarid regions of Africa and Asia, including countries like India, Uganda, Ethiopia, Nepal and Kenya.Finger millet is believed to have originated in East Africa, particularly in the highlands of Ethiopia and Uganda(**Odeny, 2013**).The origin of finger millet is traced back to the highlands of East Africa, specifically Ethiopia and Uganda(**Amede*et al.*, 2014**).Finger millet has a long history of cultivation in India. It ~~is believed to have originated in East Africa and~~ was introduced to India several thousand years ago. Finger millet has been an important traditional crop in India, particularly in the southern and central regions.Finger millet cultivation in India can be traced back to ancient times. Archaeological evidence suggests that finger millet was grown in the Indian subcontinent as early as 2000 BCE(**National Bureau of Plant Genetic Resources [NBPGR], n.d**.). India is the largest producer with an area, production and productivity of 1.19 million hectares, 1.98 million ton and 1661 kg per ha, respectively (**Sood*et al.*, 2019**). Finger millet is highly nutritious as its grains contain 65- 75% ~~Carbohydrates~~carbohydrates, 5-8% protein, 15 -20% dietary fiber and 2.5-3.5% minerals. It also contains 5-8% eleusinin, a quality protein, which our body can easily absorb.Ancient Indian texts like the Rigveda mention finger millet as a staple food.Traditional dishes made from finger millet, such as ragimudha (finger millet balls), ragi roti (finger millet flatbread), and ragi malt (finger millet porridge), are part of the culinary heritage of many Indian communities(**Zaveri&Gudigar, 2016**). Worldwide cultivation of Finger millet is majorly grown in semi-arid tropics of Asia and Africa. More than 40.0% of global millet consumption is held by African countries mainly Niger, Mali, Nigeria, Burkina, and Sudan. Around 4.5 tons of finger millet are produced~~Worldwide~~worldwide every year **(Ceasar*et al.*, 2018).**Finger millet comprises 11% of India's total production of major millets, according to the 4th Advanced Estimates of Major Millet Production for the Period of 2021-2022. In India~~, Finger~~ Majormillet is cultivated over an area of 14 million hectares with a production of 16.3 million tones giving an average productivity of 1561 kg per ha.

Agronomically and Environmentally, Finger millet is beneficial to human kind and to soil respectively. Finger millet having the adaptability to diverse agro-ecological zones, including arid and semiarid regions, it is highly valued. Finger millet hasresilience to adverse climatic conditionshas the ability to withstand drought, high temperatures, and poor soil fertility, making it an important crop in areas with limited agricultural resources (**Sharma et al., 2011**).Finger millet is typically grown as a rainfed crop, relying therefore on rainfall for its water requirements (**Zaveri&Gudigar, 2016**).Finger millet exhibits excellent drought tolerance, allowing it to thrive in regions with limited water availability (**Sharma et al., 2011**).~~Finger millet~~Thiscereal crop has the ability to improve soil fertility through its root exudates, which enhance microbial activity and nutrient availability in the soil. ~~Finger millet~~It contributes to carbon sequestration by storing carbon in its aboveground biomass and root systems, thereby mitigating greenhouse gas emissions. The extensive root system of finger millet helps prevent soil erosion, particularly on slopes, by holding the soil together. Finger millet cultivation supports agrobiodiversity by preserving traditional landraces and genetic diversity within the crop (**Geddes et al., 2019**).

The yield of finger millet still has to be greatly improved. Therefore, the current research focuses on examining the Finger millet yield and the features that contribute to it. Additionally, identifying the best genotype to farm in the Prayagraj area, which influences millet improvement in Uttar Pradesh, an Indian state that produces little millet.

MATERIALS AND METHODS

Site characteristics

The ~~present investigation~~ study was carried out at the e~~Field E~~xperimental station~~tion~~~~Center~~ ~~of Department of Genetics and Plant Breeding,~~ of Naini Agricultural Institute (latitude …., longitude …. Altitude ….m above sea level) in~~,Sam Higginbottom University of Agriculture, Technology and Sciences,~~ Prayagraj (Allahabad), U.P., during the *Kharif* season of~~,~~ 2022. The university is ~~situa~~located on the left side of Allahabad Rewa National Highway, about 5km from Prayagraj city. All types of facilities necessary for cultivation of successful crop including field preparation inputs, irrigation facilities were provided from the Department of Genetics and Plant Breeding~~., Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Allahabad), U.P.~~Prayagrajdistrict is geographically located at …..°

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North latitude and …….° East longitude. Its elevation is …..m above mean sea level. The climate of …..district is ……. The major soil types of …..district are red clay soils (…%), red shallow loamy soils (….%), deep calcareous black soils (….%) and medium calcareous soils (…..%). The total normal rainfall and actual rainfall of region are ….mm and ….mm, respectively. Average minimum and maximum temperature of the year of study were….°C and ….°C, respectively.

Finger millet genotypes tested

As much as ~~Experimental material:~~

~~The present study consists of~~ 18 Finger Millet genotypes including one check ~~variety~~ (table 1) were tested.Please, describe them briefly. Of course not each of them, but exhibit some key characteristics (origin, ecotypes, seedlings, top crosses ??)

~~hich was grown in *kharif* 2022 at the Field Experimentation Centre, Department of Genetics and Plant Breeding, SHUATS, Prayagraj.~~

Table 1.Title?

