



Pharmacognostical Properties and Medicinal Uses of *Agathosma betulina* (Rutaceae): A Review

Kamyadeep Verma, Aayushee Singh, Prakash Deep, Vivek Srivastava, Shikhar Verma

Amity Institute of Pharmacy, Amity University Uttar Pradesh, Lucknow Campus, 226010, India.

*Corresponding author's E-mail: pdeep@lko.amity.edu

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ABSTRACT

Agathosma betulina earlier *Barsoma betulina* also known as boegoe, bucco, bookoo, diosma is an evergreen shrub indigenous to the cape region of South Africa belonging to family rutaceae. It is now cultivated commercially at an altitude of 300-700 m. The genus name *Agathosma* means good smell and *betulina* means birch like due to serrated appearance of leaves. The shrubs are up to 2 m tall with serrated leaves and star shaped axillary flowers with purplish pink colored 5 petals. Leaves are alternate, opposite, glossy with blunt round apex and possess large oil glands at the margins and small oil glands at the entire lamina. It is widely used for its antimicrobial, antioxidant, anti-inflammatory and diuretic activity and to cure prostatitis and uterine tract infections. Dried leaves are also used as an insect repellent and for deodorant. Traditionally buchu vinegar, buchu tincture and buchu tea were prepared from the leaves. Extract is more effective against gram positive bacteria than gram negative bacteria but not effective against fungi. The golden/pale yellow essential oil consists of flavonoids, isomenthone, diosphenol, pulegone, limonene and smells like black currant. The use of *A. betulina* is contraindicated during pregnancy and lactation because of the presence of pulegone which is hepatotoxic. It is adulterated with the senna leaves. *A. betulina* is propagated *in vitro* with the help of phytohormones like NAA (Naphthalene Acetic acid) and BA (6-Benzylaminopurine).

Keywords: *Agathosma betulina*, *Barsoma betulina*, rutaceae, serrated, buchu tea, flavonoids

INTRODUCTION

Buchu also known as boegoe, bucco, bookoo, diosma is found in cape region of south Africa at an elevation of 300-700 m is an evergreen shrub¹. Buchu earlier known as *Barsoma betulina* and origin of word barsoma (greek) meaning "heavy smell" and betulina (latin) meaning "birch like" due to serrated appearance of leaves². *A. betulina* is also known as round leaf buchu while *A. crenulata* is known as oval leaf buchu. The genus name *Agathosma* means good smell. The native people of South Africa earlier use oil and leaves of buchu. It is mainly used for anti-inflammatory, antiseptic, diuretic, urinary tract infections, prostatitis, high blood pressure, common cold, cough, fever and sexually transmitted disease^{3,4}. Dried leaves are also used as an insect repellent and in deodorants. It is cultivated on commercial scale, for its oil. The shrubs are 30 to 200 cm tall, with opposite, simple, entire 0.5 to 3.5 cm long leaves and flowers having 5 petals in white or pale pink colour. The taste of extract is like blackcurrant. In early 1860s the infusions of *Agathosma* leaves were sold in a bottle. Buchu vinegar was made by placing leaves and stalks in vinegar. Isomenthone and diosphenol are the primary constituents obtained from the golden/pale oil of *A. betulina*. Adulteration of senna with buchu leaves has been found more than a century ago.

Synonyms

Barosma betulina Bartl. and Wendl. f. Hartogia betulina Berg.on

Taxonomical Classification⁵

Kingdom	–	Plantae
Subkingdom	–	Tracheobionta
Superdivision	–	Spermatophyta
Division	–	Magnoliophyta
Class	–	Magnoliopsida
Subclass	–	Rosidae
Order	–	Sapindales
Family	–	Rutaceae
Genus	–	<i>Agathosma</i>
Species	–	<i>betulina</i>

