

ANATOMY AND HISTOCHEMISTRY OF *MYRISTICA FRAGRANS* ARIL

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ABSTRACT

Myristica fragrans Houtt. of *Myristicaceae* is an evergreen tree that produces two spices, nutmeg, and mace. The spice has a strong aroma and the essential oils can be used as a natural flavouring extract. The nutmeg and mace are used for culinary and medicinal purposes. The present study revealed that the anatomical structure and the histochemical localization of aril.

KEYWORDS: Nutmeg, mace, essential oils, spice.

INTRODUCTION

Medicinal plants have been used in virtually all cultures as a source of medicine. Assurance of safety, quality, and efficiency of medicinal plants and herbal products have now become a key issue in industrialized and in developing countries. The widespread use of herbal remedies and healthcare preparation is described in Vedas and the Bible. Medicinal plants have been used for thousands of years to flavour and conserve food, to treat health disorders and to prevent disease including epidemics. The knowledge of their healing properties has been transmitted over the centuries within and among human communities (Singh, 2015). Medicinal plants have a promising future because there are about half a million plants around the world, and most of them their medical activities could be decisive in the treatment of present or future studies.

Myristica fragrans which is commonly known as nutmeg belongs to the family *Myristicaceae* and is a medium-sized evergreen aromatic tree (Anonymous, 1962). It is traditionally known as jatiphal and javitri in India. The name *Myristica* is derived from a Greek word *Myron* a sweet liquid distilled from the plant (Everett, 1981). In India, spices have been traditionally used since ancient times, for the preservation of food products as they possess antiseptic and disinfectant properties. India is one of the major producers of spices in the world. The nutmeg is unique among tree spices as it is the donor of the two distinct spices, nutmeg, and mace. Nutmeg is the seed kernel inside the fruit and mace is the covering on the kernel. Both mace and nutmeg are used as condiment and medicine. Nutmeg has a characteristic pleasant fragrance and is slightly warm taste, mostly related to various activities of their essential oils, such as antimicrobial, antioxidant, antifungal Spasmolytic, carminative, hepatoprotective, antiviral, anticarcinogenic (Olajide *et al.*, 1999) (Tajudeen *et al.*, 2003) memory enhancer, antidiarrheal (Grover *et al.*, 2002) with a significant sedative property.

MATERIALS & METHODS

Fresh fruits of *Myristica fragrans* were collected from households in and around Kollam district of Kerala. The mature aril was mechanically removed using a knife. After removing the aril fresh free hand sections were prepared and stained with various stains like safranin and Toluidine-blue 'O'. For histochemical localization Oil red was used. Microphotographs were taken using a microscope and Nikon digital camera.

RESULTS AND DISCUSSION**Morphology and Anatomy of the Fruit**

The fruits of *Myristica fragrans* are pyriform and yellow in colour and having a shiny outer coat (exocarp) and a fleshy mesocarp below. Exocarp, mesocarp, and endocarp together comprise the pericarp of the fruit. (Fig 1, 2 & 3). When the fruit mature the pericarp is split into two equal halves and exposing the scarlet-coloured aril covering the dark brown seed.

Aril

The aril is flat, ribbon-like repeatedly lobed creamy when young and dark red when matured. The aril is fused at the base of attachment to the seed and become free above. The aril is loosely adhering on the seed and it is easily separable (Fig 2, 3 & 4). The aril is both funicular and exostomal in origin.

Seed

The seed is ovoid or ellipsoidal and thick. The nutmeg is the seed kernel inside the fruit. Mace is the fleshy red net-like skin covering (aril) over the kernel. The ribbon-like aril is attached at the base of the seed. The seed has shallow longitudinal furrow which represents the raphe. The Oilseed is within the seed coat (endocarp) which gets detached after drying. Testa and tegmen are the layers of seed while perisperm has oil ducts within the endosperm which also houses embryo (Fig 5, 6 & 7).

Anatomy and Histochemistry of Aril

In the transverse section, the aril is flat and isobilateral. Aril is differentiated into parenchymatous epidermis; the epidermal layers have shallow folds and have thin-walled cells with cuticle. The ground tissue of the aril is in the mixture of small and larger cells. The larger cells are called idioblast. In between the idioblasts are smaller, angular or spindle shape parenchyma cells. The idioblastic cells are 40µm wide. In the centre part of the aril, there are prominent discrete vascular bundles arranged in a plate. The vascular bundles have small, strands of phloem and

xylem elements (Fig 8, 9, 10 &11). Aril is the major part of the aroma compounds of the myristica.

For localization of various compounds, fairly thin hand sections were prepared, and the sections were immersed in oil red solutions for one or two minutes. The sections were observed under the microscope. On staining with oil red 'o', Oil containing cells show red and brown coloured oil droplets (Fig.7, 8). On staining with TBO also, oil droplets could be localized (Fig. 6) In the aril, there are wide, circulatory cavities surrounded by epithelial cells.



Fig.1. Mature Splitted fruit. 2. A fruits cut, exposing the arilliate seed.

3. Mature aril. 4. Mature seed.

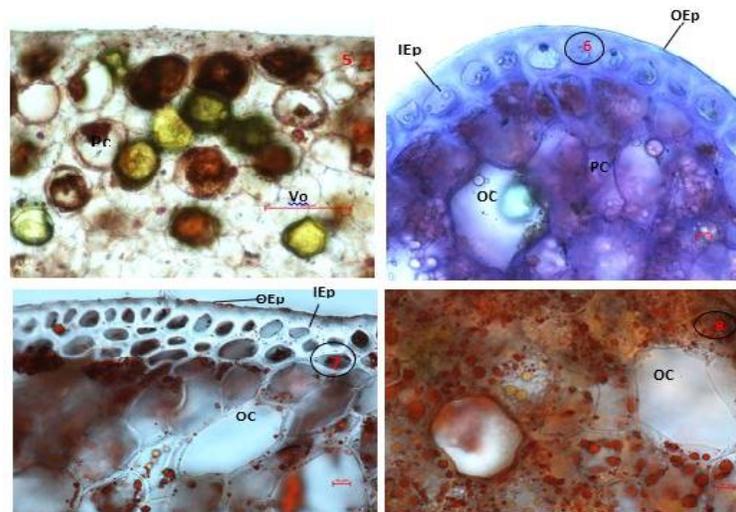


Fig.5 T.S of Aril stained with safranin. 6. T.S of Aril stained with TBO. 7&8. T.S of Aril stained with Oil red

(Pc- Paren chyma cells, IEp- Inner Epidermis, OC- Oil Cavity, OEp- Outer Epidermis, Vo- Volatile oil content)

SUMMARY AND CONCLUSION

Myristica fragrans is an aromatic plant, whose seed is widely used as a spice. Nutmeg has a characteristic pleasant fragrance and is slightly warm taste, mostly related to various activities such as antimicrobial, antioxidant, antifungal, spasmolytic, carminative, hepatoprotective, antimicrobial, antidiarrheal, anti-inflammatory *etc.* The seed contains about 10% essential oil. The plant produces odoriferous secondary metabolites in their fruits. The aril is the major source of aromatic compounds. With reference to the histochemical localization, the aril consists of wide secretory ducts, surrounded by epithelial cells. The present study revealed that the aril and the seed contain aromatic compounds. Oil-bearing cells were localized using Oil red. The anatomical studies of aril and seed revealed that the aril contains large number of oil-bearing cells.

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