S.NO.	**GENOTYPES**	**S.NO.**	**GENOTYPES**
1	IE 101	10	IE 163
2	IE 102	11	IE 165
3	IE 111	12	IE 168
4	IE 120	13	IE 169
5	IE 121	14	IE 170
6	IE 136	15	IE 172
7	IE 139	16	IE 174
8	IE 150	17	IE 175
9	IE 161	18	FIN 7669 (Check)

Experimental design

~~The 18finger millet genotypes were grown in kharif 2022 in~~The experiment was laid out following arRandomized complete bBlock dDesign with 18 finger millet genotypes in three replications. Sowing for all the genotypes ~~of finger millet~~was done on 20 July 2022, with ~~. A~~a spacing of 20 cm between rows and 10 cm between plants.~~were given and T~~the crop was

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raised as per the recommended package of practice. ~~Among the 18 genotypes grown during kharif 2022, to analyze the effect of various traits for heritability, correlation, path analysis and genetic divergence on Grain yield over the years.~~

Agronomic traits investigated

Please, describe here in details the sampling procedure used for each trait investigated ???

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Genetic parameters used (phenotypic and genotypic coefficient of variation, heritability and genetic advance)

Please, indicate for each genetic parameter above the calculation procedure used, while proving relevant references.

Path analysis

Please, explain clearly this analysis, and display the calculation procedure involved.

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~~The present investigation was carried out at the Field Experimentation Center of Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Allahabad), U.P. during Kharif, 2022. The university is situated on the left side of Allahabad Rewa National Highway, about 5km from Prayagraj city. All types of facilities necessary for cultivation of successful crop including field preparation inputs, irrigation facilities were provided from the Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Allahabad), U.P.~~

~~The 18finger millet genotypes were grown in kharif-2022 in Randomized Block Design with three replications. Sowing for all the genotypes of finger millet was done on 20 July 2022. A spacing of 20 cm between rows and 10 cm between plants were given and the crop was raised as per the recommended package of practice. Among the 18 genotypes grown during kharif 2022, to analyze the effect of various traits for heritability, correlation, path analysis and genetic divergence on Grain yield over the years.~~

~~**Experimental material:**~~

~~The present study consists of 18 Finger Millet genotypes including one check variety (table 1) which was grown in *kharif*-2022 at the Field Experimentation Centre, Department of Genetics and Plant Breeding, SHUATS, Prayagraj.~~

Table 1.

S.NO.	GENOTYPES	S.NO.	GENOTYPES
1	IE 101	10	IE 163
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7	IE 139	16	IE 174
8	IE 150	17	IE 175
9	IE 161	18	FIN 7669 (Check)

RESULTS AND DISCUSSION

Phenotypic correlations within agronomic traits

Phenotypic correlation coefficient analysis revealed that seed yield per plant exhibit high significant and positive correlation with number of fingers per ear (0.3414**), flag leaf with (0.4484*), Number of ears per plant (0.5786**), biological yield per plant (0.468**), Harvest Index (0.5204**).

Genotypic correlations within agronomic traits

Genotypic Correlation coefficient analysis revealed that seed yield per plant exhibited significant and positive correlation with Flag Leaf Length (0.9922*), Number of Fingers per Ear (0.472**), Finger Width (0.6593*), Ear Head Width (0.2747**), Number of Ears per Plant (0.4862**), Biological Yield per Plant (0.4688**), Harvest Index (0.601*).

Performances of finger millet genotypes tested

Out of 18 genotypes of Finger Millet evaluated for various characters, all genotypes found to be superior for seed yield per plant over check variety FIN 7669 The genotypes IE 175 (13.42) followed by IE 165 (12.42), IE 169 (11.17), IE 136 (11.01) showed high mean performance for seed yield per plant.

Missing: analysis of variance results and interpretations regarding yields and yield

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components.

Phenotypic, genotypic and environmental variances

The results of present study also revealed that there was a comparative higher degree of genotypic correlation coefficients than their phenotypic counterparts in most of the characters studied. This indicated that there was a higher degree of association between two characters of genotypic association, their phenotypic association was lessened due to the influence of environment.

Table?

Genotypic and phenotypic coefficient of variation (PCV, PCV)

PCV values ~~Phenotypic Coefficient of Variation (PCV) was~~ observed for all the traits (Table …), ranged from 3.06 (Days to Maturity) ~~(3.06)~~ to 38.31 (Harvest Index ~~(38.31)~~). ~~Similarly~~Similarly,GCV values ~~Genotypic Coefficient of Variation (GCV) was~~ observed for all the traits ranged from 2.94 (Days to Maturity ~~(2.94)~~) to 33.90 (Harvest index ~~(33.90)~~).What interpretation ????

Table?

Heritability and genetic advance

~~Phenotypic Coefficient of Variation (PCV) was observed for all the traits ranged from Days to Maturity (3.06) to Harvest Index (38.31). Similarly Genotypic Coefficient of Variation (GCV) was observed for all the traits ranged from Days to Maturity (2.94) to Harvest index (33.90).~~Very high values of heritability (broad sense) (≥80%) were observed for Days to 50%Flowering (98.00%), Finger Length (93.00%), Days to Maturity (92.00%), Plant Height (90.00%), Ear Head Length (84.00%), Flag Leaf Width (80.00%), and Test Weight (80.00%). Higher values (≥60%) were recorded for Harvest Index (78.00%), Number of Ears per Plant (76.00%), Number of Fingers per Ear (67.00%), and Seed Yield per Plant (65.00%). Therefore, these characters are predominantly governed by additive gene action and could be improved through individual plant selection owing to their high heritability values.Genetic advance as % of mean varied from 6.25% for Seed Yield per Plant to 61.78% for Days to 50%Flowering. Higher values of genetic advance (>20%) were recorded for Days to 50%Flowering (61.78%), Days to Maturity (54.82%), Plant Height (42.90%), Flag Leaf

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Length (35.64%), Number of Fingers per Ear (30.97%), Number of Productive Tillers (28.58%), Flag Leaf Width (27.24%), Finger Length (20.19%), Finger Width (20.03%). A moderate value of genetic advance (10-20%) was recorded for Ear Head Length (18.80%). Lower values ofthis parameter were recorded for Ear Head Width (9.02%), Number of Ears per Plant (6.95%), Peduncle Length (6.26%), Biological Yield per Plant (5.94%), Harvest Index (5.84%), Test Weight (1.70%), Seed Yield per Plant (6.25%).

