MENTHA LONGIFOLIA HERBA

Definition

Mentha longifolia herba consists of the dried aerial parts of *Mentha longifolia* (L.) Huds. subsp. *capensis* (Thunb.) Briq. and subsp. *polyadena* (Briq.) Briq. (Lamiaceae).

Synonyms

Subspecies *capensis*
M. capensis Thunb.
M. longifolia (L.).L. subsp. *bouvieri* (Briq.) Briq.
M. longifolia (L.).L. subsp. *capensis* (Thunb.) Briq. var. *cooperi* Briq. ex Cooke
M. longifolia (L.).L. subsp. *capensis* (Thunb.) Briq. var. *doratophylla* Briq.
M. longifolia (L.).L. subsp. *capensis* (Thunb.) Briq. var. *obscuriceps* Briq.
M. longifolia (L.).L. subsp. *capensis* (Thunb.) Briq. var. *salicina* Burch ex Benth.
Subspecies *polyadena*
M. sylvestris L. subsp. *polyadena* Briq.
Vernacular names
Wilde kruistement, balderjan (A); koena (S); inxina (Xh); wild mint

Description

Macroscopical[1]

Figure 1 – Live plant

Perennial rhizomatous herb with erect to straggling stems, square in cross section, finely pubescent and up to 1,5m long; **leaves** simple, opposite, sessile or subsessile, lanceolate (subsp. *capensis*) or oblong-lanceolate (subsp. *polyadena*), up to 90mm long × 22mm wide, finely pubescent on one or both surfaces (subsp. *capensis*) or glabrous (subsp. *polyadena*), with entire to finely dentate margin and acuminate apex; **flowers** small (corolla 3-5mm long), white to mauve, in clusters forming a tapering cylindrical raceme up to 100mm long × 14mm wide.

Figure 2 – line drawing

Microscopical

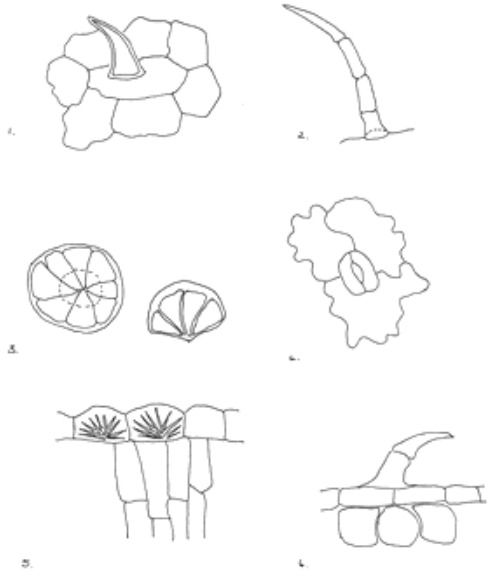

Figure 3 – microscopical features

[1] Codd, L.E. (1985). The genus *Mentha*. Flora of Southern Africa **28(4)**: 107-111.

Characteristic features are: the numerous clothing hairs of leaf and/or stem, of two types: 1-2 celled, with broad base and sharply tapering apex, up to 50µ long and curved, uniseriate, multicellular hairs, up to 140µ long, sometimes with one cell collapsed; the glandular trichomes of the lower leaf surface with unicellular stalk and globose multicellular (8-12 cells) head, up to 80µ in diameter; the stomata on the lower leaf surface only; the epidermal cells of the lower leaf surface with sinuous walls and more or less polygonal cells of the upper leaf epidermis; the single palisade layer below the epidermis of the upper leaf surface; the sphaerocrystals of calcium oxalate in the epidermal cells of both upper and lower leaf surfaces, smaller in the lower epidermal layer.

1. Polygonal cells of upper leaf epidermis with 1-2 celled curved clothing hair, up to 50µ long
2. Uniseriate, multicellular clothing hair, up to 140µ long
3. Glandular trichomes of lower leaf surface with unicellular stalk and globose 8-12 celled head, up to 80µ in diameter
4. Epidermal cells of lower leaf surface, with sinuous walls
5. Leaf lamina (T/S) showing sphaerocrystals of calcium oxalate in epidermal cells
6. Leaf lamina (T/S)

Crude drug

Supplied in bundles of young leaf and stem, having a characteristic spearmint-like odour and dull green colour.

Geographical distribution

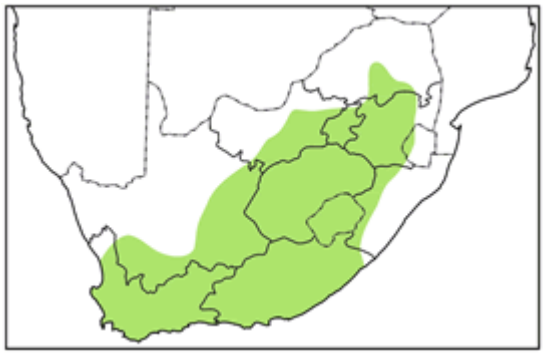

Figure 4 – distribution map

An extremely variable species with a widespread distribution in Southern Africa, Europe, the Mediterranean region and eastwards into Asia. Subspecies *capensis* occurs in moist habitats in 5 out of 9 provinces in South Africa: Western, Eastern and Northern Cape, Free State Province and KwaZulu-Natal and also in neighbouring Lesotho. Subspecies *polyadena* has a more restricted and disjunct distribution: a) at the boundary of the Western and Eastern Cape Provinces between Riversdale and Humansdorp b) Free State Province, northern KwaZulu-Natal, Mpumalanga and North-Western Province, extending into Swaziland and Lesotho.
A third subspecies, subsp. *wissii* (not included here), is confined to the Garies area of Namaqualand and Namibia and is characterised by its extremely narrow leaves, felted on both surfaces.

