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GENETIC VARIABILITY AND SEGREGATION OF SEX IN NUTMEG (*MYRISTICA FRAGRANS* Houtt.)

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ABSTRACT

In a progeny population of 16 elite mother trees of nutmeg from Kallar, Burliar, Kozha, Kalady, Moovattupuzha, Kottayam and Balamore, significant variation was observed only for plant height, number of main shoots, number of years taken for flowering, fruit weight and ratio of mace to seed weight. There was no statistically significant variation for number of erect shoots, mean girth at 1.4 m. canopy size, yield of fruits and weight of seed and mace among the progenies. Estimates of genetic parameters for the significant attributes revealed higher magnitude of phenotypic coefficient of variation (PCV) as compared to the corresponding genotypic coefficient of variation (GCV) indicating predominant role of environment in the expression of these characters. The estimates of heritability and genetic advance were low for all the characters barring the ratio of mace to seed weight, thereby implying the importance of non-additive genetic variance. Lack of significant variation for yield and certain other attributes and low estimates of heritability for most of the significant attributes can be attributed to narrow gene pool of original mother trees from which the present day nutmeg population evolved.

INTRODUCTION

Nutmeg (*Myristica fragrans* Houtt.) in India is about two centuries old crop. The original source material comprised only a few trees. At present, nutmeg is cultivated in an estimated area of about 3000 hectares, confined mainly to the states of Kerala and Tamil Nadu. Scientific breeding work of nutmeg in India is yet to get momentum.

Available literature on variability is limited to a few studies on growth rate, productivity, size and shape of leaf, flower size, shape and size of fruit and nut and correlation of fruit characters (Flach and Cruickshank, 1969; Shanmugavelu and Rao, 1977; Sriram, 1977; Krishnamoorthy *et. al.*, 1992). In order to evolve a sound breeding programme for any crop, an understanding of the variability existing in the germplasm is very essential, besides the breeding system of the plants concerned. To this end, we report the first ever assessment of variability in nutmeg population of the country.

MATERIALS AND METHODS

The materials for the present study form the progenies of 16 nutmeg trees, collected from the main areas of domestication of nutmeg in India, viz., Kerala and Tamil Nadu. Progenies of 16 trees collected two trees each from Kallar, Burliar, DAF Kozha, Kalady, Chalakkudy, Moovattupuzha and Kottayam. They were planted in a RBD at the Research Farm of the National Research Centre for Spices, Calicut during 1979. All recommended package of practices were followed. The progeny trees were of uniform age (14 to 15 years). Observations were recorded on sex, canopy shape, leaf shape, height, number of main shoots, number of erect shoots, main girth at 140 cm above ground level, number of years for flowering, canopy size and yield particulars. Data were analysed statistically. Mean, range, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability and genetic advance (for the

the other characters is found to be non-significant.

A perusal of data on genetic parameters viz., genotypic coefficient of variation, phenotypic coefficient of variation, heritability and genetic advance for the significant traits reveal that the phenotypic coefficient of variation was more than the corresponding genotypic coefficient of variation for the different characters. This clearly implies the predominant role of environment in the expression of these traits.

The estimates of heritability and genetic advance for the five significant characters, barring the ratio of mace weight to seed weight are low, indicating the importance of non additive genetic variances. The low estimates of genetic parameters for most of the significant attributes, coupled with nonsignificant variations observed for the characters like number of erect shoots, mean girth at 140 cm. above ground level, canopy size, yield of fruits and weight of seed and mace indicated lack of adequate genetic variability in the nutmeg population in the country. It is considered that the present day nutmeg population of the country evolved from a few trees was introduced from Moluccas by Britishers. Thus, the entire spectrum of genetic variability at present is centered around these few source trees. Further, given the fact that nutmeg is a long duration crop, there was not much scope for natural selection also to act. ~~These factors would have resulted in the narrow selection also to act.~~ These factors would have resulted in the narrow genetic variability observed in the present study. The role of vegetative propagation of nutmeg in the olden days is not known.

Out of the total 90 progenies observed for segregation of sex, 40 were male, 45 female and 5 bisexual types (Table II). Warburg, and Die Muskatnusz (1897) state that the sex ratio of nutmeg is uncertain. Janse (1898) estimate the percentage of male flowering trees, if raised from seeds, as 30 to 50, unisexual and bisexual taken together. Deinum (1932; 1949) observed that when trees are raised from seeds, unisexual female will be 55%, unisexual male will be 40% and bisexual 5%. Guenther (1960) mentioned that nutmeg when planted from seed, about 50% of the trees will be male. Nichols and Pryde (1958), reviewing literature on the subject came

Table II. Sex ratio in progenies of parent trees of different locations

Location	Sex proportion in progenies		
	Male	Female	Bisexual
Kallar	3	6	–
Burliar	3	5	–
Kozha	7	8	–
Kalady	9	10	1
Chalakkudy	9	1	
Moovattupuzha	7	5	–
Balamore	2	–	2
Kottayam	3	2	1
Total	40	45	5

to the conclusion that all data show general agreement in that female and male seeds are produced in approximately equal numbers. Flach (1966) concluded that freely pollinated seeds of apparently unisexual female mother trees show a segregation into one unisexual female tree to one bisexual or unisexual male tree. The present study almost agrees with the conclusion of Flach (1966).

The shape of tree is generally erect, conical or spreading with a few intermediate types. Similarly the leaf shape is generally elliptic or oblong with a few ovate and obovate types. Based on the yield characters five accessions, viz. plant No. 25 and 79 of DAF Kozha 92; 22 of DAF Kozha 101; plant no. 20 and 86 of Kannampally, Chalakkudy Tree No. 47, have been identified as better yielders (Table 3). They yield more than 500 fruits per year, flowering in the 6th year after planting. In general, they have spreading canopy with elliptic leaf shape.

To conclude the present study clearly indicates that even though there exists morphological variation for leaf and canopy shape in nutmeg population, exploitable genetic variation for crop improvement of nut meg is very much lacking. Given the fact that vegetative multiplication is the most common propagation method in this crop, the present finding will have far reaching implication. Propagation of a few elite mother trees orginating from a narrow genetic base will usher in genetic vulnerability

Table III. Salient features of high yielding nutmeg progenies

Characters	DAF Kozha 92		DAF Kozha 101, Kannampally, Chalakkudy 47		
	Progeny No. 25	79	22	20	86
Height	6.5	7.5	7	6.5	6.3
Sex	Female	Female	Female	Female	Female
Canopy shape	Spreading	Spreading	Spreading	Spreading	Conical
Number of main shoots	2	2	2	3	1
No. of erect shoots	0	2	4	4	2
Girth at 140 cm (mean of all main shoots) (cm)	39	30	43	35.3	47
Leaf shape	Elliptic	Elliptic	Elliptic	Elliptic	Elliptic
No. of years for flowering	6	6	6	6	6
Mean yield over 3 years (No.)	525	550	843	825	720
General bearing habit:	Very good	Very good	Very good	Very good	Very good
Fruit characters					
a) Fruit weight (g)	77.2	61.1	60.5	80.0	79.0
b) Seed weight (g)	12.2	9.3	8.4	11.4	9.2
c) Mace weight (g)	3.7	3.1	3.5	3.3	2.5
d) Mace wt : seed weight	0.30	0.33	0.42	0.29	0.27
Total canopy (cubic meter)	40	43	87.2	69.9	109.4

id corresponding causalities in the long run. Therefore, there is an urgent need to enrich the genepool of nutmeg by exotic introduction or by other means.

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