Table?

Path analysis (Please, the scientific writing skill must be improved below)

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Genotypic Path coefficient analysis revealed that maximum positive direct effect was due to its Flag Leaf Length (0.9922*), Number of Fingers per Ear (0.472**), Finger Width (0.6593*), Ear Head Width (0.2747**), Number of Ears per Plant (0.4862**), Biological Yield per Plant (0.4688**), Harvest Index (0.601*). Days to Maturity (-0.5805*) exhibited significant and negative correlation with seed yield per plant. Ear Head Length (0.0598), Peduncle Length (0.0999), Test Weight (0.2075) exhibited positive and non-significantly correlated with seed yield per plant. Days to 50% Flowering (-0.188), Plant Height (-0.2877), Flag Leaf Width (-0.0651), Finger Length (-0.155) exhibited non-significant and negative correlation with seed yield per plant.

Out of 18 genotypes of Finger Millet evaluated for various characters, all genotypes found to be superior for seed yield per plant over check variety FIN 7669 The genotypes IE 175 (13.42) followed by IE 165 (12.42), IE 169 (11.17), IE 136 (11.01) showed high mean performance for seed yield per plant. Phenotypic Coefficient of Variation (PCV) was observed for all the traits ranged from Days to Maturity (3.06) to Harvest Index (38.31). Similarly Genotypic Coefficient of Variation (GCV) was observed for all the traits ranged from Days to Maturity (2.94) to Harvest index (33.90).Very High heritability (broad sense) estimates (80% and above) had observed for Days to 50%Flowering (98.00), Finger Length (93.00), Days to Maturity (92.00), Plant Height (90.00), Ear Head Length (84.00), Flag Leaf Width (80.00), Test Weight (80.00). Higher heritability (60% and above) was recorded for Harvest Index (78.00), Number of Ears per Plant (76.00), Number of Fingers per Ear (67.00), Seed Yield per Plant (65.00). Therefore, these characters are predominantly governed by additive gene action and could be improved through individual plant selection owing to their high heritability values. Genetic advance as % of mean varied from 6.25 for Seed Yield per Plant to 61.78 for Days to 50%Flowering. High genetic advance as % of mean (>20%) was recorded for Days to 50%Flowering (61.78), Days to Maturity (54.82), Plant Height (42.90), Flag Leaf Length (35.64), Number of Fingers per Ear (30.97), Number of Productive Tillers (28.58), Flag Leaf Width (27.24), Finger Length (20.19), Finger Width (20.03). Moderate genetic advance as % of mean (10-20%) was recorded for Ear Head Length (18.80). Low genetic advance as % of mean was recorded for Ear Head Width (9.02), Number of Ears per Plant (6.95), Peduncle Length (6.26), Biological Yield per Plant (5.94), Harvest Index (5.84), Test Weight (1.70), Seed Yield per Plant (6.25).

The results of present study also revealed that there was a comparative higher degree of genotypic correlation coefficients than their phenotypic counterparts in most of the characters studied. This indicated that there was a higher degree of association between two characters of genotypic association, their phenotypic association was lessened due to the influence of environment.

Genotypic Correlation coefficient analysis revealed that seed yield per plant exhibited significant and positive correlation with Flag Leaf Length (0.9922*), Number of Fingers per Ear (0.472**), Finger Width (0.6593*), Ear Head Width (0.2747**), Number of Ears per Plant (0.4862**), Biological Yield per Plant (0.4688**), Harvest Index (0.601*).

Phenotypic correlation coefficient analysis revealed that seed yield per plant exhibit high significant and positive correlation with number of fingers per ear (0.3414**), flag leaf with (0.4484*), Number of ears per plant (0.5786**), biological yield per plant (0.468**), Harvest Index (0.5204**).

Genotypic Path coefficient analysis revealed that maximum positive direct effect was due to its Flag Leaf Length (0.9922*), Number of Fingers per Ear (0.472**), Finger Width (0.6593*), Ear Head Width (0.2747**), Number of Ears per Plant (0.4862**), Biological Yield per Plant (0.4688**), Harvest Index (0.601*). Days to Maturity (-0.5805*) exhibited significant and negative correlation with seed yield per plant. Ear Head Length (0.0598), Peduncle Length (0.0999), Test Weight (0.2075) exhibited positive and non-significantly correlated with seed yield per plant. Days to 50% Flowering (-0.188), Plant Height (-0.2877), Flag Leaf Width (-0.0651), Finger Length (-0.155) exhibited non-significant and negative correlation with seed yield per plant.

Phenotypic Path coefficient revealed that maximum positive direct effect on seed yield was depicted number of fingers per ear (0.3414**), flag leaf with (0.4484*), Number of ears per plant (0.5786**), biological yield per plant (0.468**), Harvest Index (0.5204**). Number of productive tillers (0.2069), ear head width (0.247), peduncle length (0.0145), Test weight (0.132) exhibited non-significant but positive correlation with seed yield per plant. Days to 50% flowering (-0.1661), days to maturity (-0.4203), plant height (-0.1783) flag leaf length (-0.1348) and finger length (-0.1394), finger width (-0.1474), ear head length (-0.0133) were non-significantly and negatively correlated with seed yield per plant.

