

AGATHOSMA BETULINA HERBA

Definition

Agathosma Betulina Herba consists of the fresh or dried leaves and smaller stalks of *Agathosma betulina* (Berg.) Pillans (Rutaceae).

Synonyms

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

Vernacular names

boegoe, bergboegoe (A), buchu (San);
round leaf buchu

Description

Macroscopical^{1,2}

Evergreen, multi-stemmed, perennial resprouting woody shrub to 1m in height, with glabrous yellow to red-brown stems; **leaves** alternate to opposite, 14-25 × 6-14mm, broadly elliptic to nearly round (average length: breadth ratio 1.95), with rounded and recurved apex; glabrous with prominent main and subsidiary veins on abaxial surface; gland dotted on underside; margin serrate with an oil gland at the base of each serration; **flowers** (June-Nov) axillary, usually solitary, up to 20mm in diameter, white to pale purple-pink, borne on slender stalks ±7mm long.



Figure 1a: Live plant



Figure 1b: Dried leaf



Figure 2: line drawing

¹ Pillans, N. (1950). A revision of the genus *Agathosma* (Rutaceae). *Journal of South African Botany* **16**: 55-117.

² Spreeth, A.D. (1976). 'n Hersiening van die *Agathosma*-species van kommersiële belang (A revision of the commercially important *Agathosma* species). *Journal of South African Botany* **42(2)**: 109-119.

Microscopical³

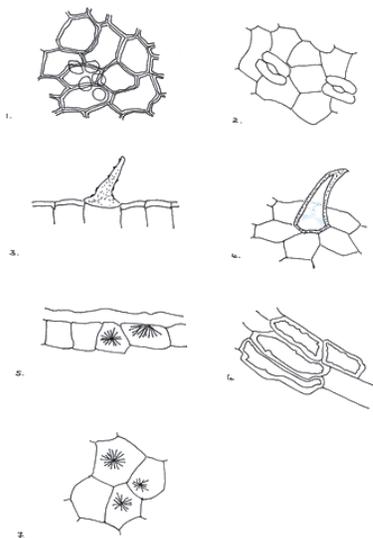


Figure 3: microscopical features

1. Cells of the upper leaf epidermis
2. Cells of the lower leaf epidermis with anomocytic stomata
3. Cells of upper leaf epidermis in sectional view showing unicellular warty clothing hair
4. Cells of lower leaf epidermis with clothing hair
5. Cells of upper leaf epidermis (sectional view) containing sphaerocrystalline masses of diosmin
6. Cells of the petiole
7. Cells of the mesophyll containing cluster crystals (rosette aggregates) of calcium oxalate

Characteristic features are: the polygonal cells of the upper leaf epidermis with slightly thickened walls, some containing sphaerocrystalline pale yellow masses of diosmin; the smaller thin-walled polygonal cells of the lower leaf epidermis; the numerous anomocytic stomata of the lower leaf surface only; occasional unicellular warty covering trichomes of leaf and petiole, each up to 300 μ in length; the cells of the leaf mesophyll containing calcium oxalate cluster crystals, each up to 80 μ in diameter; the spherical schizo-lysigenous oil glands of the mesophyll containing oil droplets staining red with Soudan IV solution; the fibres accompanying the leaf midrib and main veins.

³British Herbal Medicine Association (1996). Buchu. pp. 46-47 in: British Herbal Pharmacopoeia, Biddles Ltd., King's Lynn.

Crude drug

Collected as required or available in the marketplace as bundles of leafy twigs with light yellow-green, highly aromatic foliage; texture soft when fresh, leathery when dry; occasional flowers may be present. BPC quality buchu leaf is freely available in pharmacies in South Africa and unstandardised leaf in supermarkets.

Geographical distribution

Sandy mountain slopes of the Western Cape Province, in the Calvinia, Cedarberg, Tulbagh, Ceres and Piketberg districts, at altitudes of 300-700m above sea level.

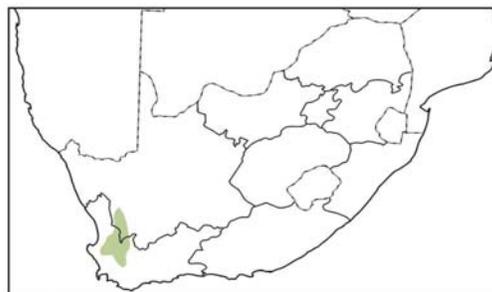


Figure 4: distribution map

Quality standards

Identity tests

Thin layer chromatography on silica gel using as solvent a mixture of toluene:diethyl ether:1.75M acetic acid (1:1:1). Reference compound cineole (0, 1% in chloroform). Method according to Appendix 2a.