MORPHOLOGICAL CHARACTERISTICS

It is an evergreen and perennial shrub with a height up to 2 m having yellow to brown stems. Leaves are alternate, opposite, glossy and pale green in colour with blunt round apex having dimension of 14-25*6-14 mm and length to breadth ratio is 1:95. Leaves possess subsidiary veins on abaxial surface with serrate margin having large oil gland at the margins and small throughout the leaf. Star shaped flowers upto 20 mm with five petals are solitary, axillary and white to purplish pink in colour⁶. Flowering season is between June to November. Fruits are brown coloured with 5 carpels.^{7,8}



a) Leaf



b) Flower



c) Plant



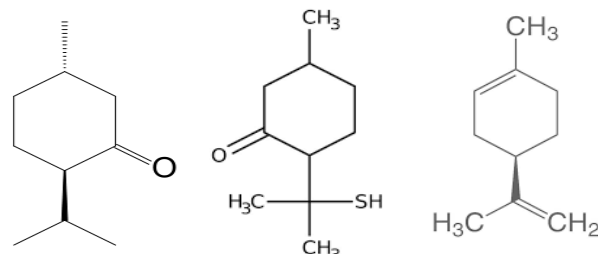
d) Dried leaves

Figure 1: *Agathosma betulina*

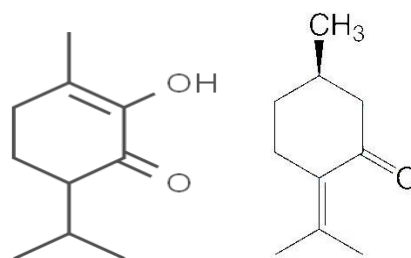
Chemical Constituents

Apart from flavonoids rutin and disomin, the foliage of *A. betulina* contains 1.5-2.5% of essential oil^{9,10} whose main constituents of essential oil are menthone/isomenthone

(29.83-60.0%), (ψ)- diosphenol (9.46-40.88%), limonene (11.6-17.0%), pulegone/isopulegone (7-34.1%), 8-mercapto-p-menthane-3-ones (3%),^{11,12,13} tricyclene, pinene, 2-methyl-3-buten-2-one, camphene, myrcene, p-mentha-1(7), 8-diene, α -terpinene, 1,8-cineole, terpinolene, methylcyclohexanone, isopinocampone, neomenthol, terpinen-4-ol, trans-dihydrocarvone, menthol, p-vinylanisole, cryptone, myrtenyl acetate, terpineol, borneol, neo-dihydrocarveol, neryl acetate, carveol, piperitenone, dimethyl anthranilate and eugenol.



Menthone 8-mercapto-p-menthane-3-one Limonene



Diosphenol

Pulegone

Agathosma betulina Oil

- Appearance – Golden/pale yellow
- Specific gravity – 0.91200 to 0.95600 (at 25° C)
- Refractive index – 1.47400 to 1.48800 (at 25° C)
- Optical rotation – 10 to 29
- Solubility – soluble in alcohol, fixed oil, water 434.5mg/L (at 25° C) and insoluble in propylene glycol and water.

MEDICINAL USES

Diuretic Activity

The diuretic activity of *A. betulina* is due to presence of diosphenol.¹⁴ Diosphenol and flavonoids irritate the gall bladder and induce urine production.¹⁵

Antimicrobial Activity

The essential oil of *A. betulina* possess antimicrobial property which is effective against certain pathogens namely *Staphylococcus aureus*, *Bacillus cereus*, *Klebsiella pneumonia* and *Candida albicans*.¹ Extract of *A. betulina* is more active against gram positive bacteria than gram negative bacteria.¹⁶ *A. betulina* is active against bacteria but not against fungi.

Anti-Oxidant Activity

The molecules which have one or more unpaired electrons, and are highly reactive, are known as free radicals which are of 2 types namely reactive oxygen species (ROS) and reactive nitrogen species (RNS).¹⁷ Polyphenolics are hoarder of free radicals which make them act as an antioxidant because of the capability of donating hydrogen of phenolic group.¹⁸ *A. betulina* contains flavonoids such as diosmin, hesperidin, rutin and mucilage which possess extensive antioxidant properties.