Table concerned??

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- **Discussion with reference to previous findings of different authors**
- **Reference of illustrationsin the text (Tables, Figures)**

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Table 2. Genetic parameters for 17 quantitative traits in Finger millet genotypes

Traits	GCV	PCV	% h² (Broad Sense)	Genetic Advancement 5%	Genetic Advancement as % of Mean 5%
Days to 50%Flowering	**13.96**	**14.04**	**98.80**	**18.55**	**28.58**
Days to Maturity	**2.94**	**3.06**	**92.79**	**8.29**	**5.84**
Plant Height	**15.77**	**16.55**	**90.85**	**34.47**	**30.97**
Flag Leaf Length	**5.74**	**10.87**	**17.90**	**2.28**	**6.25**
Number of Fingers per Ear	**11.96**	**14.59**	**67.19**	**1.11**	**20.19**
Number of Productive Tillers	**7.11**	**16.62**	**18.41**	**0.17**	**6.26**
Flag Leaf Width	**10.87**	**12.14**	**77.78**	**0.16**	**20.03**
Finger Length	**17.94**	**18.60**	**93.01**	**2.71**	**35.64**
Finger Width	**3.26**	**12.89**	**7.69**	**0.01**	**1.70**
Ear Head Length	**14.43**	**15.75**	**83.98**	**2.66**	**27.24**
Ear Head Width	**6.04**	**8.32**	**52.27**	**0.32**	**9.02**
Number of Ears per Plant	**30.37**	**34.67**	**76.75**	**2.70**	**54.82**
Peduncle Length	**5.97**	**12.36**	**23.32**	**0.66**	**5.94**
Biological Yield per Plant	**9.51**	**26.84**	**12.57**	**2.16**	**6.95**
Harvest Index	**33.90**	**38.31**	**78.29**	**20.25**	**61.78**
Test Weight	**10.14**	**11.28**	**80.56**	**0.45**	**18.80**
Seed Yield per Plant	**25.69**	**31.69**	**65.71**	**3.58**	**42.90**

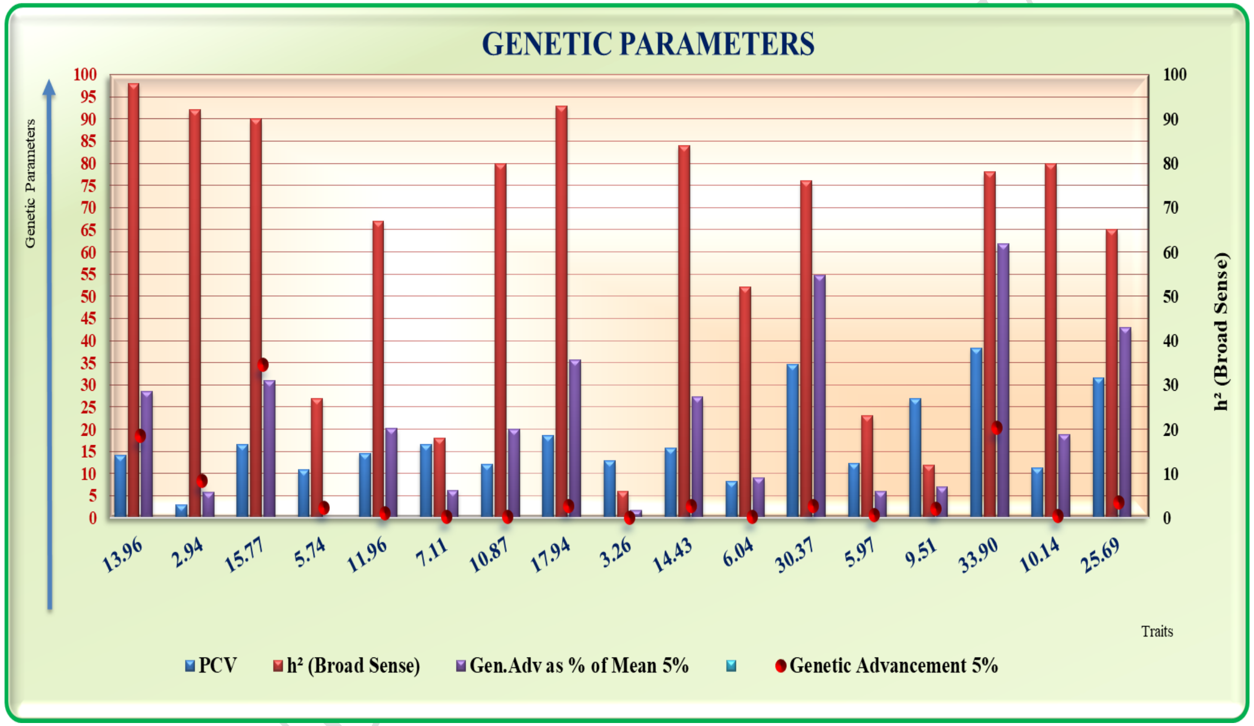


Fig 1. Bar diagram depicting GCV, PCV, heritability and genetic advance for 17 quantitative characters of Finger millet.

