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Anatomical and Histochemical Study of *Hydnocarpus pentandra* (Buch.-Ham.) Oken

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Biological diversity forms the basis of life on earth. Biodiversity means the variability among the living organisms from all sources and the ecological complexes of which they are part. It includes diversity within species or between species and of ecosystems [1]. The biodiversity found on earth today is the result of 3.5 billion years of evolution [2]. Plants form one of the dominant group with about 2,50,00 species, 70,000 genera and about 400 families and a major portion of this diversity is mainly concentrated in the tropics [3-4]. The state kerala has an exceptional biodiversity. In spite of its small size and high population density, it has forest area of 28.99% which is higher compared to the national forest cover of 21.08% [5].

Medicinal Plants based traditional systems of medicines are playing important role in providing health care to large section of population, especially in developing countries. Interest in them and utilization of herbal products produced based on them is increasing in developed countries also [6]. Herbal medicines are in great importance in planet due to their efficacy, safety and lesser side effects [7-8]. Herbal drugs are most widely used than allopathic drugs as antioxidants because they are in expensive have better cultural acceptability, better compatibility with the human body and minimal side effects [9].

Hydnocarpus pentandra is a medicinal tree and most widely distributed species in moist deciduous and semi-evergreen forests of Western Ghats, India upto 850m [10]. *Hydnocarpus pentandra* belongs to family Flacourtiaceae. This family consists of about 85-89 genera and 800-1250 species distributed throughout tropical and subtropical world [11]. These trees are upto 10 m tall. Trunk and bark brownish, fissured; blaze pinkish. Branches and branchlets subterete, minutely pubescent. Leaves simple, alternate, distichous; stipules caducous; petiole 0.7-2.2 cm long, subterete, pubescent; lamina 8-23 × 3.5-10 cm usually oblong to elliptic-

oblong, apex caudate-acuminate, base acute or cuneate, margin serrate, charactaceous, glabrous; midrib raised above; secondary nerves 5-7 pairs, obliquely ascending towards apex; tertiary nerves closely horizontally percurrent. Flowers are in axillary short cymes or solitary, tomentose; petals white. Flowering takes place from January to April. Fruit and seeds are berry, woody, globose, apiculate 6-10 cm across usually brown tomentose, black when young; seeds numerous [12].

Seeds are the economic part of this plant. Oil extracted from the seed is called chaulmoogra oil. It is mainly used in leprosy treatment. The seed oil contains 'Hydnocarpin' a flavonolignan which are responsible for antimicrobial, antibacterial, antileprotic, antitubercular, antipsoriatic, antirheumatic, hypolipidemic, antidiabetic, anticancer, anti-inflammatory, alterative, stimulant and antioxidant activities. Seed oil is helpful in the treatment of rheumatism, sprains and bruises, sciatica, arthritis and chest complaints [13]. *Hydnocarpus pentandra* also exhibit a wide range of antioxidant capacities, thus making them a valuable source of natural antioxidants [14]. This tree has been considered as a vulnerable species by IUCN [15].

Collection of plant material

Fresh and fully mature leaf, stem and petiole of *Hydnocarpus pentandra* were collected from the Kerala (Puthoor, Aryankavu). Healthy and disease-free plant part were selected for the study. Free hand sections with razor blades were prepared and stained with Toluidine – blue 'o', and Safranin.

Photography

Nikon binocular Eclipse- Niu model microscope with light and fluorescent options system was used to take micro photographs. Photographs of different magnifications were taken. For normal observation bright filed was used. For the study of crystals and lignified cells, polarized light was employed. Magnification of figures are indicated by scale bars.

Anatomical and histochemical studies

Leaf

In the cross section of midrib, the upper and lower epidermal cells are covered with thick cuticle, trichomes are present just above the upper epidermis (Fig 1). Trichomes are

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uniseriate and unicellular in type. Commonly it used in the protection of plant body from outer injurious agencies. Lower epidermis only cruciferous type of stomata present. The epidermis is single layered and rectangular in shape (Fig 2). Mesophyll contains palisade and spongy cells. Palisade tissues are irregular, contain single layer and 3-4 layers of irregularly,

and rounded, loosely arranged spongy parenchyma cells and polyphenolic compound are present (Fig 3). The vascular bundle are single, large and bowl shaped, Xylem towards upper side and phloem towards lower side. Xylem consists of vessels and phloem with sieve tubes and companion cells (Fig 4). The pith is parenchymatous [16].

