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DIVERGENCE ANALYSIS OF LITCHI (*LITCHI CHINENSIS* SONN.) CULTIVARS GROWN IN WEST BENGAL

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ABSTRACT

Genetic diversity was assessed in eleven cultivars of litchi on the basis of six fruit characters. The study revealed enormous diversity in the material as indicated by the wide range of D^2 values from 11.3 (between the varieties Rose Scented and Mclean) to 1952.5 (between cvs. Bedana and Mclean). The cultivars were grouped in four clusters on the basis of the Tocher's method. Cluster I was the largest with five cultivars and all other clusters had two cultivars each. The intercluster D^2 values varied from 213.9 (between clusters II and III) to 1373.4 (between clusters I and IV); the intracluster D^2 values varied from 79.7 (cluster I) to 138.8 (cluster IV). Crossing between cultivars belonging to cluster I with those of cluster IV is expected to give maximum extent heterosis whereas crosses between the cultivars of clusters III and IV should yield derivatives with better fruit characters.

Key words: Fruit characters, diversity, litchi.

In spite of the existing cultivars of litchi having high genetic variability [1, 2] there is practically no information available on genetic divergence in this fruit crop to initiate hybridization to exploit heterosis. For this, a knowledge of the relative genetic distance among different cultivars of litchi would be necessary. The present study aims to assess genetic diversity in a collection of eleven litchi cultivars on the basis of six fruit characters.

MATERIALS AND METHODS

The study was carried out in randomized block design with three replications at the Horticultural Research Station, Mondouri, Nadia, West Bengal, with the litchi cultivars Bedana, Bombai, China, Early Muzaffarpur, Elachi, Kasba, Mclean, Muzaffarpur, Naffarpal, Rose Scented and Seedless. Observations were recorded at maturity on fruit length, diameter and weight, peel and aril weight, and stone weight.

The Mahalanobis' D^2 statistics was used to estimate the genetic divergence between cultivars. The cultivars were grouped using the Tocher's method as described by Rao [3]. Canonical analysis was carried out by calculating the first two vectors or canonical roots, which accounted for 97.7% of the total variability. The mean values of the first two canonical vectors for the 11 cultivars studied were plotted on a two-dimensional graph and the D^2 clusters superimposed over it. With the help of D^2 values between and within clusters, the cluster diagram showing the relationship between different populations ($D = \sqrt{D^2}$) was drawn.

RESULTS AND DISCUSSION

The average D^2 values computed for all possible 55 pairs of combinations of litchi cultivars ranged from 11.3 (between cvs. Rose Scented and Mclean) to 1952.5 (between Bedana and Mclean). The wide range of D^2 values indicates enormous diversity even in this small group of eleven genotypes. The sizeable diversity recorded for fruit components in the present study is an encouraging situation.

On the basis of D^2 analysis, the 11 cultivars were grouped into four clusters (Table 1). Cluster I was the largest with as many as five cultivars (Table 1, Fig. 1). All other clusters had two cultivars each.

Table 1. Grouping of litchi cultivars into various clusters

Cluster	No. of cultivars	Cultivars
I	5	Rose Scented, Muzaffarpur, Naffarpal, Elachi, Mclean
II	2	China, Early Muzaffarpur
III	2	Kasba, Bombai
IV	2	Bedana, Seedless

The average intra- and intercluster D^2 values are given in Table 2 and the relationship within and between clusters is shown in Fig. 2. The intracluster distances ranged from 79.7 to 138.8 for clusters I and IV, respectively, and did not transgress the limits of any of the intercluster distances. Clusters I and IV were the most diverse, the intercluster distance between them (1373.4) being maximum, followed by the distances between I and III (618.0), II and IV (567.1), III and IV (429.8), and I and II (233.5). The intercluster proximity was maximum between clusters II and III (213.9), hence they were closely related. Genotypes belonging to the clusters separated by high genetic distance should be used in hybridization to obtain a wide spectrum of variation among the segregates [4, 5].

Table 2. Average intra- and intercluster D^2 values in litchi

Clusters	I	II	III	IV
I	**79.7**	233.5	618.0	1373.4
II		**71.3**	213.9	567.1
III			**104.8**	429.8
IV				**138.8**

Note. Values in the diagonal (in bold) are intracluster distances.

