

Original Research Article

Genetic Variability and Divergence Studies In Finger Millet (*Eleusine coracana* (L.) Gaertn.)

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ABSTRACT

Keywords

Finger millet,
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The experimental material comprised 35 diverse genotypes of finger millet (*Eleusine coracana* (L.) Gaertn). The data on 7 quantitative traits were recorded to know the genetic variability and divergence existing in the material. The coefficient of variation at phenotypic (PCV) and genotypic (GCV) levels were high for seed yield plant⁻¹, productive tillers plant⁻¹ and main ear length. High heritability coupled with high genetic advance observed for seed yield plant⁻¹ and main ear length. On the basis of non-hierarchical Euclidean cluster analysis, all the 35 genotypes of the present study were grouped into six non-overlapping clusters. The clustering pattern revealed that the genotypes originating from different geographical regions got themselves grouped into different clusters, indicated that the geographic biodiversity is not the responsible factor in determining genetic biodiversity. Among the characters plant height followed by seed yield plant⁻¹, main ear length contributed maximum towards the total divergence.

Introduction

Finger millet is the third most important millet grown in many states of India under diversified situations of soil, temperature and rainfall. Early maturity, low input requirements, freedom from major pests and diseases, rejuvenation capacity after alleviation of stress conditions have made this crop an ideal for dryland farming.

Genetic improvement through conventional breeding approaches depends mainly on the availability of the diverse

germplasm and the amount of genetic variability present in the population (ArunPrabhuet *al.*, 2008).

The knowledge of characters influencing divergence is an important aspect for a breeder. Information on the nature and degree of genetic divergence would help the plant breeder to choose right parents for breeding programmes (Vivekanandan and Subramanian, 1990). Among the multivariate procedures, Mahalanobis (1936) generalized distance (D²) has been

used extensively. Attempt has been made in this study to assess the nature and magnitude of genetic divergence for yield and its component in finger millet and also to identify divergent parents from distantly related clusters for suitable hybridization.

Materials and Methods

The experimental material consisted 35 finger millet genotypes grown in randomized block design with three replications at RARS, Chinthapalli (A.P.). Each entry was grown in two rows of three meter length with a spacing of 30X10 cm. The data was recorded on 5 randomly selected plants for 7 quantitative traits viz., days to 50% flowering, plant height (cm), number of productive tillers, main ear length (cm), number of fingers ear⁻¹, days to maturity and seed yield plant⁻¹ (g). Genetic divergence was estimated by multivariate analysis using Mahalanobis (1936) D² statistic as described by Rao (1952). On the basis of D² values genotypes were grouped into different clusters according to Tocher's method given by Rao (1952).

Results and Discussion

Analysis of variance (Table 1) revealed significant differences among the genotypes for all the characters under study, indicating considerable amount of variability in experimental material. The recordings of the means, range, coefficient of variation, heritability and genetic advance as percent of means are presented in Table 2. The co-efficient of variation at phenotypic (PCV) and Genotypic (GCV) levels were high for the traits seed yield plant⁻¹ and productive tillers plant⁻¹. The similar results of high PCV and GCV were reported by Kadam (2008) for productive tillers plant⁻¹ and

seed yield plant⁻¹. In the present study, heritability was high for the characters seed yield plant⁻¹, plant height, main ear length and fingers ear⁻¹. The traits seed yield plant⁻¹, productive tillers plant⁻¹ and main ear length expressed high genetic advance as percent of mean. Similar trend was also obtained by Ganapathy *et al.*, (2011).

Based on relative magnitude of D² values 35 genotypes were grouped into six clusters (Table 3) (Fig.1). Cluster I and II had the maximum of 14 genotypes each followed by cluster III (4) while the remaining three clusters were solitary. The genotypes L-76, VR-708 and GPU-67 formed single stocked cluster indicating wide diversity from set, as well as from each other.

The average intra and inter cluster D² values (Table 4) showed that the intra cluster distance ranged from 9.39 (cluster II) to 28.88 (cluster III). There were three solitary clusters possessing single entries with no intra cluster distance. The inter cluster D² values ranged from 27.67 (between cluster V and VI) to 101.243 (between cluster II and V).

The cluster means estimated over genotypes for the 7 characters revealed considerable inter cluster variation (Table 5). Cluster V exhibited higher mean values for plant height, days to maturity and seed yield plant⁻¹. Cluster I showed higher mean value for plant height. Cluster II showed higher mean value for seed yield plant⁻¹.