Table 3. Phenotypic correlation coefficient between yield and its components traits in Finger millet

Traits	DFF	DM	PH	FLL	NFE	NPT	FLW	FL	FW	EHL	EHW	NEP	PL	BYP	HI	TW	SYP
DFF	1	0.3278	**0.5398****	0.1775	0.1109	0.0053	0.1906	**0.6293***	0.42	**0.7105***	**0.6037***	**-0.524****	-0.2958	0.1543	**-0.516****	-0.305	-0.1661
DM		1	**0.6586***	**0.4616****	0.1719	-0.3493	0.2018	0.2194	-0.0037	0.2927	0.2848	-0.6968*	-0.1391	0.0915	**-0.6217***	**-0.5092****	-0.4203
PH			1	0.424	**0.6048***	0.0647	0.1354	0.2947	**0.4761****	0.4514	**0.6417***	-0.7237*	-0.1501	0.3937	**-0.6701***	-0.2327	-0.1783
FLL				1	0.2117	0.0418	**0.5337****	-0.1636	0.0275	-0.0885	0.1157	-0.2809	0.0276	0.2865	**-0.6013***	-0.0671	-0.1348
NFE					1	0.1478	0.1993	0.0694	**0.4574****	0.1775	**0.4892****	-0.3149	0.1757	**0.5206****	-0.2058	-0.0825	**0.3414****
NPT						1	-0.0291	-0.1535	0.22	-0.1196	-0.0719	0.2719	0.3074	0.4189	-0.0342	0.3003	0.2069
FLW							1	-0.0986	0.2299	-0.0823	0.0383	-0.1077	-0.0409	0.0815	-0.3016	**-0.5446****	**0.4484***
FL								1	0.3491	**0.9547***	**0.5352****	**-0.5044****	-0.2237	-0.1353	-0.0101	-0.3442	-0.1394
FW									1	0.3433	**0.7224***	-0.3064	-0.1953	0.2633	-0.2306	-0.1409	0.1474
EHL										1	**0.6198***	**-0.5144****	-0.2651	0.0022	-0.0587	-0.3376	-0.0133
EHW											1	**-0.4785****	-0.3773	0.2788	-0.2429	-0.2736	0.247
NEP												1	0.1633	0.1797	**0.5469***	0.407	**0.5786****
PL													1	0.3495	-0.1167	0.3617	0.0145
BYP														1	-0.4177	0.2103	0.468**
HI															1	0.1322	**0.5204****
TW																1	0.132
SYP																	1

** 5% Level of Significance
*   1% Level of Significance

DFF: Days to 50%Flowering, **DM**: Days to Maturity, **PH**: Plant Height, **FLL**: Flag Leaf Length, **FLW**: Flag Leaf Width, **NFE**: Number of Fingers per Ear, **NPT**: Number of Productive Tillers, **FL**: Finger Length, **FW**: Finger Width, **EHL**: Ear Head Length, **EHW**: Ear Head Width, **NEP**: Number of Ears per Plant, **PL**: Peduncle Length, **BYP**: Biological Yield per Plant, **HI**: Harvest Index, **TW**: Test Weight, **SYP**: Seed Yield per Plant

Table 4. Genotypic correlation coefficient between yield and its components traits in Finger millet

Traits	DFF	DM	PH	FLL	NFE	NPT	FLW	FL	FW	EHL	EHW	NEP	PL	BYP	HI	TW	SYP
DFF	1	0.3475	**0.5882****	-0.3424	0.1534	0.0136	0.2141	**0.6544***	-1.7377	**0.7719***	**0.8169***	**-0.5767****	**-0.6007***	**0.5321****	**-0.5809***	-0.3123	-0.188
DM		1	**0.6994***	-0.0126	0.2563	**-0.8444***	0.2157	0.2353	0.1098	0.3731	0.4182	**-0.8644***	**-0.4497****	0.0845	**-0.7516***	**-0.5986***	**-0.5805***
PH			1	**-0.9476***	**0.7169***	0.1002	0.1302	0.3018	**-0.5518***	**0.5163***	**0.8686***	**-0.9091***	-0.3465	**0.8829***	**-0.7643***	-0.3322	-0.2877
FLL				1	-0.2628	0.2678	-0.0081	0.3043	**0.6683***	0.2122	-0.0444	0.0934	-0.4139	0.2337	0.378	-0.0885	**0.9922***
NF					1	0.2516	0.318	0.1265	**-0.9825***	0.2255	**0.7519***	**-0.4702****	**0.8204***	**0.8105***	-0.3328	-0.2405	**0.472****
NPT						1	-0.2779	-0.3117	0.2705	-0.3229	**-0.4999****	**0.4473****	**0.7079***	0.6072	-0.0913	**0.8545***	0.0546
FLW							1	-0.1061	**-0.6592***	-0.0894	-0.0289	-0.2419	-0.1082	-0.0416	-0.3996	**-0.6841***	-0.0651
FL								1	-0.3914	0.0086	**0.7577***	**-0.5833***	**-0.5483***	-0.4271	0.0596	-0.3993	-0.155
FW									1	**-0.6034***	-0.2178	**0.5498***	**0.768***	-1.5224	**0.7461***	**0.9536***	**0.6593***
EHL										1	**0.9823***	**-0.5643***	**-0.7371***	0.1485	0.0078	-0.3588	0.0598
EHW											1	**-0.8256***	-0.0363	0.0862	-0.1675	-0.3499	**0.2747****
NE												1	0.4131	-0.4124	**0.6202***	**0.4629****	**0.4862****
PL													1	**0.9418***	-0.0785	**0.9375***	**0.0999**
BYP														1	-0.4177	0.2103	**0.4688****
HI															1	0.1331	**0.601***
TW																1	0.2075
SYP																	1

** 5% Level of Significance
*   1% Level of Significance

DFF: Days to 50%Flowering, **DM**: Days to Maturity, **PH**: Plant Height, **FLL**: Flag Leaf Length, **FLW**: Flag Leaf Width, **NFE**: Number of Fingers per Ear, **NPT**: Number of Productive Tillers, **FL**: Finger Length, **FW**: Finger Width, **EHL**: Ear Head Length, **EHW**: Ear Head Width, **NEP**: Number of Ears per Plant, **PL**: Peduncle Length, **BYP**: Biological Yield per Plant, **HI**: Harvest Index, **TW**: Test Weight, **SYP**: Seed Yield per Plant.

