

A note on sterile nutmeg from the secondary center of domestication






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Abstract

A unique nutmeg accession having normal fruit, but with rudimentary, sterile seed and finely packed  mace having a human brain  appearance was collected from a farmer's garden from the secondary center of domestication  characterized. Seed (female) sterility in a dioecious or rare  monoecious plant like nutmeg is hitherto not recorded and  novelty. This unique accession is conserved at the germplasm conservatory of tree spices at ICAR- Indian Institute of Spices Research, Kozhikode, Kerala.

Keywords: female sterility, germplasm, *Myristica fragrans*, participatory germplasm collection, rudimentary seed

Nutmeg (*Myristica fragrans* Houtt.) (Family Myristicaceae) is an evergreen tree yielding two important  different spices namely, nutmeg and aril  (mace). Nutmeg is the dried kernel and mace is the dried aril which is  the fleshy reticulated covering over the seed.  Nutmeg, an important spice which also has immense medicinal properties was introduced into India by the British East India Company during the 18th century. And thus the tree has a domestication history of about 200 years in the country and at present India is one of the major production centers of the spice in the world. Nutmeg is predominantly a dioecious crop with male and female flowers borne on separate trees. However, monoecious trees are also reported in nutmeg (Flach 1966; Krishnamoorthy *et al.* 1996; Rema *et al.* 2014 ). Nutmeg is a cross pollinated crop and hence  variation exists in the seedling population  morphological and chemical parameters. Morphological variation

has been observed  tree shape, tree size, leaf size, flowering characters, fruit shape, fruit size, fruit colour, number of nut/fruit, size and thickness of aril etc. (Rema *et al.* 1997). Utilizing this variability, several  high yielding nutmeg varieties have  been released (Rema *et al.* 2003; Rema *et al.* 2014a). Many  farmer generated varieties  exist in this crop which were  derived from the first generation seedling mother trees (Sasikumar *et al.* 2014).

 Farmer participatory germplasm collection undertaken by  ICAR-Indian Institute of Spices Research, Kozhikode in Kerala State, a unique 25 year old nutmeg tree with rudimentary seed was located in a farmer's garden at Muniyara, Idukki district, (Lat: N9°55' 46" Long: E 77°04'31" Altitude: 850 m MSL. A collection number Acc.7653 was given to the specimen.  tree and the fruit traits were characterized using standard procedures.

Tree, fruit, aril and seed character were recorded in this unique Acc. 7653 (Table 1). Acc. 7653 has a conical shape with elliptic lanceolate leaf. Solitary flowers are borne on the leaf axil and the flowers are light creamy yellow, with thick gamosepalous perianth. The fruits were oblong in shape with a thick pericarp and with an average fruit weight of 105 g. The flowers and fruits produced by the tree are normal in appearance. The seed or kernel was rudimentary. The seed or kernel was rudimentary with an average seed weight of 0.043g and had the shape of orange seed with a size of 0.2 - 0.5 cm. The fresh and dry weight of aril ranged from 9.3 to 12.0 g and 2.0 to 3.0 g, respectively, in Acc. 7653. The aril was thick, compact and had the appearance of a human brain (Figs. 1 & 2). Comparative features of the accession vis-a-vis the normal tree are given in Table 1.

The seeds of Acc.7653 did not germinate even after three months and were sterile. Grafts produced from the tree were conserved in the germplasm repository of tree spices at the ICAR-Indian Institute of Spices Research, Kozhikode as an unique accession.

Being a cross pollinated crop wide variability exists in nutmeg for fruit, mace, seed and quality characters. But this is the first time a seed sterile nutmeg with rudimentary seed is observed. Though the seed weight in a normal nutmeg ranges from 6 to 17 g, and the seed size from 2 to 4 cm, this is the first report of a nutmeg with such small size (0.2 - 0.5 cm) and weight (0.043 g) and hence is considered as unique and novel. More over the seed was sterile and did not germinate. Generally, a nutmeg tree has conical or cylindrical shape and the fruit shape would be round, oblong or oval in a normal tree and the colour would range from light yellow to deep yellow. There was no abnormality for these characters in Acc. 7653 when compared to normal nutmeg. However, unlike the aril in normal tree which is reticulate covering the entire seed, in this case the aril was thick, compact and had the appearance of a human brain!. However, the average aril weight was similar to that of a normal nutmeg though its shape was different, may be due to

