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Assessment of the Usage in Folk Medicine and Morphological Characteristics of *Eucalyptus gomphocephala* and *Eucalyptus camaldulensis* in Northern Cyprus

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Abstract

One of the most significant and extensively planted genera in the world is *Eucalyptus*, which consists of tall, evergreen trees with leathery leaves. They are indigenous to Australia and comprise more than 900 species and subspecies. About 62 species of *Eucalyptus* may be found in Cyprus; 47 of these are named, while the remaining 15 are hybrid or unclassified. Traditional medicine uses a variety of *Eucalyptus* species as an antiseptic and to treat upper respiratory tract illnesses. By inhaling the essential oil extracted from these plants, pulmonary infections can be treated therapeutically. The purpose of this study was to provide information on the physical characteristics of *Eucalyptus gomphocephala* DC. and *Eucalyptus camaldulensis* Dehnh., as well as to investigate the traditional usage of *Eucalyptus* trees in North Cyprus.

It has been noted that there are numerous differences between the two species' flower buds, flowers, fruits, and barks. This study, conducted in Northern Cyprus, is to record and inform Eastern Mediterranean University Faculty of Pharmacy students and staff on the traditional uses of *Eucalyptus* species by various nations (Turkiye, Cyprus, Iran, Nigeria, Uganda).

One hundred informants whose ages ranging from 20 to 60 were interviewed in person for the study. Questions concerning the use of *Eucalyptus* plants, where they come from, which parts of the plant are used, and how they are used were asked to interviewees, who ranged in age from 20 to 60.

Observations have led to the widespread use of *Eucalyptus* by Iranian and Turkish Cypriots, Boiling the leaves and using the steam to enhance respiratory health was the most frequently used method in the local application of the plant in the treatment.

Keywords

Eucalyptus camaldulensis, *Eucalyptus gomphocephala*, folk medicine, North Cyprus

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INTRODUCTION

Eucalyptus gomphocephala DC. and *Eucalyptus camaldulensis* Dehnh. belong to the Myrataceae family. Myrtaceae include about 5,950 species in about 132 genera. *Eucalyptus* is a genus of flowering plants with more than 700 species from the Myrtaceae family. *Eucalyptus* is a cultivated tree originated in Australia. All species of the family are evergreen trees and rich in organic hydrosols (Bachir and Benali, 2012; Adediran, 2021; Adediran et al., 2021; Tsintides et al., 2002).

French agriculturist Madon was the first to bring *Eucalyptus* to Cyprus. Madon, in 1876, was sent to Cyprus by the Ottoman administration to prepare a report regarding existing forests (Yıkıcı, 2015). *Eucalyptus* trees dry up swamps and prevent malaria. During XVII. and XIX. centuries, *Eucalyptus* trees were used to drain swamps that were the source of malaria in Cyprus (Gorcelioglu, 1988).

Eucalyptus trees are widely used for health-improving purposes to fight against malaria. They also play a vital role in producing pollen for bees by flowering during the long, dry periods of the year. The trees can grow on chalky and clayish hills. *E. gomphocephala* DC. (tuart) and *E. camaldulensis* Dehnh. (river red gum) are flowering in late summer, especially from October to December during which honey bees can feed on the plants.

E. gomphocephala is a tree up to 40 meters tall. *E. gomphocephala* leaves are green lanceolate in shape, petiolate leaf with alternate leaf position, base attenuate, and the tip is mucronulate. Stem is smooth orange with orange petiole and pith glands of the stem are absent. The flower is a creamy in colour. Fruit with campanulate shape and orange colour has a shiny wax and slight fruit ribbing.

E. camaldulensis is an evergreen tree up to 30 meters high with whitish, yellowish or greyish patches after irregularly decorticated bark; simple, leathery leaves which are aromatic when crushed; glaucous green young leaves and dull green or pallid green mature leaves. Flowers are 5-10 in axillary umbels and appear from March to May. Fruits that re woody capsules ripen from August to September. It is an exotic tree in Cyprus and widely cultivated in the lowlands (Tsintides et al., 2002). *E. camaldulensis* (commonly known as the river red gum) typically grows on river edges and live up to a thousand year. This tree generally has a single stem, and a large trunk, and can grow as tall as 30-45 meters (Ghasemian et al., 2019). The trunk diameter of this species is usually between 1-2 meters. Leaves are alternate, with grey-

blue color, length is 8-22 cm long, width is 1-2 cm, often curved or sickle-shaped, tapering, short pointed at the base. The inflorescence is auxiliary, solitary, 7-11 flowered; flower buds are white, globularrostrate or ovoid-conical; operculum is hemispherical, rostrate or conical, 4-6 x 3-6 mm, obtuse. The flowering period is between August and November (Ozan, 2011). The bark is smooth and can have colour variations of white, yellow, green, grey, and pink. The barks of *E. camaldulensis* occasionally shred in strips or irregular flakes. Fruits are capsule, small, and contain tiny seeds (Al-snafi, 2017).

