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D^2 analysis in vegetable amaranthus

S. ANUJA
Department of Horticulture, Faculty of Agriculture, Annamalai University, ANNAMALAINAGAR (T. N.) INDIA

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Presence of wide genetic diversity among the genotypes was revealed by Mahalonobis D^2 analysis. The types chosen from the same eco-geographical origin were found scattered in different clusters. The clustering of types from different eco-geographic regions in one cluster was also observed. Among the clusters, the clusters VII and clusters IX showed high genetic divergence, hence, the crossing between the types of these two clusters may result in the development of useful progenies. Among the different characters member of leaves and leaf weight contributed the maximum genetic divergence.

Key words : Genetic diversity, Amaranthus, Greenyield.

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INTRODUCTION

Amaranth (*Amaranthus* sp.) occupies a prominent position among tropical leafy vegetables all over the world. Though majority of Indian population are vegetarian, the per capita intake of vegetables is estimated to be only about 135 g as against the requirement of about 285 g, among which leafy vegetables constitute 80 g for a balanced diet (Pandey, 1993). The D^2 analysis proposed by Mahalanobis (1936) has been reported to be an effective tool to assess the genetic divergence among the types. Such an attempt eventually help to choose desirable parents for recombination breeding and thus results in the development of superior varieties. The present investigation has been undertaken to assess the genetic divergence among the genotypes of amaranthus.

RESEARCH METHODOLOGY

The hundred genotypes of amaranthus belonging to A. tricolor, A. blitum, A. tricolor var. *tristis*, A. dubius from diverse sources chosen from the germplasm maintained at the Department of Horticulture, Faculty of Agriculture, Annamalai University was raised in randomized block design with three replications in July - September, 2007. Observations were recorded on 10 random plants for green yield and its contributing characters at 30 days after sowing. (Evaluation stage – 4) Mahalanobis's D^2 analysis as suggested by Rao (1952) was used for estimating the genetic divergence among the 100 genotypes. For determining the group constellations, a relatively simple criteria suggested by Tocher (Rao, 1952) was followed.

RESULTS AND ANALYSIS

The 100 genotypes were grouped into 9 clusters by the application of clustering technique (Table 1). It was observed that cluster I had maximum of 65 genotypes of diverse origin. This was followed by cluster II and IV with 7 genotypes, cluster V and VIII with 5 genotypes each, cluster IV with four genotypes each, cluster VI and VII with 3 genotypes each and cluster IX with one genotypes.

In general, genotypes belonging to different species clustered together. The grouping pattern of the genotypes indicated that the clusters were heterogenous for geographical origin of genotypes. From a close observation of the distribution of genotypes among the clusters, no relationship could be established between clustering and eco-geographical origin (Patil and Bhapkar, 1987). The absence of relationship between genetic diversity indicated that forces other than geographical origin such as exchange of genetic stocks, genetic drift, spontaneous variation, natural and artificial selection may be responsible for genetic diversity as reported by Nagarajan and Prasad (1980).

The character number of leaves contributed maximum (14.73 per cent) towards the yield of greens

Table 1 : Composition of D^2 clusters for amaranthus genotypes during monsoon season at evaluation stage – 4 (30 DAS)

Cluster number	Number of genotypes	Acc. nos. of the genotypes
I	65	A-1, A-2, A-5, A-6, A-7,A-8, A-9, A-10, A-12, A-13, A-14, A-15, A-16, A-18, A-19, A-20, A-21, A-22, A-23, A-26, A-27, A-30, A-31, A-32, A-34, A-35, A-36, A-38, A-39, A-41, A-42, A-43, A-45, A-46,A-49, A-50,A-51,A-52, A-53, A-54, A-55, A-56, A-57, A-59, A-60, A-63, A-64, A-65, A-69, A-71, A-72, A-75, A-76, A-77, A-78, A-79,A-82,A-87, A-90, A-92, A-93, A-94, A-96, A-97, A-98.
II	7	A-40,A-47,A-70,A-73,A-74,A-84, A-100
III	4	A-11, A-24, A-44,A-67
IV	7	A-28, A-29, A-33, A-61, A-62, A-85, A-95
V	5	A-25,A-48,A-58,A-81,A-91
VI	3	A-4, A-17, A-80
VII	3	A-37, A-66, A-68
VIII	5	A-3, A-38, A-83, A-86, A-89
IX	1	A-99

Table : 2 Composition of various characters towards yield of greens during monsoon season at evaluation stage -4 (30 DAS)

