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Genetic diversity studies in coconut

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Divergence
Genetic Distance
Tall and Dwarf Varieties.

Abstract

Studies on genetic diversity of 28 coconut genotypes from coconut research Station, Veppankulam was evaluated based on 17 traits. Characters studied included both vegetative, inflorescence and fruit/nut characters. Genotypes were grouped into 8 clusters. Tall cultivars were grouped in 4 clusters. Dwarf cultivars resolved into four clusters. The inter cluster distance was highest in the seventh cluster. Andaman Ordinary Dwarf and Chowghat Giant dwarf show distinguishing nut characters constituted a separate cluster. This analysis indicated the possibility of obtaining promising progeny from the parents of divergent clusters. The study also confirmed the distinctiveness of the dwarf and tall varieties. Nut characters were found to be more efficient in assessing genetic divergence. Intercrossing among the genotypes belonging to cluster II and VII was suggested to develop high yielding varieties with other desirable characters.

Introduction

Coconut is a robust palm with tall slender and uniformly stem and massive crown with large no. of leaves bearing bunches of nuts in their axis. Variability exist among cultivars of coconut for many characters. Genetic improvement is normally achieved by selected the genotypes with desirable characters or combinations of good plant characters existing in the available tall and dwarf varieties. The study of material variation in cultivated crops is an essential prerequisite to the identification of varieties superior in respect to their economic attributes characterization and classification of coconut varieties was attempted by Narayanan and John (1949), Liyanage (1958) based on plant habit and geographical characters. The biometric clustering in coconut was carried out using different statistical methods by different researchers (Kumaran *et al*., 2000).

An assessment of nature and magnitude of diversity between genotypes will help to choose better parents for hybridization. Mahalanobis (1936) D^2 statistics of multivariate analysis is recognized as a powerful tool in quantifying the degree of genetic divergence among the population. This concept was employed in the present investigation to estimate the genetic distance among the 28 varieties of coconut and to identify the suitable donors for a successful breeding programme in the crop.

Materials and Methods

Twenty eight genotypes of coconut (*Cocos nucifera*.L) are maintained at Coconut Research Station, Veppankulam, TamilNadu, India, formed the materials for this study. The palms were planted in 1985 and the experiment was conducted in a Randomized Block Design with two replications. Observation were recorded from four plants represent ting each genotypes in each replication. The mean data of the four palms were subjected to statistical analysis. For studying the nut characters, two nuts of 12 months maturity were collected from each of the four palms at harvest.

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Varieties Used

Tall Varieties

1.	Andaman Ordinary	11.LCO
2.	Andaman Giant	12.LCM
3.	Cochin China	13.NGT
4.	ECT	14.PHO
5.	FijiTall	15.Sanblas
6.	FMS	16.Siam
7.	GOA	17.Spicata
8.	JMT	18.SSG
9.	JGT	19. Tailand
20.	Kappadam	20.WCT

Dwarf Varieties

1.	AOD	5.MGD
2.	CGD	6.MOD
3.	COD	7.MYD
4.	GBD	8.Ayiramkachi

Characters Studied

1. Girth at 1m level (cm)
2. Length of internodes (cm)
3. Palm height (cm)
4. Length of inflorescence (cm)
5. Length of spikelet portion (cm)
6. No. of spikelets
7. Bunches with button
8. Bunches without button
9. Bunches without nuts
10. No. of female flowers
11. Nut length (cm)
12. Nut breadth (cm)
13. Whole nut weight (g)
14. Dehusked nut weight
15. Kernel thickness
16. Copra content
17. Copra yield

All the 17 parameters were recorded and the data was statistically analysed. The mean data were analysed for genetic divergence using Mahalanobis D^2 statistics and the population were grouped into clusters according to Tocher's method as described by Rao (1972).

Results and Discussion

The Multivariate analysis giving the D^2 values between 28 genotypes revealed that these genotypes can be grouped into 8 clusters (Table 1). Among these clusters, cluster I consisted 10 varieties followed by VII and VIII had 4 varieties respectively. Table 1 shows the list of varieties in each cluster. Dwarf cultivars are comes under IV, VI, II and VIII clusters. The clustering pattern obtained in the present study revealed that the cultivars collected from one location were scattered in different clusters, thus supporting the view that geographic distribution and genetic divergence do not follow the same trend. Murthy and Arunachalam (1966) reported the genetic drift and selection in different environments could cause greater diversity than cluster I showed all the cultivars are comes under the Tall types cluster four and six have the dwarf varieties, these groups shows that varietal variation depends on the not only for the nut characters (Figure 1) but also depends in the vegetative characters. Nut characters have been found to be more dependable and had been used by Ovarasu (1998) and Zizumbovillareal and Punerio (1998). Rao and Pillai (1983) which also of the same opinion and indicated that the island populations Andaman ordinary, Andaman grant represent introgressed forms. Eventhough West Host Tall and East Host Tall are tall varieties they are grouped in two clusters. The differences between these varieties may be due to the spatial isolation of their environments.

