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@ik.amity.edu

Received: 18-06-2020; Revised: 22-08-2020; Accepted: 30-08-2020. DOI: 10.47583/ijpsrr.2020.v64i01.018

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, isomethone, 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 (Napthalene 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 shrub. 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 leaves. 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. 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. Isomethone 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 Classification

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

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 colour. Flowering season is between June to November. Fruits are brown coloured with 5 carpels.
Apart from flavonoids rutin and disomin, the foliage of *Agathosma betulina* contains 1.5–2.5% of essential oil, whose main constituents 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%), tricyclene, pinene, 2-methyl-3-buten-2-one, camphene, myrcene, p-mentha-1(7), 8-diene, α-terpinene, 1,8-cineole, terpinolene, methylcyclohexanone, isopinocamphone, neomenthol, terpinen-4-ol, trans-dihydrocarvone, menthol, p-vinylanisole, cryptone, myrtenyl acetate, terpineol, borneol, neo-dihydrocarveol, neryl acetate, carveol, piperitenone, dimethyl anthranilate and eugenol.

**Figure 1: *Agathosma betulina***

**Chemical Constituents**

Apart from flavonoids rutin and disomin, the foliage of *Agathosma betulina* contains 1.5-2.5% of essential oil, 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%), tricyclene, pinene, 2-methyl-3-buten-2-one, camphene, myrcene, p-mentha-1(7), 8-diene, α-terpinene, 1,8-cineole, terpinolene, methylcyclohexanone, isopinocamphone, neomenthol, terpinen-4-ol, trans-dihydrocarvone, menthol, p-vinylanisole, cryptone, myrtenyl acetate, terpineol, borneol, neo-dihydrocarveol, neryl acetate, carveol, piperitenone, dimethyl anthranilate and eugenol.

**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. Diosphenol and flavonoids irritate the gall bladder and induce urine production.

**Antimicrobial Activity**

The essential oil of *A. betulina* possess antimicrobial property which is effective against certain pathogens namely *Staphylococcus aureus*, *Bacillus sereus*, *Klebsiella pneumonia* and *Candida ablicans*. Extract of *A. betulina* is more active against gram positive bacteria than gram negative bacteria. *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 monoterpane hydrocarbon which is a constituent of A. betulina possess good anti-inflammatory activity.5 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 antiptic 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.

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.

REFERENCES

1. Moolla A, Van VSF, Van ZRL, Viljoen AM. Biological activity and toxicity profile of Agathosma (Rutaceae) species, South African Journal of Botany. 73, 2007, 588-592.
2. Gentry HS. Buchu, a new cultivated crop in South Africa, Economic Botany. 15(4), 1961, 326-331.
3. Moolla A, Viljoen AM. ‘Buchu’ – Agathosma betulina and Agathosma crenulata (Rutaceae): A review, Journal of Ethnopharmacology. 119, 2009, 413-419.
4. Lis-Balchin M, Hart S, Simpson E. Buchu (Agathosma betulina and A. Crenulata, Rutaceae) essential oils: their pharmacological action on guinea-pig ileum and...
antimicrobial activity on microorganisms, Journal of Pharmacy and Pharmacology. 53, 2001, 579-592.

5. https://plants.usda.gov/core/profile?symbol=AGBE2

6. Lis-Balchin M. Aromatherapy science: A guide for healthcare professionals, Pharmaceutical Press, London. 2006, 129-130.

7. Pillans N. A revision of the genus Agathosma (Rutaceae), Journal of South African Botany. 16, 1950, 55-117.

8. Spreeth AD, N Hersiening, Van D. Agathosma-species van kommersiële belang (A revision of the commercially important Agathosma species), Journal of South African Botany. 42 (2), 1976, 109-119.

9. Lynn K. British Herbal Pharmacopoeia, Biddles limited. 1996, 46-47.

10. British Pharmaceutical Codex, Pharmaceutical Society of Great Britain, Lund Humphries, London. 1963

11. Kaiser R, Lamparsky D, Schudel P. Analysis of buchu leaf oil, Journal of Agricultural and Food Chemistry. 23 (5), 1975, 943-950.

12. Blommaert KLJ, Bartel E. Chemotaxonomic aspects of the buchu series Agathosma betulina Pillans and A. crenulata Pillans from local plantings, Journal of South African Botany. 42(2), 1976, 121-126.

13. Posthumus MA, Beek TA, Collins NF, Graven EH. Chemical composition of the essential oils of Agathosma betulina, A. crenulata and an A. betulina × crenulata hybrid (Buchu), Journal of Essential Oil Research. 8, 1996, 223-228.

14. Gentry HS. Buchu, a new cultivated crop in South Africa, Economic Botany. 15 (4), 1961, 326-331.

15. Eaton CL. Aetiology and pathogenesis of benign prostatic hyperplasia, Current opinion in urology. 13, 2003, 7-10.

16. Viljoen AM, et. al. The biological activity and essential oil composition of 17 Agathosma (Rutaceae) species, Journal of Essential Oil Research. 18, 2006, 2–16.

17. Kothari S, Thompson A, Agarwal A, du Plessis SS. Free radicals: Their beneficial and detrimental effects on sperm maturation, Indian Journal of Experimental Biology. 48, 2010, 425-435.

18. Yen GC, Hsieh CL. Anti-oxidant activity of extracts from Du-zhong (Eucommia ulmoides) toward various lipid peroxidation models in vitro, Journal of Agricultural and Food Chemistry. 46, 1998, 3952–3957.

19. Ulleryd P. Febrile urinary tract infection in men, International Journal of Antimicrobial Agents. 22, 2003, S89-S93.

20. Grieve M. A Modern Herbal, Jonathan Cape, London. 1937, 133-134.

21. Skosana B, Aboua G. Buchu - The multi-purpose ethnomedicinally important species and its benefits in the reproductive system, In: Antioxidant-antidiabetic agents and human health. 2014, 297-316.

22. http://etd.cput.ac.za/handle/20.500.11838/841

Source of Support: None declared.

Conflict of Interest: None declared.

For any question relates to this article, please reach us at: editor@globalresearchonline.net

New manuscripts for publication can be submitted at: submit@globalresearchonline.net and submit_ijpsrr@rediffmail.com