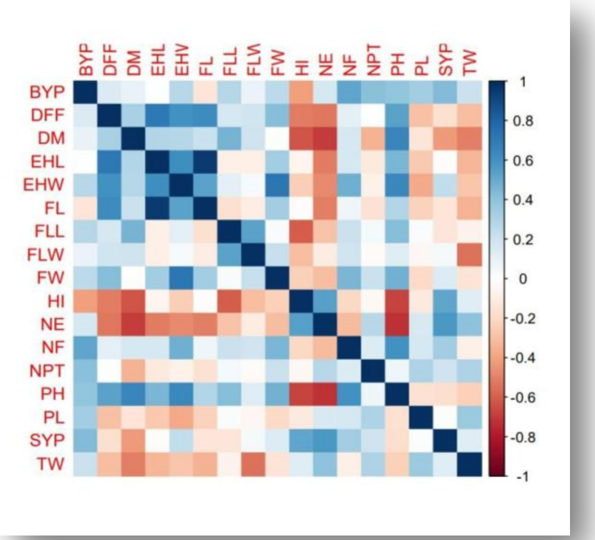
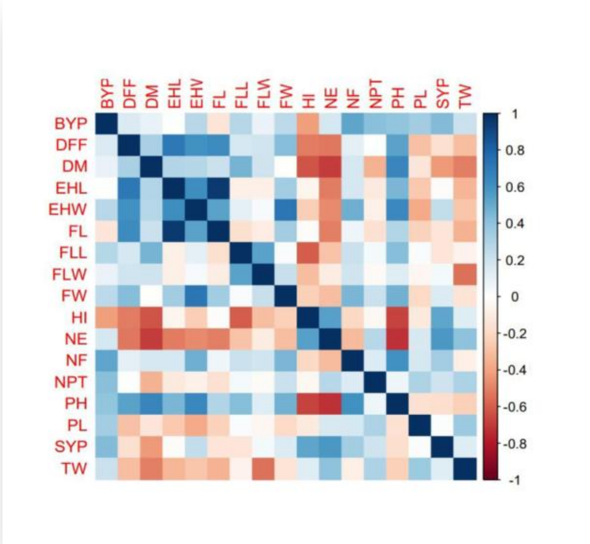


Fig 2. PHENOTYPIC CORRELATION GRAPH



~~Fig 3.GENOTYPIC CORRELATION~~ GRAPH

Table 5. Direct and Indirect effects of 17 quantitative characters on seed yield at Phenotypic level

Traits	DFF	DM	PH	FLL	NFE	NPT	FLW	FL	FW	EHL	EHW	NEP	PL	BYP	HI	TW	SYP
DFF	**0.4615**	0.1513	0.2491	0.0819	0.0512	0.0024	0.0879	0.2904	0.1938	0.3279	0.2786	-0.2418	-0.1365	0.0712	-0.2381	-0.1407	-0.1661
DM	0.0391	**0.1193**	0.0786	0.0551	0.0205	-0.0417	0.0241	0.0262	-0.0004	0.0349	0.034	-0.0831	-0.0166	0.0109	-0.0742	-0.0607	-0.4203
PH	0.0891	0.1087	**0.1651**	0.07	0.0999	0.0107	0.0224	0.0487	0.0786	0.0745	0.1059	-0.1195	-0.0248	0.065	-0.1106	-0.0384	-0.1783
FLL	0.0246	0.0639	0.0587	**0.1384**	0.0293	0.0058	0.0738	-0.0226	0.0038	-0.0122	0.016	-0.0389	0.0038	0.0396	-0.0832	-0.0093	-0.1348
NFE	0.0016	0.0025	0.0089	0.0031	**0.0148**	0.0022	0.0029	0.001	0.0067	0.0026	0.0072	-0.0046	0.0026	0.0077	-0.003	-0.0012	**0.3414****
NPT	-0.0005	0.0362	-0.0067	-0.0043	-0.0153	**-0.1036**	0.003	0.0159	-0.0228	0.0124	0.0074	-0.0282	-0.0318	-0.0434	0.0035	-0.0311	0.2069
FLW	0.0303	0.0321	0.0215	0.0849	0.0317	-0.0046	**0.159**	-0.0157	0.0366	-0.0131	0.0061	-0.0171	-0.0065	0.013	-0.048	-0.0866	**0.4484***
FL	-0.1819	-0.0634	-0.0852	0.0473	-0.0201	0.0444	0.0285	**-0.2891**	-0.1009	-0.276	-0.1547	0.1458	0.0647	0.0391	0.0029	0.0995	-0.1394
FW	-0.0126	0.0001	-0.0143	-0.0008	-0.0137	-0.0066	-0.0069	-0.0105	**-0.03**	-0.0103	-0.0217	0.0092	0.0059	-0.0079	0.0069	0.0042	0.1474
EHL	-0.109	-0.0449	-0.0692	0.0136	-0.0272	0.0184	0.0126	-0.1464	-0.0527	**-0.1534**	-0.0951	0.0789	0.0407	-0.0003	0.009	0.0518	-0.0133
EHW	0.2547	0.1202	0.2707	0.0488	0.2064	-0.0304	0.0162	0.2258	0.3048	0.2615	**0.4219**	-0.2019	-0.1592	0.1176	-0.1025	-0.1154	0.247
NEP	-0.1399	-0.1861	-0.1932	-0.075	-0.0841	0.0726	-0.0288	-0.1347	-0.0818	-0.1373	-0.1278	**0.267**	0.0436	0.048	0.146	0.1087	**0.5786****
PL	-0.0558	-0.0263	-0.0283	0.0052	0.0332	0.058	-0.0077	-0.0422	-0.0369	-0.05	-0.0712	0.0308	**0.1887**	0.066	-0.022	0.0683	0.0145
BYP	0.081	0.0481	0.2067	0.1504	0.2733	0.2199	0.0428	-0.071	0.1382	0.0012	0.1463	0.0943	0.1835	**0.525**	-0.2193	0.1104	**0.468****
HI	-0.646	-0.7783	-0.8389	-0.7528	-0.2577	-0.0428	-0.3776	-0.0127	-0.2887	-0.0735	-0.3041	0.6847	-0.1461	-0.5229	**1.252**	0.1655	**0.5204****
TW	-0.0022	-0.0037	-0.0017	-0.0005	-0.0006	0.0022	-0.0039	-0.0025	-0.001	-0.0024	-0.002	0.0029	0.0026	0.0015	0.001	**0.0072**	0.132
SYP	-0.1661	-0.4203	-0.1783	-0.1348	**0.3414****	0.2069	**0.4484****	-0.1394	0.1474	-0.0133	0.247	**0.5786****	0.0145	**0.468****	**0.5204****	0.132	-0.1661