Note The methods used for thin layer chromatography and HPLC gave poor results for this species. Further work is required.

HPLC on C₁₈ column, method according to Appendix 2b.

Water-soluble extractive value: not less than 14%³

Volatile oil content: not less than 1.3%³; not less than 1.8%⁴

⁴ British Pharmaceutical Codex (1963). Pharmaceutical Society of Great Britain, Lund Humphries, London.

Stems: not more than 5%^{3,4}
Total ash: not more than 5%^{3,4}

Purity tests

Assay

None available. Assay methods for buchu oil have been published.⁵⁻⁷

Major chemical constituents

Apart from the common flavonoids rutin and diosmin, the foliage of *A. betulina* contains 1.5-2.5%^{3,4} of an essential oil of which the main constituents are menthone/isomenthone (29.83-60.0%), (ψ)-diosphenol/diosphenol (9.46-40.88%), limonene (11.6-17.0%), pulegone/isopulegone (7.0-34.1%) and both *cis*- and *trans*-8-mercapto-*p*-menthane-3-ones ($\pm 3\%$)^{5,6,7}. The latter are said to contribute most to the characteristic odour of the oil, reminiscent of blackcurrants (see **d** below).

1. *Agathosma betulina*

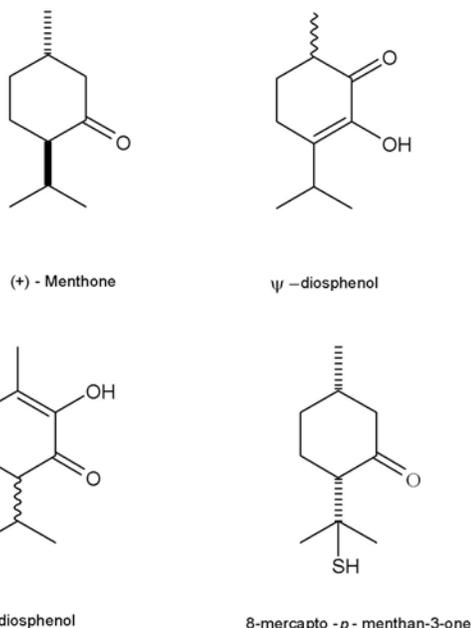


Figure 7: chemical constituents

Dosage forms

In traditional practice, *A. betulina* is most commonly taken orally in the form of an aqueous infusion, sometimes sweetened with brown sugar, or as a tincture in brandy. Other dosage forms include a vinegar infusion, for external application as an antiseptic wash or embrocation.^{GR1, 11 and 21-24}

Buchu was introduced into Britain in 1790 and in 1821 included in the British Pharmacopoeia (BP); later also in the British Pharmaceutical Codex (BPC). It remained an official remedy until 1963; dosage forms included a concentrated infusion (BPC 1954) and a tincture (BPC 1949). Various mixtures were listed in formularies current at the time e.g. Mistura Buchu et Hyoscyamus (British National Formulary 1939) and Compound Buchu Mixture (Chelsea Hospital for Women).

In Europe, a number of patent remedies containing buchu e.g. teas, dragees and drops are available for self medication^{GR8}.

Medicinal uses

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

⁶ Blommaert, K.L.J. and Bartel, E. (1976). Chemotaxonomic aspects of the buchu series *Agathosma betulina* Pillans and *A. crenulata* Pillans from local plantings. *Journal of South African Botany* **42**(2): 121-126.

⁷ Posthumus, M.A. van Beek, T.A., Collins, N.F. and Graven, E.H. (1996). Chemical composition of the essential oils of *Agathosma betulina*, *A. crenulata* and an *A. betulina* \times *crenulata* hybrid (Buchu). *Journal of Essential Oil Research* **8**: 223-228.

Buchu, originally a highly prized San and Khoi-khoi traditional remedy, has remained one of the most popular herbal medicines in South Africa. Its traditional use encompasses the treatment of kidney and urinary tract infections, colds, stomach ailments, rheumatism, gout and fever. Externally it is applied as an antiseptic wash to infected wounds and as a compress to relieve swelling, bruising and sprains^{GR1, 11 and 19-24}. Combinations of buchu with wilde als (*Artemisia afra*) or wilde knoffel (*Tulbaghia* spp.) are commonly taken for colds and influenza or as a general tonic.