Anti-Inflammatory Activity

Limonene a monoterpene hydrocarbon which is a constituent of *A. betulina* possess good anti-inflammatory activity.^{1, 17} The essential oil of *A. betulina* inhibits the synthesis of leukotrienes by blocking the synthesis of 5-lipoxygenase and thus preventing inflammation. Limonene is also effective in reducing the biosynthesis of cyclooxygenase (COX) 1 and 2 enzyme thereby reducing the synthesis of proinflammatory agents like prostaglandins and leukotrienes which results in reducing inflammation.³

Urinary Tract Infection

Bacteria, responsible for urinary tract infection, are *Escherichia coli*, *Klebsiella pneumoniae*, *enterococci* and *Staphylococcus epidermis*.¹⁹ The reservoir for this pathogenic bacteria is near anus. Bacteria invades the urinary tract by forming colony in the opening of urethra which further get attached to the epithelial lining of the urethra. Invasion of urethra in men is difficult because of the distance between urethral opening and perianal region where bacteria resides and other reason is the presence of bactericidal prostatic fluid in urethra. Common symptom of UTI is dysuria i.e. painful urination. *A. betulina* has the antimicrobial property against certain bacteria and flavonoids reduce the inflammation and can be used for chronic UTI. The diuretic action flushes out bacteria by urinary tract due to its ability to increase urinary output resulting in reduced colonisation by bacteria. Herbal tincture increases fluid intake thereby increasing urinary output which flushes bacteria outside.

Traditional Uses

The leaves of *A. betulina*, because of having various phenolic compounds, possess diuretic and antiseptic properties so it was earlier used as herbal medication for gastrointestinal and urinary tract infections. In 1860's and 1870's "Buchu Tea" (leaf infusion) was sold in closed bottles mainly in English speaking countries. By placing leaves and stalks in brandy "Buchu Tincture" was prepared. "Buchu Vinegar" was prepared by steeping leaves and stalks in vinegar for treating bruises, contusions, sprains and fractures.^{20, 21} The plant was used as an insect repellent and oil was used as a moisturiser. It was topically applied for its antifungal property and smell.

Contraindication and Toxicity

The use of *A. betulina* is contraindicated during pregnancy and lactation because of the glutathione in liver.²³ Gastrointestinal irritation is reported when administered orally so it is not recommended for patients with kidney infections and haemorrhoids. It should be used at lower concentration because one of the constituent, diosphenol is toxic at higher doses.¹

In-Vitro Germination²²

Studies reveal that the radical appears 10 days after physical scarification and smoke treatment in-vitro. Decontamination is done with 1.5% NaOCl solution. Ex-vitro decontaminated plant material is not economically viable. Seedlings derived from germinated seed produces a stable plant with developed root system which is necessary at the time of hardening off, after *in-vitro* growth. Extracts are prepared by adding boiling water to the plant material whereas ethanol is used as an extractant. Explants are treated with phytohormones 2,4-D (2,4-Dichlorophenoxyacetic acid) 0.5mgL⁻¹ and 1mgL⁻¹. Phytohormone BA 0.5mgL⁻¹ (6-Benzylaminopurine) is used for producing soft and friable callus. NAA 3mgL⁻¹ (Naphthalene Acetic acid) is essential for developing multiple adventitious roots. The highest relative concentration of limonene was found in the callus of nodal explants when exposed to 0.5mgL⁻¹ NAA. Pulegone was not found making it suitable for limonene production.

CONCLUSION

The intensive study of *Agathosma betulina* proves its biological importance due to having various pharmacological uses. It is being used since long time as herbal medicine by the native people of South Africa and now it is cultivated commercially also through *in vitro* fertilization because of its medicinal value. The phytoconstituents present in the essential oil are used to treat various disease and infections and makes it of great importance. A thorough pharmacological study and clinical trials for various medicinal uses of *A. betulina* is still required it will also reveal the toxicity, contraindications and adverse effects in detail.

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