Based on intra and inter-cluster distance among the groups, it is suggested to make crosses between the genotypes of the clusters II (RAU-8, OEB-530, PRM-6107,

Table.1 Analysis of variance for 7 characters in 35 finger millet genotypes

Character	Replications	Treatments	Error
	df:2	df:34	df:68
Plant Height (cm)	5.2494	660.1017	39.4507
Productive Tillers/ Plant	0.0941	1.2311	0.2278
Main Ear Length (cm)	0.4027	6.5201	0.5340
Fingers/ Ear	0.0594	2.5226	0.3359
Days to 50% Flowering	11.2667	59.9961	19.1490
Days to Maturity	2.4667	89.2577	40.4569
Seed Yield/ Plant (gm)	0.2220	10.5995	0.6195

Table.2 Mean, coefficient of variation, heritability (broad sense), genetic advance and GA as per cent of mean for 7 characters in 35 finger millet (*Eleusine coracana* (L.) Gaertn.) genotypes

Character	Range		General Mean	Coefficient of variation		Variance		h ² (b) (%)	Genetic advance	Genetic advance as per cent of mean (%)
	Min	Max		Genotypic (%)	Phenotypic (%)	Genotypic	Phenotypic			
Plant Height (cm)	90.30	141.73	118.49	12.14	13.25	206.88	246.33	83.98	27.15	22.92
Productive Tillers/ Plant	1.60	4.67	2.59	22.33	28.96	0.33	0.56	59.48	0.92	35.48
Main Ear Length (cm)	5.60	12.87	8.42	16.78	18.89	2.00	2.53	78.89	2.58	30.70
Fingers/ Ear	6.33	10.53	7.62	11.21	13.55	0.73	1.06	68.45	1.46	19.10
Days to 50% Flowering	77.00	98.33	84.73	4.35	6.76	13.62	32.76	41.56	4.90	5.78
Days to Maturity	117.00	139.00	124.95	3.23	6.03	16.27	56.72	28.68	4.45	3.56
Seed Yield/ Plant (gm)	1.63	8.47	5.23	34.85	37.95	3.33	3.95	84.30	3.45	65.91

Table.3 Clustering pattern of 35 finger millet genotypes by Tocher's method

Cluster No.	No. of genotypes	Genotype (s) and their origin
I	14	TNAU-1062, GPU-72, NRV-1, KMR-107, TNAU-1039, VR-958, PR-202, GPU-76, KB-105, VR-929, TNAU-1063, NRV-2, KB-100, OEB-530
II	14	RAU-8, OEB-530, PRM-6107, GPU-45, HR-374, DHRS-1-1, TNAU-1066, VL-351, DM-7, OEB-532, DM-1, PPR-2885, VL-149, OEB-526
III	4	BR-1, BR-2, KMR-305, VR-948
IV	1	L-76
V	1	VR-708
VI	1	GPU-67

Table.4 Average intra (diagonal) and inter-cluster D² values among six clusters

Cluster Number	I	II	III	IV	V	VI
I	12.108	39.788	43.568	37.245	59.067	45.834
II		9.394	78.03	46.368	101.243	70.181
III			28.883	40.886	56.32	56.318
IV				14.172	96.396	60.43
V					12.848	27.665
VI						22.976

Table.5 Mean values of six clusters estimated by Tocher's method

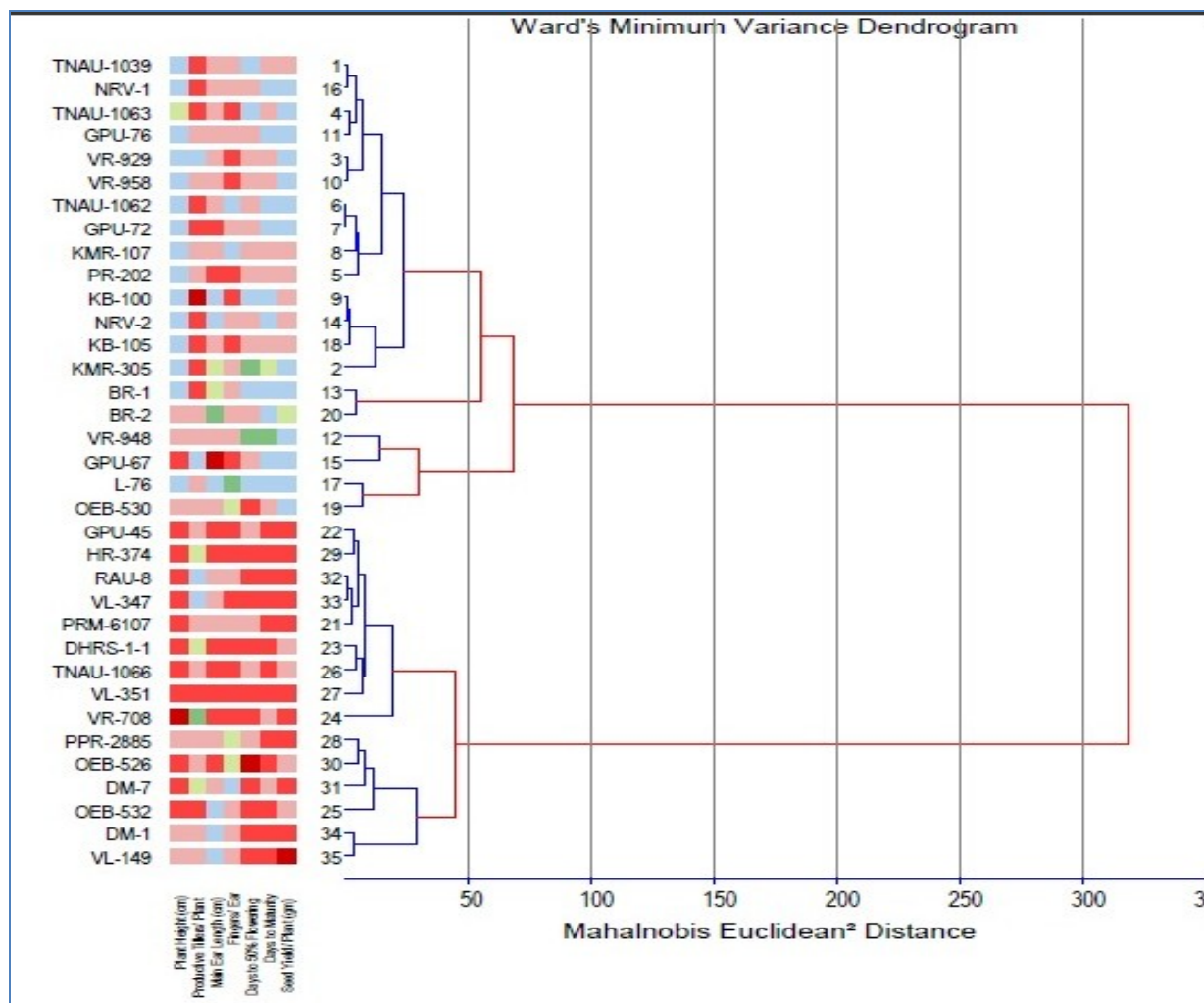
Cluster	Plant Height (cm)	Productive Tillers/ Plant	Main Ear Length (cm)	Fingers/ Ear	Days to 50% Flowering	Days to Maturity	Seed Yield/ Plant (gm)
I	133.014	2.233	8.643	7.467	87.167	128.571	6.143
II	126.083	2.467	12.367	7.867	86.167	128.500	7.900
III	111.217	2.767	7.183	7.433	91.667	134.000	7.417
IV	126.733	2.317	9.167	9.767	85.667	127.833	7.683
V	100.807	3.130	7.174	6.800	81.185	119.519	3.326
VI	108.261	2.683	8.611	8.456	81.278	119.500	3.544

