Major chemical constituents of nut, mace and leaf of *Myristica fragrans*

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Abstract

Nutmeg *Myristica frangrans* Houtt is a very important tree spice, having both industrial and medicinal applications. Nut and mace are commercially important spice products. It is also a unique spice, which causes hallucination if consumed in large quantities. The nutmeg plants maintained at IISR experimental farm, Peruvannamuzhi contained 2-12% oil in nut, 3-15% in mace and 0.5-2% in the leaf. Myristicin and elemicin, two constituents of the oil, known to cause hallucination are present in all the three parts. The concentration of these constituents vary widely in these three parts.

Key words : chemical constituents, elemicin, mace, *Myristica fragrans*, ,myristicin.

Introduction

Nutmeg, *Myristica fragrans* is an important tree spice having lot of applications in industrial and medicinal fields. Nut and mace are commercially very important. Nutmeg is the kernel of the seed and mace is the dried aril that surrounds the single seed within the fruit. It is a spreading evergreen tree, usually dioecious, which is native to Moluccas in the East Indian Archipelago belonging to the family Myristicaceae. Mace is more expensive than nutmeg. Both nut and mace are used as spices and in medicine. The essential oils are similar in both spices. The flavours of them are distinctive. Nutmeg is used in small quantities to flavour mild dishes, cakes, punches and possets. Mace is used to flavour savory dishes, pickles and ketchups.

Nutmeg is known to have stimulative, carminative, astringent and aphrodisiae properties. Oil of nutmeg is used for flavouring food products and liquors, in perfumery, for scenting soaps etc. Nutmeg butter is used as a mild external stimulant. The volatile oil present in both spices contain myristicin and elemicin which are narcotic and poisonous which prevent large scale consumption of it. (Purseglove *et al.* 1981). Being an introduced crop with few seedlings, we cannot expect much genetic variability in the nutmeg trees grown in Kerala. However, variability was seen in the secondary metabolites like nutmeg oil, mace oil, starch, protein, leaf oil etc. An attempt has been made to characterise few nutmeg accessions based on the nutmeg butter, volatile oil, leaf oil, myristicin and elemicin levels.

Materials and methods

Nutmeg accessions maintained at Indian Institute of Spices Research, Experimental Farm Peruvannamuzhi were used for the study. The naturally splitting fruits are harvested. The nut and mace are separated and dried under shade. The mace is removed separately and dried. After removal of mace, nutmegs are dried in their shells. The dried kernel and mace are used for the study. Butter was extracted from the kernel using petroleum ether. (Sadasivam Manickam 1992). Saponification value of the butter was estimated. Protein, starch, reducing sugars and phenol content were also estimated. Essential oil was estimated using the hydrodistillation method using Cleavenger trap and oleoresin was extracted using acetone by the cold percolation technique. (ASTA 1968) constituents of the oil were detected in gas chromatograph. Gas Chromatographic profile was carried out in a HS-40 Perkin-Elmer GC equipped with a 1022 GC plus integrator. The column used was SE-30. Oven was programmed from 70-210°C at the rate 5°C/min. The compounds were identified using reports of authentic standards.

Results and discussion

Levels of oil, oleoresin, myristicin and elemicin content in the oil are listed in Table 1. Myristicin and elemicin are known to be the major hallucinogenic compounds present in the oil. The essential oil in the nut ranged from 4.5 to 12.4 % and the mace ranged from 4.9 to 15.8%. Purseglove *et al.* (1981) reported upto 21% oil in nut and mace. Mallavarapu and Ramesh

(1998) reported 4.5% oil in nutmeg and 10.5% in mace. Gopalakrishnan (1992) reported 6.6% in nutmeg and 9.2% in mace. He has carried out the proximate analysis of nutmeg and mace. He has reported myristicin as the major hallucinogenic principle. The variability in myristicin and elemicin in both nut and mace are remarkable. Myristicin content in the nut oil ranged from 1.3 to 17.6% and in the mace oil it ranged from 4.3 to 22%. Elemicin content ranged from 0.6 to 19.8% in nut and 1.9 to 18.4% in mace. Similar observation is evident in nutmeg butter and saponification value. Butter content ranged from 25 to 42% in kernel and the saponification value from 202% to 244%. The butter percentage and saponification value of the same is given in Table 2. Saponification value is an indication of fatty acid present in the fat. The main fatty acid present

Table 1. Levels of oil, oleoresin, myristicin and elemicin in the accessions.