** 5% Level of Significance
*   1% Level of Significance

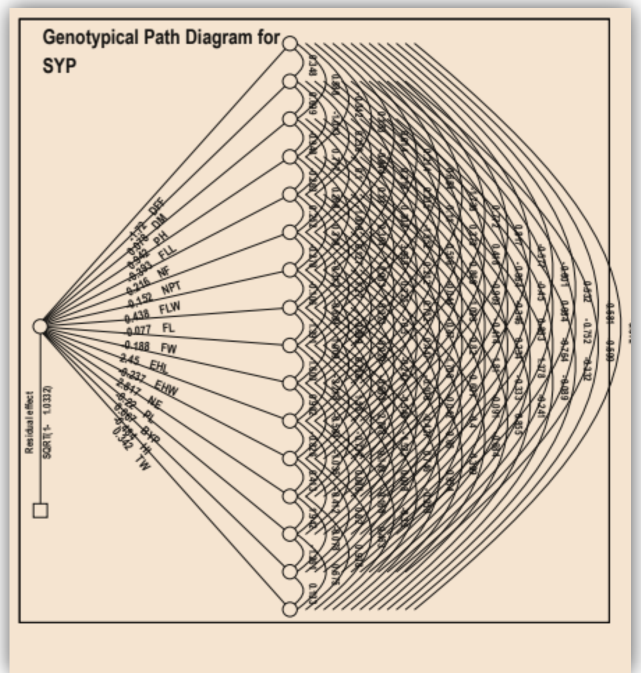
DFF: Days to 50%Flowering, **DM**: Days to Maturity, **PH**: Plant Height, **FLL**: Flag Leaf Length, **FLW**: Flag Leaf Width, **NFE**: Number of Fingers per Ear, **NPT**: Number of Productive Tillers, **FL**: Finger Length, **FW**: Finger Width, **EHL**: Ear Head Length, **EHW**: Ear Head Width, **NEP**: Number of Ears per Plant, **PL**: Peduncle Length, **BYP**: Biological Yield per Plant, **HI**: Harvest Index, **TW**: Test Weight, **SYP**: Seed Yield per Plant

Table 6. Direct and Indirect effects of 17 quantitative characters on seed yield at Genotypic level