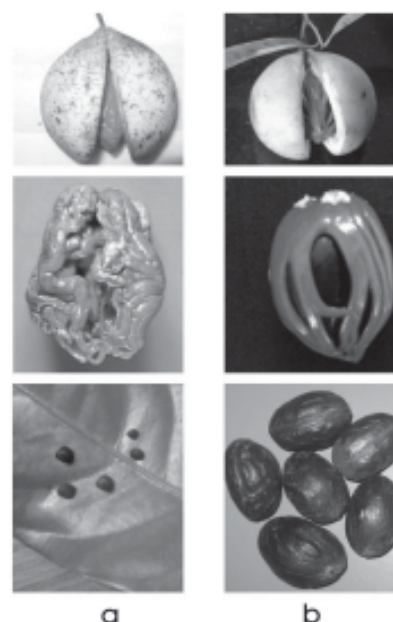


Fig. 1. Fruit, aril and seeds of sterile (a) and fertile nutmeg (b)

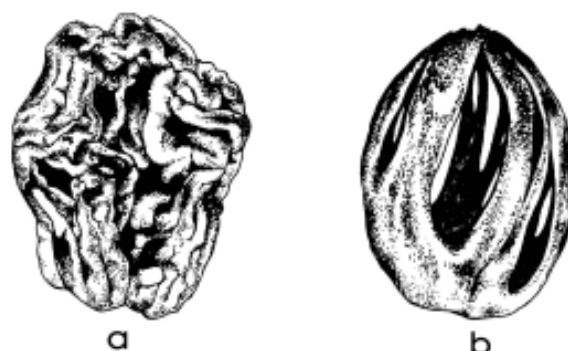


Fig. 2. Aril of sterile nutmeg and normal one- Schematic representation

the absence of the seed and the varied ontogeny. Though male sterility is relatively more common in plant kingdom, female sterility is rare, may be due to lethality. However, in a tree like nutmeg where, excellent vegetative propagation methods have been standardized, the seed (female) sterility need not be a bane. Nutmeg yields two spices namely the seed (kernel) and aril (mace), the later being more valuable as a spice. Hence, even though the tree produces only aborted seeds (nuts), the other spice, the mace, production will remain an incentive to maintain the seed sterile trees by the growers which can be propagated vegetatively.

Table 1. Comparative features of the seed sterile nutmeg and the normal nutmeg

Trait	Seed sterile nutmeg	Normal nutmeg
Canopy	Conical	Conical, cylindrical
Leaf shape	Elliptic- lanceolate	Elliptic
Leaf size, cm	12.45 × 6.8	12.1 × 5.0
Fruit shape	Oblong	Oblong, round, oval
Fruit weight, g	105 .0	50.0 – 175.0
Seed size, cm	0.2- 0.5	2.0- 4.0
Seed shape	Like banana seed	Round, oblong
Seed weight, g	0.043	6.0-17.0
Aril weight (fresh),g	9.3- 12.0	5.0-18.0
Aril weight (dry),g	2-3.0	0.5-4.0
Aril shape	Human hand like, many fold, closely folded and compact	'Reticulate', straight and loose
Aril colour	red	red
Palatability	Typical taste like	Typical taste like

In a predominantly dioecious tree like nutmeg, seed sterile female plants are not yet reported and this variant (mutant) is a novelty. An yellow mace mutant is the lone natural mutant reported in nutmeg (Rema & Krishnamoorthy 2014). Occurrence of extremely rare natural mutants in a perennial plant like nutmeg in its secondary center of domestication that too within in span of about 200 years of domestication is very interesting.!

Even though mutation(s) is indicated to be the causative factor for female sterility in other plants, the exact reason behind this phenomenon in nutmeg needs to be studied. Zero seed mutants in fruit trees like rambutan, litchi etc. if spotted or induced will have definite consumer preference.

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References

- Flach M 1966 Nutmeg cultivation and its sex problem. Mededelingen Landbouwhogehoe school, Wageningen 66: 1-85.
- Krishnamoorthy B, Sasikumar B & Rema J 1996 Genetic variability and segregation of sex in nutmeg (*Myristica fragrans* Houtt.), J. Plantn. Crops 24: 468-472.
- Rema J & Krishnamoorthy B 2014 Conservation of a nutmeg variant with yellow aril at Indian Institute of Spices research. Indian J. Arec. Spices Med. Plants 17: 13-14.
- Rema J, Krishnamoorthy B & Mathew P A 1997 Vegetative propagation of major tree spices – a review. J. Spices Arom. Crops 6: 87-106.
- Rema J, Krishnamoorthy B & Mathew P A 2003 High yielding varieties of cinnamon and nutmeg. *Spice India* 16: 7-17.
- Rema J, Krishnamoorthy B, Mathew P A & John Zachariah T 2014b IISR Keralashree - A new nutmeg variety. Indian J. Arec. Spices Med. Plants 16: 25-27.
- Rema J, Saji K V, Sasikumar B & Anandaraj M 2014a Monoecious nutmeg in Uttarkannada and Shimoga Districts of Karnataka. Indian J. Arec. Spices Med. Plants 16: 3-5.
- Sasikumar B, Rema J & Saji K V 2014 In the trail of elite nutmeg. *Spice India* 7: 8-14.