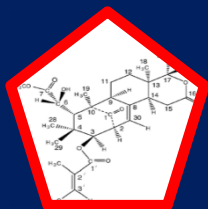
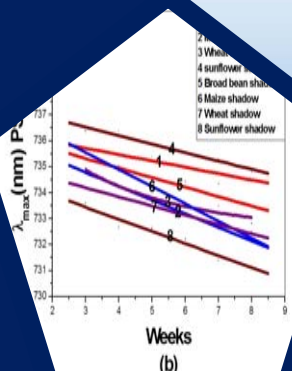




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Comparative Study Of Anatomy Of *Eucalyptus Microtheca* And *Eucalyptus Camaldulensis* Leaves

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ABSTRACT

The leaf is the most important part of the plant and can be studied histologically to find out its anatomical characteristics as good taxonomic evidence. In this study, the anatomical structure of the leaves of two *Eucalyptus* species *Eucalyptus camaldulensis* and *Eucalyptus microtheca* family Myrtaceae were compared to assist as a relevant source of information and contribute towards the standards to dispose the quality and identity of these plants to avoid adulterations. Transverse sections of the leaves of the two species were done using wax method technique. The anatomical structures of the leaves of the two studied species are closely similar. The upper epidermises are formed of one layer of small polygonal cells covered by thick cuticle, the cuticle of *E. camaldulensis* is thicker than that of *E. microtheca* and there are small epidermal hairs appeared as pappili. The two leaves are isobilateral formed of three layers of small palisade cells on both adaxial and abaxial sides. The region between the two palisade layers is narrow and formed of small spongy parenchyma cells with dense chlorophyll and small intercellular spaces. Large numbers of schizolysigenous oil glands are scattered through the transverse sections of the leaves, their sizes and numbers are larger in *E. camaldulensis* leaf. The vascular bundles are large heart shaped the size of the vascular bundle is larger in *E. camaldulensis*. The

vascular bundles are surrounded by sclerenchymatus sheath which is much denser in *E. camaldulensis*.

مستخلص

الورقة اهم جزء من أجزاء النبات ويمكن دراستها نسيجيا لمعرفة الصفات التشريحية كدليل تصنيفي جيد. في هذه الدراسة، تمت مقارنة التركيب التشريحي لأوراق نوعين من نبات الكافور هما الكافور كمالدولنسيس والكافور ميكروسيكا من العائلة الميرسيتية للمساعدة في ايجاد معلومات والمساهمة في وضع معايير نحو الجودة ومعرفة هوية هذه النباتات لتجنب الغش. تم عمل قطاعات مستعرضة لأوراق هذين النوعين النباتيين باستخدام طريقة تقوية الشمع. الصفات التشريحية للنباتين متشابهة جدا. البشرة العليا تتكون من خلايا مضلعة مغطاة بطبقة ادمة سميكة، طبقة الادمة اكثر سمكا في كمالدولنسيس ويظهر عدد من الشعيرات الصغيرة في شكل حلقات. اوراق النوعين من النوع متماثل الجانبين يتكون من ثلاث طبقات من خلايا عمادية صغيرة على جانبي الورقة. المنطقة بين طبقتي الخلايا العمادية ضيقة وتتكون من خلايا برانشيمية اسفنجية بها كمية كبيرة من البلاستيدات الخضراء وبينها مسافات بينية صغيرة. عدد كبير من الغدد الزيتية الانفصالية ينتشر خلال القطاع العرضي للأوراق وهي ذات عدد كبير في النوع كمالدولنسيس. الحزم الوعائية قلبية الشكل وحجمها كبير في النوع كمالدولنسيس، تحاط الحزم الوعائية بغلاف سكلرنشيمي وهو اكثر كثافة في النوع كمالدولنسيس.

Keywords: Leaf anatomy , *Eucalyptus camaldulensis*, *Eucalyptus microtheca*, *Myrtaceae*

1. INTRODUCTION

Eucalyptus genus are trees and shrubs. It comprises over 700 species, almost all of which are native to Australia (Chen and Craven, 2007). *Eucalyptus* trees range from 6 feet tall to over 300 feet, although there are differences among the eucalyptus species, there are several features common to almost all eucalyptus trees. Wood and leaf essential oil of *Eucalyptus* species are used for many purposes in pharmaceutical and cosmetics industries. Wood of the tree is mainly used for manufacturing paper, fiberboard, charcoal, acetic acid, methanol and cellulose (Dayal, 1988). In traditional medicine, *Eucalyptus* leaves are used as antiseptic against infections of the upper respiratory tract such as common cold, influenza, bronchitis and sinusitis (Seziket *et al* 1997). Additionally its essential oil has a therapeutic application in treatment of pulmonary infections by inhalation and is added to herbal candies, pastilles and cough syrups as antiseptic (Hasegawa *et al* 2008).

Tree, evergreen, stems: upright and irregular, leaves: 8 inch long, ribbon shaped, blue-green broadly or narrowly lanceolate to falcate, Base cuneate to asymmetric, apex acuminate and narrow, petiole 1-2 cm. Venation is pinnate, lateral veins joined near the edge of the leaf and form a parallel vein to the edge. Umbels 2-10 flowered, creamy yellow. Fruit conical, greenish-brown. seed pod. No thorns, wind resistant 1 (FABAD, 2012).