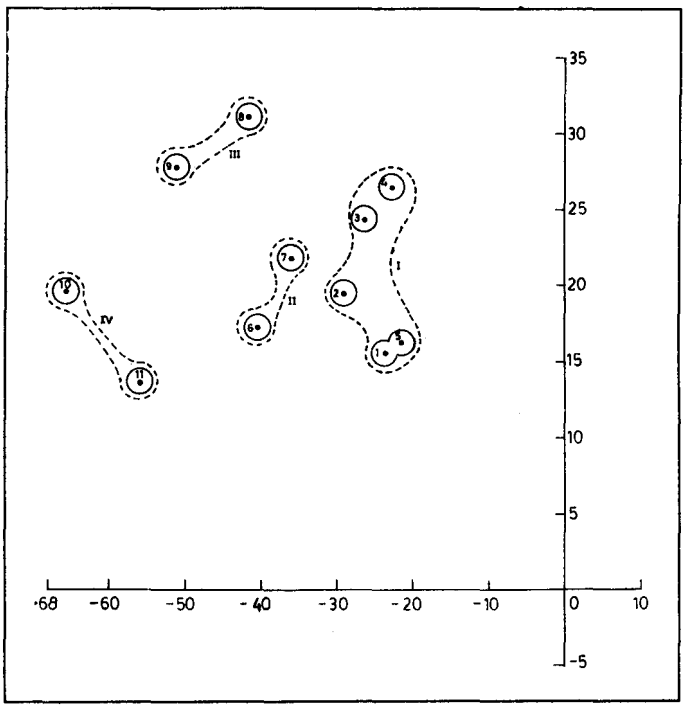

Fig. 1.
Canonical diagram of the first two cononical vectors showing relative positions of eleven cultivars of litchi: 1) Rose Scented; 2) Muzaffarpur; 3) Naffarpal; 4) Elachi; 5) Mclean; 6) China; 7) Early Muzaffarpur; 8) Kasba; 9) Bombai; 10) Bedana; 11) Seedless.

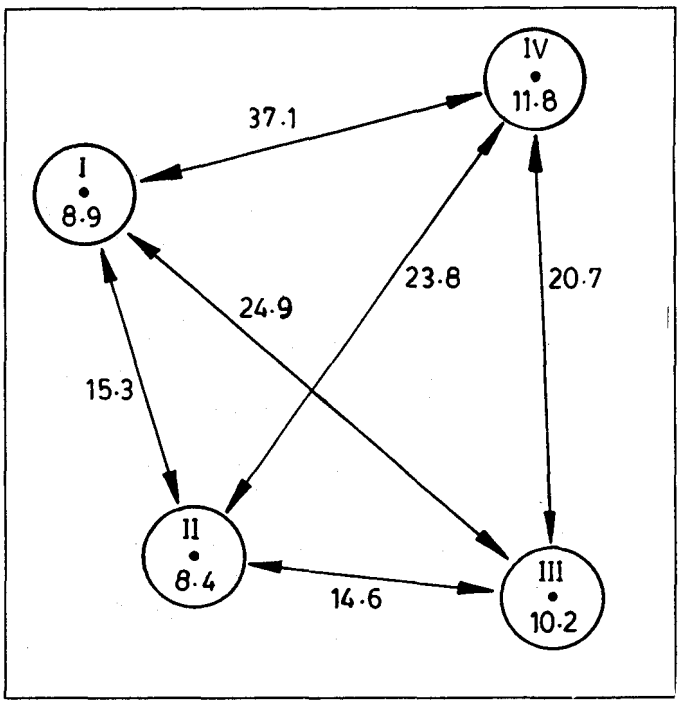

Fig. 2.
Cluster diagram showing genetic divergence between varietal groups (clusters) of litchi.

Since all kinds of gene actions and interactions are possible in the expression of a quantitative character, it is advisable to make crosses between genotypes selected from the clusters with high mean performance to get desirable transgressive segregates. The mean values of the six characters in the four clusters (Table 3) showed that cluster III was superior in respect of different characters (fruit length, diameter and weight and peel and aril weight), followed by cluster IV. It was also evident that genotypes of cluster I had higher stone weight, an undesirable character.

Table 3. Cluster means for six characters among eleven litchi cultivars

Character	Mean values of different clusters			
	I	II	III	IV
Fruit length (cm)	3.5	3.6	4.2	3.4
Fruit diameter (cm)	3.0	3.2	3.5	3.5
Fruit weight (g)	14.8	16.9	24.3	20.3
Peel weight (g)	2.4	2.4	3.9	2.5
Aril weight (g)	9.6	10.8	16.4	15.8
Stone weight (g)	2.9	2.7	4.0	2.0

Based on the intercluster distances and character means of the four clusters, hybridization between cultivars of cluster I and those of cluster IV is likely to give maximum heterosis for fruit yield, while crosses between the cultivars of clusters III and IV are expected to yield derivatives with better fruit characters.

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