Average intra and inter cluster D^2 values among 28 cultivars presented in Table 2 indicated that cluster II showed minimum intra cluster value. (12.67) indicating that the cultivars within the cluster were similar. While cluster VII showed maximum intracluster value (82.05) followed by cluster VIII (69.37) revealing thereby the existence of diverse genotypes in this cluster. The intercluster D^2 values ranged from 23.69 to 136.6. Minimum intercluster D^2 values was observed between cluster II and III (23.69) indicating the close relationship among the cultivars included in these clusters. Maximum intercluster value observed between cluster III and VII (136.6) which indicated that the genotypes included in these clusters had maximum divergence. Hence intermating between the cultivars included in these different clusters may give high heterotic response and better segregants. The average cluster means for 17 characters are attributed in (Table 3). The genotypes included in the cluster III were in high palm height,

Table 1: Distribution of the clusters

Cluster No	No. of varieties in cluster	Description of varieties
I	10	Andaman Ordinary, Andaman Giant, Cochin China, ECT, Fiji Tall, FMS, GOA, JMT, TGT , NGT
II	2	PHO,SSG
III	2	LCD. Spicata
IV	2	AOD,CGD
V	2	Tailand, WCT
VI	2	GBD,MGD
VII	4	Kappadam, LCM, COD, Ayiramkachi
VIII	4	Sanblas, Siam, MOD, MYD

Table 2: Inter and Intra cluster D^2 and D (parenthesis) values in coconut

Cluster	I	II	III	IV	V	VI	VII	VIII
I	1706.30 (41.30)	996.84 (31.57)	1135.04 (33.69)	3494.96 (59.11)	2919.01 (54.02)	2919.23 (47.08)	16374.74 (127.96)	3224.37 (56.78)
II		160.70 (12.67)	561.36 (23.69)	3212.30 (56.67)	3475.69 (56.95)	1922.85 (43.85)	15874.23 (125.99)	2635.58 (51.33)
III			192.92 (13.88)	1751.64 (41.85)	2918.28 (54.02)	848.83 (29.13)	18674.49 (136.6)	2146.28 (46.32)
IV				227.79 (15.09)	45678.19 (67.58)	578.87 (24.05)	13576.55 (116.57)	2687.11 (57.83)
V					548.92 (23.42)	3050.97 (55.23)	8263.57 (90.90)	4960.37 (70.42)
VI						588.90 (24.96)	13021.86 (114.11)	2273.49 (47.68)
VII							6733.76 (82.05)	17108.03 (130.79)
VIII								4812.47 (69.37)

Table 3: Cluster means for seventeen characters in 28 varieties of coconut

Cluster	1	2	3	4	5	6	7	8	9	10
I	88.65	43.94	11.76	83.50	38.57	38.27	17.50	4.90	9.42	29.28
II	100.37	44.50	11.35	72.75	31.50	39.62	13.78	4.75	8.50	30.55
III	78.00	38.87	11.77	93.12	47.75	32.37	16.85	4.37	8.87	34.03
IV	76.87	41.87	8.36	75.12	33.75	32.50	23.31	4.50	8.87	23.76
V	79.62	41.87	9.94	89.25	38.93	46.75	30.78	4.62	12.62	29.25
VI	91.25	43.43	11.04	79.50	39.00	42.75	22.59	4.50	8.62	30.37
VII	76.37	34.50	9.73	77.40	39.12	35.00	53.31	4.68	14.06	27.80
VIII	84.18	44.50	9.29	79.81	38.50	37.43	18.90	4.50	8.06	30.20

length of inflorescence, no. of spikelet portion. N'cho *et al.* (1993) grouped the coconut genotypes based on vegetative characters. Sugimura *et al* (1997) also reported that usefulness of leaf and spathe characters

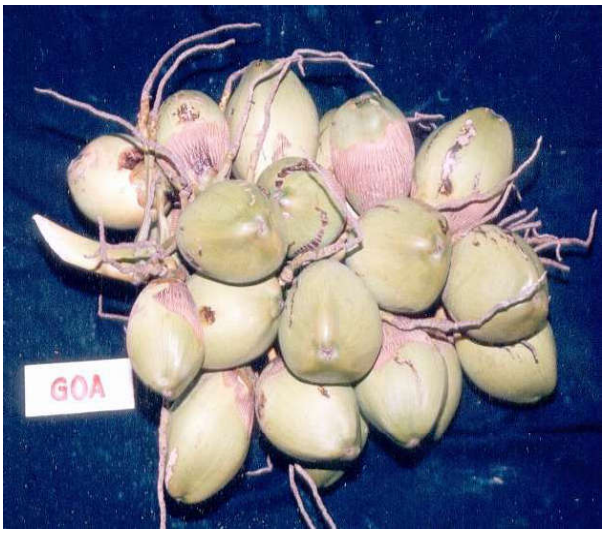

Fig. 1: Nut characters of different varieties

in the genetic analysis of coconut cultivars. Kumaran *et al*. (2000) reported that the variations in leaf and inflorescence characters contributed to variation in coconut genotypes.

Among the inflorescence characters, no. of female flowers was highest for cluster III (34.03) followed by cluster II (30.55). Cluster V also have more. No of bunches (Ayiramkachi Figure 1) without nuts and cluster V also have more nut breadth and highest no. of spike lets. Members of this cluster can be said to be distinct with respect to floral characters. Balakrishnan and Namboodiri (1987) found inflorescence characters as major factors contributing to divergence. Cluster VIII has highest nut length, whole nut weight and dehusked nut weight. Variability considered in this study was not split into two separate groups, "Dwarfs and Talls". This is in confirmation with the finding of Jay *et al*. (1991). He had reported the same while classifying coconut cultivars based on leaf polyphenols. He suggests that the appearance of dwarfism, on the species historic scale, is a relatively recent phenomenon. It can be concluded from the above experiments that the genotypes included in cluster II and VII hold good promise as parents to use in selection and hybridization programme.

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