The objectives of the present study is to outline the anatomical characters of the leaves of *Eucalyptus camaldulensis* Dehnel. and *E.*

microtheca that can be utilized for the solution of existing of medicinal plant leaves adulterations and substitutions which can not be discovered in most of their morphological characters. These two plant species were selected because of their great importance in Sudanese traditional medicine and no anatomical studies were done on them in Sudan.

2. MATERIALS AND METHODS

2.1. The Plant materials:

The leaves of *Eucalyptus camaldulensis* and *E. microtheca* were collected from Khartoum state, Central Sudan and they were taxonomically identified by one author, Professor. Hatil Hashim Elkamali and herbarium specimens were deposited in the Herbarium of Botany department, Faculty of Science and Technology, Omdurman Islamic University.

2.2. Methods:

The leaves of the studied plants; *Eucalyptus camaldulensis* and *E. microtheca* were sectioned and studied anatomically. Wax method technique (Johansen, 1940) was used. The leaves parts were fixed for at least 72 hours using FAA (formalin: acetic acid: alcohol 90:5:5) fixative, washed several times using distilled water and dehydrated using serial concentrations of alcohol 50%, 70%, 90%, 95% and 100%, respectively. For clearing, they were transferred every three hours from a mixture of 1:1 cedar wood oil: absolute alcohol, into pure cedar wood oil followed by a mixture of cedar wood oil and xylene and finally left overnight in pure xylene. Wax embedding

was carried out in an oven adjusted at 60°C, embedded in clear wax and sectioned using a rotatory microtome. Staining was done using safranin and fast green stains, sections were mounted in a drop of Canada balsam, covered and left to dry. Five prepared slides of each of the two studied plant leaves were repeatedly examined under the microscope the best ones were chosen; the eye piece lens was (X10) whereas the objective lenses were (X4 and X20) and the slides were photographed using a digital camera fitted with the microscope.

3. RESULTS AND DISCUSSION

The transverse sections of the leaves of the two studied species showed that *E. camaldulensis* leaf is thicker (290µm) than that of *E. microthica* leaf (248.8µm) (plate 1). The upper epidermises are formed of one layer of small polygonal cells covered by thick cuticle, the cuticle of *E. camaldulensis* is thicker (10.35µm) than that of *E. microthica* (10µm) and there are small epidermal hairs appeared as pappili. The thick cuticle in *E. camaldulensis* may be due to the presence of wax, the abaxial cuticle is thicker than the adaxial.

The two leaves are isobilateral formed of three layers of small palisade cells on both adaxial and abaxial sides. The region between the two palisade layers is narrow and formed of small spongy parenchyma cells with dense chlorophyll and small intercellular spaces. Large numbers of schizolysigenous oil glands are scattered through the transverse sections of the leaves, their

sizes and numbers are larger in *E.camaldulensis* leaf, they are often located in the palisade layers close to upper and the lower epidermises. Calcium oxalate druses are found within and outer the vascular bundles.

The mid rib region is found to be 687.5 μm in *E. camaldulensis* and 491.07 μm in *E. microtheca*. The upper and lower epidermises in the midrib regions are followed by 3 to 6 layers of collenchymas cells which are interrupted by oil glands.

The vascular bundles are collateral, large heart shaped the size of the vascular bundle is larger in *E. camaldulensis* than in *E. microtheca* (plate 2). The vascular bundles are surrounded by sclerenchymatus sheath which is much denser in *E.camaldulensis*. There are distinct xylems and phloems. The lower epidermises are formed of one layer of small cells with large density of small hairs. The anatomical characters of the two studied species of *Eucalyptus* had been studied before and correlated with the ecological conditions; leaf anatomy is quite responsive to climatic conditions, for example *Eucalyptus camaldulensis* plants from more arid locations have thick leaves and high oil gland density (James, and Bell. 1995). Cao, 2000 also reported that low stomatal density and presence of two or more layers of palisade cells in leaves are xeromorphic features. *Eucalyptus microtheca* is well known for its high drought tolerance (Liand Wang. 2003). This is supported by specific structural adaptations like leaf thickness, increased sclerification in leaves, and total vascular region area and metaxylem area. Anatomical characteristics of the leaves of *Eucalyptus* genus are used to

differentiate the species. In certain species, oil glands were reported in pith and midrib Carr and Carr, 1969. The characters in this study coincide with Tombul (2012 who described the transverse sections of *Eucalyptus* leaves.



(a)



(b)

Fig 1. (Plate 1) Transverse sections of the leaves of (a) *Eucalyptus camaldulensis* (b) *Eucalyptus microtheca* (X40)



(a)



(b)

Fig 2. (Plate 2) Transverse sections of the leaves of (a) *Eucalyptus camaldulensis* (b) *Eucalyptus microtheca*(X100).

4. CONCLUSION

The anatomical study of the two *Eucalyptus* species revealed that they are closely similar. *E. cmaldulensis* is thicker with larger sizes and numbers of oil glands and vascular bundles. Further studies on this field will contribute positively in the identification and authentication of the medicinal plants.

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