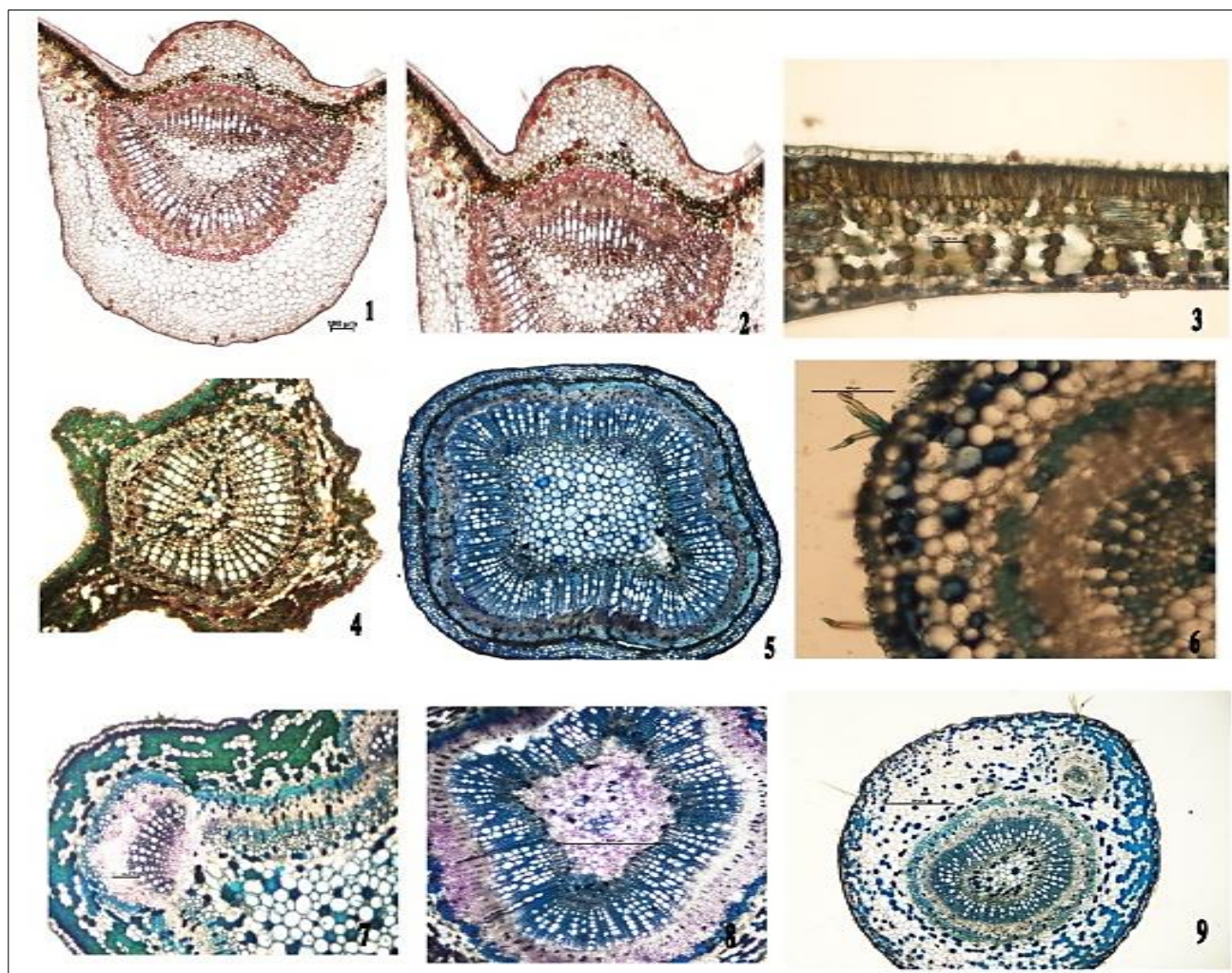


Fig 1 Cross section of midrib region stained with Safranin

Fig 2 Leaf stained with Safranin showing the trichomes

Fig 3 Enlarged portion of leaf lamina showing prominent palisade and spongy parenchyma and polyphenolic compound

Fig 4 Enlarged view of midrib region showing the vascular bundle

Fig 5 Section of stem showing the ground anatomy with medullary ray stained with Toluidine blue O

Fig 6 Stem stained with TBO showing the trichomes

Fig 7 Enlarged portion of a cork region showing the polyphenolic compound

Fig 8 Enlarged portion of stem section shows the vascular bundles and presence of Solitary calcium oxalate Crystals

Fig 9 Cross section of petiole Stained with TBO

Stem

The transverse sections of the stem show an outer rind region composed of a cork region made of thin-walled parenchymatous cells and externally covered by thick cuticle (Fig 5). Plant cuticle also plays critical role in plant defense against diverse bacterial and fungal pathogens, most of which use natural openings, such as stomata and hydathodes in leaves, or lenticels in fruits to enter plants without directly penetrating the cuticle layer [17]. Unicellular trichomes are found on the surface. Polyphenolic compound is observed in the cork region (Fig 6). Polyphenols appear blue green in colour on Staining with Toluidine blue O (Fig 7). A Pericycle is found as a composite and continuous ring of sclerenchyma cells. In addition to that large solitary calcium oxalate crystals are also present. The Vascular bundles are single circular with thick-

walled vessels of xylem elements and thick are phloem. Pith is made of parenchymatous cells (Fig 8) [18].

Petiole

The cross-sectional outline of the petiole has a broadly oval shape with even and smooth outline. The epidermis is uniseriate and darkly stained, consisting of small sized barrel shaped cells with outer thick walls. The supporting tissues of the petiole are collenchymatous. The collenchyma cells are found immediately beneath the epidermis. The Sclerenchymatous patches are also present below the epidermis. The vascular bundles are collateral. Pith comprises of rounded to polygonal parenchyma cells. Vascular ring is oval shaped. Unicellular trichomes are present on the upper epidermis (Fig 9) [19].

SUMMARY

The present investigation was aimed to study the anatomical features and localize important compounds in *Hydnocarpus pentandra* (Buch.-Ham.) Oken. belonging to the family Flacourtiaceae. It is commonly called as marroti. *Hydnocarpus pentandra* is a medicinal tree and most widely distributed species in moist deciduous and semi evergreen forest of Western Ghats India. It is grown upto 850m in height. The seeds yield Hydnocarpus or Chaulmoogra oil. The oil used in leprosy. Seed oil is anti-inflammatory, alternative, tonic,

used as local application in rheumatism, sprains. This paper will highlight the histochemical studies of *Hydnocarpus pentandra*. Microscopic studies revealed the presence of unicellular trichomes, calcium oxalate crystals, polyphenolic cells. Histochemical localization of polyphenols and solitary calcium oxalate crystals was carried out using Toluidine blue O and safranin. Anatomical and histochemical studies revealed the distribution of various tissue components in the stem, leaf and petiole and important chemicals such as polyphenols were localized. Further research of *H. pentandra* is necessary for elucidating the active principles and their mode of action.

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