Traits	DFF	DM	PH	FLL	NF	NPT	FLW	FL	FW	EHL	EHW	NEP	PL	BYP	HI	TW	SYP
DFF	**-1.7201**	-0.5978	-1.0117	0.589	-0.2638	-0.0235	-0.3683	-1.1256	2.9889	-1.3277	-1.4051	0.9919	1.0333	-0.9153	0.9992	0.5372	-0.188
DM	0.0271	**0.0781**	0.0546	-0.0791	0.02	-0.066	0.0168	0.0184	0.0086	0.0291	0.0327	-0.0675	-0.0351	0.0066	-0.0587	-0.0468	**-0.5805***
PH	0.5538	0.6585	**0.9416**	-0.8923	0.6751	0.0944	0.1226	0.2842	-1.4612	0.4861	0.8179	-0.856	-0.3263	0.8314	-0.7197	-0.3128	-0.2877
FLL	0.1347	0.3983	0.3727	**-0.3933**	0.1034	-0.1053	0.3965	-0.1197	-1.4429	-0.0835	0.0174	-0.4301	0.1628	-0.0919	-0.542	0.0348	**0.9922***
NFE	0.0331	0.0554	0.1549	-0.0568	**0.2161**	0.0544	0.0687	0.0273	-0.6445	0.0487	0.1625	-0.1016	0.1773	0.3912	-0.0719	-0.052	**0.472****
NPT	-0.0021	0.1279	-0.0152	-0.0406	-0.0381	**-0.1515**	0.0421	0.0472	-0.1925	0.0489	0.0757	-0.0678	-0.2588	-0.092	0.0138	-0.1295	0.0546
FLW	0.0938	0.0944	0.057	-0.4414	0.1392	-0.1217	**0.4378**	-0.0464	-0.2886	-0.0392	-0.0127	-0.1059	-0.0474	-0.0182	-0.175	-0.2995	-0.0651
FL	-0.0503	-0.0181	-0.0232	-0.0234	-0.0097	0.0239	0.0081	**-0.0768**	0.1069	-0.0775	-0.0582	0.0448	0.0421	0.0328	-0.0046	0.0307	-0.155
FW	0.3269	-0.0207	0.2919	-0.6901	0.5611	-0.239	0.124	0.2617	**-0.1881**	0.3016	0.6053	-0.2915	-0.5207	0.2864	-0.1403	-0.1794	**0.6593***
EHL	1.8908	0.9138	1.2647	0.5199	0.5523	-0.791	-0.2191	2.4707	-3.9278	**2.4496**	2.4063	-1.3824	-1.8055	0.3638	0.019	-0.8788	0.0598
EHW	-0.1936	-0.0991	-0.2058	0.0105	-0.1782	0.1184	0.0068	-0.1795	0.7625	-0.2328	**-0.237**	0.1956	0.2456	-0.0204	0.0397	0.0829	**0.2747****
NE	-1.6244	-2.4348	-2.5607	3.0797	-1.3246	1.2601	-0.6814	-1.6431	4.3656	-1.5896	-2.3255	**2.8168**	1.1637	-1.1617	1.7469	1.3039	**0.4862****
PL	0.1323	0.0991	0.0763	0.0912	-0.1807	-0.3762	0.0238	0.1208	-0.6097	0.1624	0.2283	-0.091	**-0.2203**	-0.4277	0.0173	-0.2065	0.0999
BYP	0.0357	0.0057	0.0592	0.0157	0.1214	0.0407	-0.0028	-0.0286	-0.1021	0.01	0.0058	-0.0276	0.1302	**0.067**	-0.0846	0.0452	**0.4688****
HI	0.281	0.3636	0.3698	-0.6666	0.161	0.0442	0.1933	-0.0288	-0.3609	-0.0038	0.081	-0.3	0.038	0.6103	**-0.4838**	-0.0644	**0.601***
TW	-0.1069	-0.205	-0.1138	-0.0303	-0.0824	0.2926	-0.2342	-0.1367	0.3265	-0.1228	-0.1198	0.1585	0.321	0.231	0.0456	**0.3424**	0.2075
SYP	-0.188	**-0.5805***	-0.2877	**0.9922***	**0.472****	0.0546	-0.0651	-0.155	**0.6593***	0.0598	**0.2747****	**0.4862****	0.0999	**0.4688****	**0.601***	0.2075	1

** 5% Level of Significance
* 1% Level of Significance

DFF: Days to 50%Flowering, **DM**: Days to Maturity, **PH**: Plant Height, **FLL**: Flag Leaf Length, **FLW**: Flag Leaf Width, **NFE**: Number of Fingers per Ear, **NPT**: Number of Productive Tillers, **FL**: Finger Length, **FW**: Finger Width, **EHL**: Ear Head Length, **EHW**: Ear Head Width, **NEP**: Number of Ears per Plant, **PL**: Peduncle Length, **BYP**: Biological Yield per Plant, **HI**: Harvest Index, **TW**: Test Weight, **SYP**: Seed Yield per Plant.



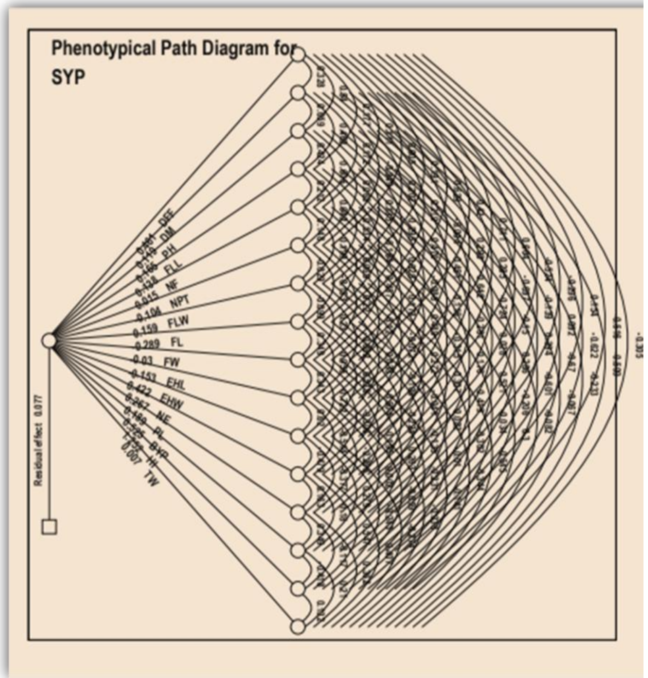


Fig 4 GENOTYPIC PATH DIAGRAM

Fig 5. PHENOTYPIC PATH

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CONCLUSION

Based on the work in 18 Genotypes of Finger millet on 17 quantitative characters, it is concluded that all ~~the studied~~ genotypes tested have shown significant differences. The genotype~~,~~IE 175has shown the highest mean performance for seed yield per plant. Whereas, genotypic and phenotypic coefficient of variation were found high for number of ears per plant and harvest index. ~~high~~High heritability coupled with high genetic advance as percent of mean were~~as~~ observed for days to 50% flowering, plant height, finger length, ear head length, test weight. ~~Correlation coefficient revealed that~~Moreover, the seed yield per plant exhibited significant and positive correlations with number of fingers per ear, number of ears per plant, biological yield per plant, harvest index at both genotypic and phenotypic levels. The Path Coefficient Analysis ~~has revealed~~showed that number of fingers per ear, number of ears per plant, biological yield per plant, harvest index positive and direct effect on seed yield per plant at both genotypic and phenotypic levels. Hence the selection of genotypes based on the above-mentioned characters will be useful for crop improvement in Finger millet.

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