Sr. No	Source	Time ranked -1st	Contribution % F
1.	Plant height	393	7.56
2.	Stem girth	374	7.43
3.	Number of leaves	729	14.73
4.	Leaf length	445	8.99
5.	Leaf width	375	7.58
6.	Petiole length	436	8.81
7.	Leaf area	163	3.29
8.	Root length	120	3.43
9.	Root weight	445	8.99
10.	Leaf weight	665	13.43
11.	Stem weight	278	5.62
12.	Leaf / stem ratio	214	4.32
13.	Dry matter content	263	5.31
14.	Greens yield	0	0.00

Table 3 : Average intra (bold) and inter – cluster D2 and D values (in parenthesis) during monsoon season at evaluation stage – 4 (30 DAS)

Characters	I	II	III	IV	V	VI	VII	VIII	IX
I	4.239 (2.059)	9.060 (3.010)	10.131 (3.183)	11.323 (3.365)	14.236 (3.773)	12.638 (3.555)	16.459 (4.057)	13.010 (3.607)	10.910 (3.303)
II		2.528 (1.590)	11.049 (3.324)	20.376 (4.514)	13.344 (3.653)	15.880 (3.985)	19.776 (4.447)	15.359 (3.919)	29.268 (5.410)
III			10.569 (3.251)	12.688 (3.562)	11.149 (3.339)	17.322 (4.162)	14.025 (3.745)	24.940 (4.994)	19.722 (4.441)
IV				6.416 (2.533)	14.846 (3.853)	18.318 (4.280)	15.618 (3.952)	15.101 (3.886)	20.196 (4.494)
V					7.140 (2.672)	17.472 (4.180)	14.823 (3.850)	15.516 (3.939)	12.924 (3.595)
VI						1.899 (1.378)	19.829 (4.453)	16.524 (4.065)	23.146 (4.811)
VII							6.017 (2.543)	27.384 (5.233)	31.855 (5.644)
VIII								2.566 (1.602)	28.880 (5.374)
IX									0.000 (0.000)

Table 4 : Cluster means for various characters during monsoon season at evaluation stage 4 (30 DAS)

Characters Clusters	Plant height (cm)	Stem girth (cm)	No. of leaves	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)	Leaf area (sq.cm)	Root length (cm)	Root weight (g)	Leaf weight (g)	Stem weight (g)	Leaf/ stem ratio	Dry matter content (g)	Greens yield (g)
I	48.81	2.66	33.44	7.32	5.59	5.96	41.65	9.19	7.32	24.76	40.11	0.62	15.56	72.19
II	59.71	3.04	34.57	8.55	6.16	7.31	54.46	8.77	8.32	22.45	38.15	0.61	16.33	68.93
III	49.72	2.74	32.96	7.64	5.09	5.33	38.25	10.44	5.78	19.34	32.58	0.57	14.30	57.87
IV	52.91	2.56	25.92	7.62	6.37	5.90	48.53	8.78	5.86	17.07	25.98	0.65	16.30	48.92
V	41.07	2.70	54.38	6.75	6.10	6.19	40.21	8.69	7.78	18.02	31.90	0.57	16.38	57.39
VI	59.88	3.05	39.47	8.40	5.99	6.79	53.04	9.51	9.61	24.35	43.82	0.60	15.70	77.79
VII	52.06	3.33	23.24	8.43	5.48	6.76	40.20	9.20	8.05	26.53	41.41	0.64	17.00	75.99
VIII	53.75	2.60	40.26	7.34	5.42	8.15	43.92	7.20	7.53	26.61	45.40	0.61	16.15	79.55
IX	51.83	2.84	30.48	6.44	4.97	7.08	33.39	8.52	8.09	21.27	31.08	0.70	16.40	60.63

followed leaf weight (13.43). The contribution of root length (3.43 per cent) and leaf area (3.29 per cent) was minimum (Table 2).

The intra-cluster generalized distance ranged from 1.899 – 10.569 (Table 3). Cluster Vl showed minimum intra cluster distance (1.899) and maximum intra – cluster distance (10.569) was exhibited by the cluster III. Minimum inter-cluster distance was found to exist between clusters I and II (9.60), while maximum inter-cluster distance was observed between cluster VII and IX (31.855) followed by cluster II and IX (29.268). Since the clusters VI and IX showed high genetic divergence between them and crossing between the types of these two clusters may result in high genetic divergence between them and crossing between the types of these two clusters may result in high heterosis for good characters. The cluster VIII showed highest mean values for greens yield, leaf weight, stem weight and petiole length, whereas cluster VI recorded the highest desirable mean value for plant height and cluster V recorded maximum mean value for number of leaves (Table 4). Desirable types can be selected from the clusters based on the objective of the breeding programmes. Absence of relationship between the genetic diversity and geographical distance was thus brought to focus by the present study. Genetically diverse types having useful characters from the same region can be effectively used for the breeding programmes.

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