GENETIC DIVERGENCE IN CULINARY VARIETIES OF BANANA

K. A. Mercy[1] and K C. George

College of Veterinary and Animal Sciences, Trichur 680 651, India

The use of Mahalanobis D^2 statistic for estimating genetic divergence has been emphasized by many workers (Chaudhary and Singh, 1975; George, 1976). Suchan and Sarma (1971) and Peter and Rai (1976) examined the genetic divergence of tomatoes using D^2 statistics. Estimation of genetic diversity in banana varieties has not been attempted so far in detail. Banana being an important fruit crop in India, high yielding, disease resistant and delicious banana varieties with keeping qualities are to be developed for the benefit of the banana cultivators. Hence the present study was undertaken to estimate the genetic deversity among 30 culinary varieties of banana, to find out the character which contributes maximum towards genetic divergence, to form clusters of banana varieties which are genetically diverse and to make a comparative study of the clusters formed through the D^2 analysis and through canonical analysis.

Materials and Methods

The study was based on the crop raised at the Banana Research Station, Kannara of the Kerala Agricultural University in randomised blocks with three replications, each replication containing three plants. Observations were recorded on thirteen different morphological characters. The characters observed were height, girth, leaves per plant, hand weight, finger weight, bunch weight, fingers per bunch, finger length, finger thickness, hands per bunch, fingers per hand, peducle length and roots per plant.

Genetic divergence was studied in this set of material using Mahalanobis D^2 statistic and canonical analysis, as described by Rao (1952). D^2 values based on uncorrelated variables were used to classify the 30 varieties. The constellation of groups were formed according to Tochers method (Rao, 1952). The characters which contributed maximum towards genetic diversity was found by ranking the D^2 values and through canonical analysis.

Results and Discussion

Analysis of variance carried out separately for each of the characters has shown highly significant differences among the varieties for all the 13 characters studied. Wilks 'Λ' criterion has also shown highly significant differences among the varieties for the aggregate effect of all the characters ($\chi^2 = 2219.36$ for 13×29 df). These differences suggest the existence of considerable divergence among the materials under study.

[1] Present address: Department of Agrl. Statistics, College of Horticulture, Trichur 680 654, India

Table 1
Cluster means for 13 characters

Cluster No.	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}
I	288.0	75.0	31.7	1186.3	86.4	10.4	102.3	13.0	15.5	75	13.7	72.4	218.1
II	294.2	74.4	31.5	680.1	46.4	11.7	161.7	11.4	9.3	11.2	14.7	80.1	245.7
III	321.9	72.5	31.2	1702.8	149.4	12.9	73.5	17.3	14.2	6.0	12.4	78.5	260.3
IV	212.0	62.7	30.7	1058.7	69.6	7.4	90.3	19.0	100	67	19.1	79.2	122.0
V	299.7	78.7	32.3	884.1	55.8	13.7	221.7	10.0	8 8	12.7	175	95.0	347.7
VI	331.7	81.0	31.7	1003.8	68.7	20.2	275.3	10.3	8.4	15.0	18.7	134.7	203.7
VII	346.7	73.0	28.3	2058 3	189.2	14.0	75.0	16.7	15.8	6.0	12.5	101.3	277.0
VIII	303.3	73.0	31.0	156.0	124.5	14.5	105.3	18.1	13.5	8.0	13.1	81.8	197.0
IX	311.7	73.0	27.7	2369.0	217.2	12.2	61.0	19.8	25.4	5.0	12.1	74.7	241.7
X	340.0	73.3	31.7	1447.3	117.0	9.8	56.7	17.8	14.3	5.3	10.7	98.2	138.7
XI	317.3	75.7	32.3	857.3	76.0	16.8	201.0	13.4	10.0	13.0	15.5	138.7	167.0
XII	322.0	75.0	31.7	2177.3	175.3	11.3	57.0	18 4	24.7	5.3	10.8	179.0	221.3

X_1 = height, X_2 = girth, X_3 = leaves per plant X_4 = hand weight, X_5 = finger weight X_6 = bunch weight, X_7 = fingers per bunch.
X_8 = finger length, X_9 = finger thickness, X_{10} = hands per bunch, X_{11} = fingers per hand, X_{12} = peduncle length and
X_{13} = numbers per root.