Acc.No.	Ess.oil (%)		Oleoresin (%)		Myristicin in oil (%)		Elemicin in oil (%)	
	Nut	Mace	Nut	Mace	Nut	Mace	Nut	Mace
A4-22	4.5	4.9	13.5	10.8	1.3	4.4	1.7	2.5
A9-79	6.0	6.8	3.6	9.18	10.8	20.4	1.3	1.9
A9-150	12.4	9.7	4.2	7.5	5.3	0.7	0.6	5.9
A9-41	9.0	10.0	4.8	3.2	17.6	22.0	14.2	18.4
A9-72	9.0	11.0	4.2	7.5	7.5	14.2	11.5	17.0
A9-12	9.0	11.0	17.0	5.3	4.4	7.14	12.0	13.3
A9-69	6.0	11.6	7.3	3.1	1.3	-	5.2	-
A9-86	9.9	15.8	4.4	2.5	4.9	4.3	19.8	19.3
Mean	8.2	10.10	7.3	6.1	8.8	10.4	8.3	11.2
S.D.	2.4	3.1	4.7	2.9	5.4	8.4	7.0	7.5

Table 2. Levels of butter and saponification value.

Acc. No.	Butter (%)		Saponification value
	Nut	Mace	Nut
A4-22	24.0	23.0	241.4
A9-79	42.0	18.0	224.0
A9-150	25.0	42.0	220.0
A9-41	29.0	24.0	235.0
A9-72	38.0	27.0	230.0
A9-12	37.0	19.0	202.0
A9-69	27.0	25.0	224.0
A9-86	40.0	19.0	225.0
Mean	32.75	24.63	225.13
S.D.	6.78	7.23	109.0

Table 3. Leaf oil levels and profile in 15 accessions.

Acc. No.	Leaf oil (%)	Myristicin in oil (%)	Elemicin in oil (%)
A11-70 Male	1.5	11.9	0.9
A11-70 Bisexual	2.5	8.5	0.6
A11-70 Female	1.0	3.2	0.4
A11-70 Female	1.2	9.6	1.2
A11-70 Male	1.4	0.3	0.3
O3-Bisexual	1.0	0.8	0.8
A9-17 Bisexual	1.0	7.2	0.4
A4-35 Male	1.0	0.7	1.8
O6-Female	1.25	0.5	0.5
O4-Male	1.25	3.6	5.6
O7-Female	0.99	0.4	0.3
A9-27 Male	1.24	0.7	0.3
A9-25 Female	2.2	11.8	7.2
A9-18 Female	1.25	4.9	0.3
A9-26 Male	0.98	0.7	0.7
Mean	1.3	4.3	1.4
S.D.	0.45	4.4	2.0

Table 4. Total phenol, protein, starch and reducing sugars in nutmeg accessions.

Acc. No.	Protein (%)		Starch (%)	Reducing Sugars (mg/g)	Phenol (mg%)
	Nut	Mace	Nut	Mace	Mace
A4-22	11.5	17.8	25.0	1.3	412 A9-
79	7.4	10.5	30.8	1.5	208 A9-
150	8.9	8.2	26.9	2.8	109 A9-
41	4.5	11.0	32.8	2.2	155 A9-
72	4.5	10.6	37.2	3.0	130 A9-
12	4.8	10.5	35.5	1.45	285 A9-
69	8.8	17.2	31.1	1.86	458 A9-
86	6.2	12.7	27.9	13.34	165
Mean	7.0	12.3	30.9	2.2	240 S.D
2.3	3.2	3.9	0.78	132	

in nutmeg butter is myristic acid. Leaf oil content and the myristicin and elemicin level are presented in table 3. Very good variability exist in the leaf oil and myristicin content. Male and female plants did not show any specific property with regard to these constituents. The variability noticed in protein content, starch, phenol and reducing sugars (Table 4) also establish the fact that good variability exist among the plants for these characters and they can be exploited and shortlisted for better chemical quality.

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