Studies about phytochemicals of *Eucalyptus* species are generally related to essential oils (EO) due to its high eucalyptol (1,8-cineole), caryophyllene and carvacrol in its composition. In addition to EOs, it includes many secondary metabolites. These are flavonoids (rutin, hyperin), phenolics, tannins, caffeic acid, and waxes. Phytochemicals and medicinal activities of the *Eucalyptus* tree were investigated by many studies. The EOs of *E. camaldulensis* have spasmolytic and antioxidative activities, and cytotoxic effects (Al-snafi, 2017). Research on antibacterial activity and phytochemicals of water-distilled EOs from leaves of *E. camaldulensis* collected from the North part of Cyprus was conducted. The findings showed that ethanone, eucalyptol (1,8-cineole), caryophyllene, and carvacrol were major components of the EO (Akin et al. 2010). In addition, the antibacterial activity of the vapor of *E. camaldulensis* EO from was investigated in another study. The findings showed that it inhibited the growth of both *Staphylococcus aureus* and *Escherichia coli*. 1,8-cineole was the major component, and terpeniol was the main contributory component for its antibacterial activity that exhibited an eight-fold higher effect than 1,8-cineole against *S. aureus* (Ghalem and Mohamed, 2008). Antimicrobial activity of 1,8-cineole against many bacteria including *Mycobacterium tuberculosis* and methicillin-resistant *Staphylococcus aureus* (MRSA), viruses, and fungi (including *Candida*) was reported (Sadlon Lamson, 2010). Antioxidant and antidiabetic activities of the EO of *E. camaldulensis* were documented in detail for the first time by Basak and Candan (2010). The tree also has analgesic, anti-inflammatory, antioxidant, immune-stimulatory, and spasmolytic activities. Vapor inhalation or oral route can be used in both purulent and non-purulent respiratory problems, including chronic obstructive pulmonary disease (COPD), bronchitis and asthma (Sadlon Lamson, 2010). 1,8-cineole, *p*-cymene, β-pinene, terpinen-4-ol, and globulol are the main chemicals found in EO of *E. camaldulensis* leaves (Pagula et

al., 2000). The species identification, chemical composition, and antibacterial activity of the fruits and leaves of *E. gomphocephala* were examined by Stankov et al. (2020). The fruits and leaves had 0.34% and 0.23% EO in their compositions, respectively. 1,8-cineole (46.69%), *p*-cymene (8.99%), baeckeol (8.57%), α-pinene (5.21%), and globulol (4.25%) were the primary constituents of tuart fruits' EOs whereas 1,8-cineole (24.25%), *p*-cymene (20.70%), α-pinene (14.15%), β-pinene (8.17%), γ-terpinene (6.90%), methyleugenol (6.78%), α-terpineol (4.75%), and limonene (3.80%) were the primary contents of tuart leaves' EOs. Additionally, they discovered that the EO of tuart leaves displayed more pronounced antimicrobial activity than fruit EO against all tested microorganisms (*S. aureus, Bacillus subtilis, Kocuria rhizophila, E. coli, Pseudomonas aeruginosa, Salmonella* Abony, *Saccharomyces cerevisiae, Candida albicans,* and *Aspergillus brasiliensis*) (Adediran, 2021).

A diverse range of biological activities has been reported for many compounds including flavonoids, tannins, phloroglucinol derivatives and terpenoids isolated from different *Eucalyptus* species. Gallic acid, quercetin, myricetin, chlorogenic acid, gentisic acid, and ellagic acid have been reported as components of *E. gomphocephala* and the EO constituents of *E. gomphocephala* included α-pinene, β-pinene, limonene, myrcene, 1,8-cineole, allo-aromadendrene and globulol (Al-Sayed et al., 2010).

Eucalyptus has a traditionally important role in Cyprus. Its leaves are widely used in folk medicine. The method of using *Eucalyptus* is breathing the vapor over a cauldron of boiling water containing the leaves with a towel-tent over the head. Sometimes, orange peel, lemon peel, rosemary, or myrtle are added to *Eucalyptus* leaves. This method is called ‘Thermo’ or ‘Hermo’ by local people. It is widely used against congestion, cough, bronchitis, cold and flu, asthma, sinusitis and for well-being in the postpartum period. Feet are put into the hot water containing *Eucalyptus* leaves against foot pain. Myrtle branches, orange, and lemon peel may be added beside *Eucalyptus* leaves against menstrual pain. The oil obtained from crushed leaves is used externally to relieve pain. The layer of leaves and olive oil are applied onto warts.