Note: Bold figures are minimum and maximum values

Table.6 Contribution of different characters towards genetic divergence

S. No.	Character	No. of times ranked first	Per cent contribution
1	Plant Height (cm)	166	27.8992
2	Productive Tillers/ Plant	52	8.7395
3	Main Ear Length (cm)	111	18.6555
4	Fingers/ Ear	88	14.7899
5	Days to 50% Flowering	21	3.5294
6	Days to Maturity	0.01	0
7	Seed Yield/ Plant (gm)	157	26.3866

Fig.1 Dendrogram showing relationship of 35 finger millet genotypes in six clusters based on Mahalanobis' D² values



GPU-45, HR-374, DHRS-1-1, TNAU-1066, VL-351, DM-7, OEB-532, DM-1, PPR-2885, VL-149, OEB-526) and V (VR-708) or IV (L-76) and V (VR-708) after confirming their general combining ability for evolving transgressive segregants for yield and yield components. Contribution of different characters towards genetic divergence is presented in Table 6. The trait plant height (27.89%) contributed maximum towards total diversity followed by seed yield plant⁻¹ (26.38%), main ear length (18.65%), number of fingers ear⁻¹ (14.79%), productive tillers plant⁻¹ (8.74%), days to 50% flowering (3.53%). Similar results were also reported by Anantharaju and Meenakshiganesan (2008), Arun Prabhu *et al.*, (2008) and Kadam (2008).

Present investigation revealed that genetic divergence has no relationship with the geographic divergence as observed by the random pattern of distribution of genotypes into various clusters from different geographic regions. This could be due to the reason that genotypes in a particular geographic region could have been evolved with different objectives and varied local situations. Hence, genotypes with same geographical origin could have undergone change for different characters under selection during the process of evolution.

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References

- Anantharaju, P and Meenakshiganesan, N. 2008. Genetic divergence studies in finger millet (*Eleusine coracana* (L.) Gaertn.). *Indian Journal of Agricultural Research*.42 (2): 120-123.
- ArunPrabhu, D., Selvi, B and Govindaraj, M. 2008. Genetic variability and multivariate analysis in finger millet (*Eleusine coracana*) germplasm for yield characters. *Crop Research*.36 (1,2&3): 218-223.
- Ganapathy S, Nirmalakumari A and Muthiah AR 2011 Genetic variability and interrelationship analyses for economic traits in finger millet germplasm. *World Journal of Agricultural Sciences*.7 (2): 185-188.
- Kadam, D.D. 2008. Genetic divergence in finger millet. *Journal of Soils and Crops*. 18 (1): 138-142.
- Mahalanobis, P.C. (1936). On the generalized distance in statistics. *Proceedings of National Institute of Science, India*,2: 49-55.
- Rao, C.R. 1952. *Advanced Statistical Methods in Biometrical Research*. John Wiley and sons. New York. 236-272.
- Vivekanandan, P and Subramanian, S. (1990). Genetic divergence in rainfed rice. *Oriza*.30: 60-62.