Table 2

Grouping of varieties into different clusters

Cluster	No. of varieties included	Varieties included in cluster
I	11	Neymannna, Mannan, Alukhel, Sawai, Boodi, Hybrid Sawai' Sambrani Monthan Neyvannan, Vannan, Gloria, Ennabenian.
II	5	Kapur, Jaya, Nangneripeyan, Nellabaksa, Asyhyabathesa.
III	5	Bluggoe, Karibontha, Malaimonthan, Monthan, Bising.
IV	1	Erachi Vazha
V	1	Pisang Awak
VI	1	Pay Kunnan
VII	1	Nallabontha
VIII	1	Kanchikela
IX	1	Pachabontha Bathesa
X	1	Ashmonthan
XI	1	Walha
XII	1	Chetty

The computed D^2 values varied substantially showing high divergence among the different strains. Maximum divergence was observed between varieties 'Kanchikela' and 'Pachabontha Bathesa' (19065.20). The minimum divergence was between 'Neymannan' and 'Mannan' (160.97). On the basis of relative magnitude of D^2 values all the 30 varieties were grouped into 12 clusters out of which the first cluster included 11 varieties, the second and third clusters five varieties each and remaining nine clusters only one variety each. Cluster means for the thirteen characters are given in Table 1. The grouping of varieties is shown in Table 2. The intra and inter cluster average D values are presented in Table 3. Intra–cluster D values were least in cluster 2 and highest in cluster 1 while the divergence at inter-cluster level was maximum between cluster 8 and 9.

The D^2 values were ranked by taking the varieties pairwise for each character. From the ranks, the character bunch weight (yield) showed the maximum variability followed by hand weight. In the same manner, the minimum contribution of the variability was through girth followed by height.

Canonical analysis revealed that the first two canonical roots accounted for more than 90 per cent of the total genetic diversity present in the 30 varieties. The first two canonical vectors which correspond to the first two canonical roots are presented in Table 4. From the table of canonical vectors the characters hand weight and bunch weight respectively accounted for the maximum variability. Girth and height showed the minimum variability.

Table 3

Average intra and inter-cluster D values of 12 clusters

Cluster No.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
I	26.8	66.2	43.9	42.0	42.3	44.5	65.8	75.3	82.8	35.0	51.8	75.1
II		21.3	72.9	47.1	32.2	42.1	95.9	66 5	114.1	57.6	39.4	95.6
III			21.5	60.8	66.6	66.5	32.0	104.5	51 8	38.2	76.6	39.5
IV				0.0	61.3	53.2	84.5	74.1	101.2	31.3	43.5	90.1
V					0.0	34.3	85.0	88.0	107.6	62.7	47.9	90.1
VI						0.0	889	83.6	100.7	64.6	70.0	85.4
VII							0.0	126.7	37.3	57.0	94.7	34.7
VIII								0.0	138.1	85.1	72.0	124.6
IX									0.0	74.2	117.8	22.7
X										0.0	50.7	56.6
XI											0.0	99.3
XII												0.0

Table 4

The first two canonical vectors based on the first two canonical roots

No.	Character	Vector 1	Vector 2
1	Height	0.0171	0.0092
2	Girth	-0.0096	0.0055
3	Leaves per plant	— 0.0170	0.0104
4	Hand weight	0.6613	**0.4948**
5	Finger weight	—.0.0294	-0.1384
6	Bunch weight	—-0.4521	0.7582
7	Fingers per bunch	—0.4023	—0.2899
8	Finger length	—0.1488	0.2101
9	Finger thickness	-0.2215	0.0761
10	Hands per bunch	0.1934	—0.0884
11	Fingers per hand	0.0327	—0.0051
12	Peduncle length	-0.2457	0.1292
13	Numbers per root	0.1577	-0.0485

A scatter diagram showing the positions of the 30 varieties on the basis of mean values of canonical variates was prepared. From the scatter diagram it was clear that the 12 clusters formed on the basis of D^2 values were almost in agreement with the points shown in the scatter diagram. The only exception was the variety 'Ashmonthan'. This variety was not falling in the first cluster on the basis of D^2 values whereas it had a closer approximation to the varieties in the first cluster on the basis of canonical analysis which may be viewed as exception.

Summary

Thirty culinary varieties of banana grown at the Banana Research Station, Kannara, Kerala were observed for 13 different morphological characters and the data were subjected to analysis of variance. Significant differences were recorded among all the varieties with regard to different morphological characters.

By using D^2 analysis the varieties were grouped into 12 clusters which were homogeneous within and heterogeneous between. The same clustering pattern was obtained in the canonical analysis except for the variety 'Ashmonthan'. This variety was in the first cluster through canonical analysis. The characters which were contributing maximum towards divergence were bunch weight and hand weight. The characters which were contributing minimum towards divergence were girth and height. The same results were obtained through both the methods.

Acknowledgement

References

Chaudhary, B. D. and Singh, V. P. 1975. Genetic divergence in some and exotic barley varieties and their hybrids. *Indian J. Genet.* **35:** 409-413.

George, K. C. 1976. Estimation of genetic diversity among arecanut varieties· *Haryana J. hort. Sci.* 4: 49-56.

Peter, K. V. and Rai, B. 1976. Analysis of genetic divergence in tomato. *Indian J. Genet.* 36: 379-383.

Rao, C. R. 1952. *Advanced Statistical Methods in Biometric Research.* John Wiely and Sons, New York.

Sachan, J. K. S. and Sarma, J. R. 1971. Multivariate analysis of genetic divergence in tomato. *Indian J. Genet.* **31:** 86-96.