Local name of *E. camaldulensis* is Efgalitto or Okaliptus in North Cyprus. Preparation of *E. camaldulensis* for local usage is as follows: 10 leaves are boiled in 3 L water, and the resulting steam is inhaled. The steam obtained by boiling the leaves is used to treat flu, cold, and cough and relieve congestion.

MATERIALS AND METHODS

As plant material, *E. gomphocephala* and *E. camaldulensis* were collected from the Salamis forest at Famagusta region of Northern Cyprus, in October 2024 (Figure 1). The plant samples were identified, and the macroscopic and microscopic characterizations of herbal substances were conducted. Herbarium specimens (voucher numbers TE007 and TE008) were deposited and retained in the herbarium at Eastern Mediterranean University, Faculty of Pharmacy. Information such as local names, areas of use, parts used, preparation methods, and usage dosages of these plants were recorded.

Figure 1: Study area: Salamis forest (Map showing the location of Famagusta, North Cyprus).

a **b** **c** **d**

Figure 2. Flowers' buds (a), Flowers (b), fruits (c) and barks (d) of *E. gomphocephala*.

Flowers buds, Flowers, fruits, and barks of *E. gomphocephala* (Figure 2) and *E. camaldulensis* are shown in Figure 2 and Figure 3.

a **b** **c** **d**

Figure 3: Flowers' buds (a), Flowers (b), fruits (c) and barks (d) of *E. camaldulensis.*

In this study, it was aimed to collect data about the traditional usages of *Eucalyptus* species in different countries (Turkiye, Cyprus, Iran, Nigeria, Uganda) via a questionnaire conducted on 100 students and workers in Eastern Mediterranean University (EMU) Faculty of Pharmacy students and staff. Face-to-face interviews were conducted with students and the staff at EMU Faculty of Pharmacy. The participants were asked whether they have ever used *E. camaldulensis* for any local treatment. The participants who used the plant as a part of local treatment were interviewed about its usage, the part of the plants used and the method of application.

RESULT AND CONCLUSION

Of 100 participants, 50 reported that they have used *E. camaldulensis* as a part of local treatment. The plant's local use distribution by age group and nationality is displayed in Table 1. 27 (69.2%) Turkish Cypriots and 15 Iranians (100%) reported using *E. camaldulensis* as a local remedy. Only 5 (12.5%) out of 40 Turkish participants utilized *Eucalyptus* as a local remedy. Additionally, participants from Iran, Uganda, and Nigeria demonstrate that they use *Eucalyptus* as a local remedy.

Table 1: Distribution of the local use of the plant according to the nationalities and age groups.

	Age Groups (years)										
	20-30		**30-40**		**40-50**		**50-60**		**All**		**Total**
Country	**Y***	**N***	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Total**
Turkiye	5	33	0	0	0	2	0	0	5	35	40
Cyprus	8	12	10	0	2	0	7	0	27	12	39
Nigeria	3	3	0	0	0	0	0	0	3	3	6
Iran	12	0	0	0	0	0	0	0	12	0	12
Uganda	3	0	0	0	0	0	0	0	3	0	3
Total	**31**	**48**	**10**	**0**	**2**	**2**	**7**	**0**	**50**	**50**	**100**

*Y: Yes; N: No

The ages of the participants ranged from 20 to 60 years. In general, 39.2% (n=31) of participants whose ages ranged from 20-30 years used *Eucalyptus* for the treatment. All of 17 participants older than 30 years old responded that they have heard about the

usage of *Eucalyptus* as a local treatment in their countries (Table 1).

The majority of the interviewees stated that they learned the use of this medicinal plant from their parents and older relatives. Some of the participants stated that they inspect the fruits of the tree before collecting the leaves, while the others stated that they ask the elderly relatives which tree they need to gather for their own purpose. The locals, especially those who were older than 30 years old, said they can easily distinguish and utilize *E. camaldulensis* from other *Eucalyptus* species particularly because of its leaf odor. One of the primary differences in identifying *E. gomphocephala* as shown in Figure 2d, is the tree's bark; in Figure 3d, the barks of *E. camaldulensis* are different. The tree's body appears to have been peeled off, and it is light brown in color. The bark of the other species, *E. gomphocephala* (Figure 2d), is darker, and its body is dark brown, almost black. There are apparent differences between the flower buds and fruits of the *E. gomphocephala* (Figure 2a-c) and *E. camaldulensis* (Figure 3a-c) trees.

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