Buchu was described in the BP and BPC as a weak diuretic and urinary tract antiseptic for the treatment of urethritis, cystitis and prostatitis. These are its recommended uses in Europe at the present time^{8, 9 and GR 6, 7, 8, 10}.

Pharmacology/bioactivity

In vitro tests of both aqueous/alcoholic extracts and of volatile oil demonstrated little antimicrobial activity against common urinary tract pathogens^{GR7}. A more recent study showed the essential oil (10µl/well) to possess weak antimicrobial activity against *Escherichia coli*, *Staphylococcus aureus* and *Saccharomyces cerevisiae* but none against *Enterococcus hirae* and *Pseudomonas aeruginosa*¹⁰. In the same study, initial smooth muscle spasmogenic activity (guinea pig ileum), followed by spasmolysis, was demonstrated for the essential oil (concentration range 4×10^{-6} to 8×10^{-5} v/v in methanol). Spasmolytic action was dose related, with an IC50 of 8×10^{-6} .

In an *in vitro* assay, aqueous leaf extracts showed no antiviral activity (cell culture) against Herpes Virus Type 2, Influenza Virus

A2 (Manheim 57), Poliovirus II or Vaccinia Virus¹¹. In this study no cytotoxic activity against HeLa cells was shown. Antimutagenic activity of an aqueous leaf infusion was assessed *in vitro* (*Salmonella typhimurium* TA 98 and TA 100) against ethyl methanesulphonate- and amino anthracene-induced mutagenicity, but no activity could be demonstrated¹². *In vivo* anti-inflammatory activity has been demonstrated for diosmin (isolated from the overground parts of the plant), which reduced carrageenan-induced rat paw oedema at a dose of 600mg/kg body weight. Other animal studies appear to be lacking.

Contraindications

Owing to the variable composition of buchu essential oil, particularly in respect of pulegone levels (see 9.0 above), the use of buchu preparations during pregnancy and lactation is contraindicated.

Adverse reactions

Traditional practitioners report gastro-intestinal irritation as a possible side effect of oral use. Buchu preparations should therefore be used with caution by patients suffering from kidney infections, haemorrhoids or irritable bowel syndrome. See also GR 6-8.

Precautions

Prolonged or excessive use of this herb is not advisable.

Dosage

Dried leaf: 1-2 g (\pm 1-2 teaspoonsful powdered leaf) by infusion, three times daily. An infusion may be prepared by adding 600ml of boiling water to 30g of powdered

⁸ Pharmacopée Française, Xe édition (1983). See also Bulletin Officiel No. 90/22 bis: Buchu, feuille

⁹ German Kommission E monograph (published 1/2/1990): Barosmae folium (Buccoblätter)

¹⁰ Lis-Balchin, M. and Simpson, S.H. (2001). Buchu (*Agathosma betulina* and *A. crenulata*, Rutaceae) essential oils: their pharmacological action on guinea pig ileum and antimicrobial activity on micro-organisms. *Journal of Pharmacy and Pharmacology* **53**(4):579-582.

¹¹ May, G. and Willuhn, G. (1978). Antiviral activity of aqueous extracts from medicinal plants in tissue cultures. *Arzneimittel-Forschung*. **28**(1): 1-7.

¹² Badria, F. A. (1994). Is man helpless against cancer? An environmental approach: antimutagenic agents from Egyptian food and medicinal preparations. *Cancer Letters* **84** (1): 1-5.

drug and allowing to stand in a covered vessel for 30 minutes. The resultant infusion is strained and stored in the refrigerator; to be taken in 30-60ml (2-4 tablespoonsful) doses, three times daily, diluted with plenty of water.

Concentrated Buchu Infusion BPC 1954
(1:2.5 prepared by percolation with 25% ethanol): 4-8ml

Liquid extract (1:1 in 90% ethanol): 0.3-1.2 ml

Buchu Tincture BPC 1949 (1:5 prepared by percolation in 60% ethanol): 2-4ml

Food use

Buchu oil has been approved in the USA as a food flavouring agent, at concentrations of up to about 0.002% (15.4 ppm). The oil is also listed by the Council of Europe as a natural source of food flavouring (category N3)^{GR17}