Quality standards

Identity tests:

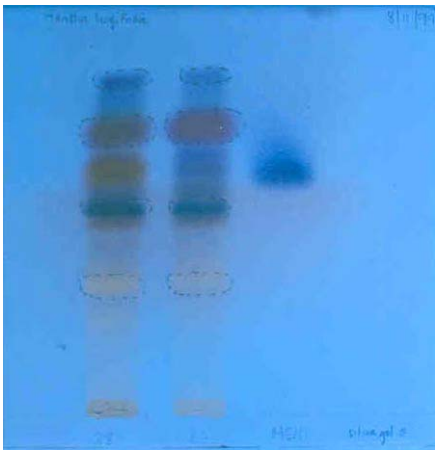

Figure 5 – TLC plate

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

Major compounds

R_f values: 0,34 (yellow); 0,53 (purple); 0,74 (pink); 0,87 (mauve); menthol 0,62 (purple). HPLC on C_{18} column, method according to Appendix 2b.

Major compounds:

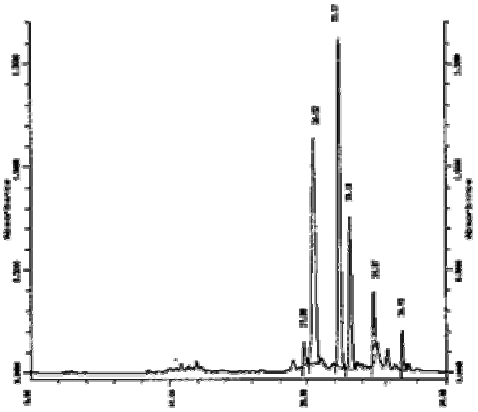

Figure 6a – MeOH HPLC spectrum

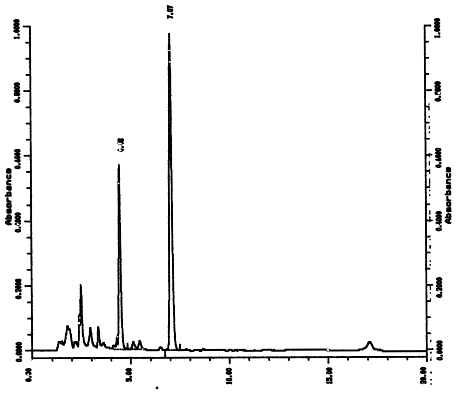

Figure 6b – DCM HPLC spectrum

Methanol extract (figure 6a):
Retention times (mins): 20.52; 22.37; 23.15;24.87; 26.94
Dicloromethane extract (figure 6b):
Retention times (mins): 4.48; 7.07

Ethanol (70%) soluble extractive value: not < 8.0% (range: 7.89-17.47%)

Volatile oil content: not < 1.5% V/W (range: 1.33-2.0%)

Purity tests

Assay

Not yet available

Major chemical constituents

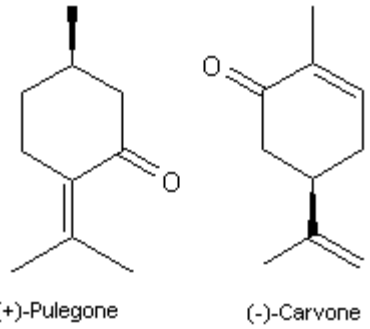

Figure 7 – chemical constituents

Little is known of the secondary chemistry of the Southern African subspecies of *Mentha longifolia.* Microchemical tests in our laboratories indicated the presence of tannins, saponins and flavonoids but not of alkaloids. Common flavonoids e.g. acacetin, hesperidin, as well as luteolin and apigenin glucuronides have been reported from European populations [2].

Overground parts of the plant yield 2,4%[3] (our laboratories: 1,33-2,0%) of an essential oil, of which the chief component appears to be the monoterpene ketone carvone[4] (70% in one South African oil sample and up to 77% in populations, subspecies or varieties from elsewhere). *Mentha longifolia* thus approaches spearmint (*Mentha spicata*) rather than peppermint (*M. piperita*) in oil composition. Other major constituents of the essential oil, according to various studies[5], include piperitenone and its oxide, piperitone and its oxide and pulegone.

Dosage forms

Used mainly in the form of an aqueous infusion, orally, *per rectum* or as a topical

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[2] Bourweig, D. and Pohl, R. (1973). Flavonoids from *Mentha longifolia. Planta Medica* **24**: 304-314.

[3] Watt, J. M. and Breyer-Brandwijk, M. M. (1962). The Medicinal and Poisonous Plants of Southern and Eastern Africa. (2nd edition). London, E. and S. Livingstone Ltd..

[4] Hegnauer, R. (1953). The content of essential oil and carvone in various species of mint. *Ber. Schweiz. Bot. Ges.* **63**: 90-102.

[5] Sticher, V.O. and Fluck, H. (1968). Composition of genuine extracted and distilled essential oils of some *Mentha* species. *Pharmaceutica Acta Hevetica* **43**: 411-.

application. An ointment is prepared from the leaves. Fresh leaf may be inserted into the nostrils or added to boiling water and the vapours inhaled.

Medicinal uses

Internal

For the treatment of colic, menstrual disorders, indigestion, flatulence, pulmonary infection and congestion, headache, fever, cough, colds and urinary tract infections. A leaf decoction is used as an *inembe* (a traditional preparation taken during the third trimester of pregnancy to facilitate labour, or at term to induce labour).

External

To relieve swelling and to treat sores or minor wounds. Leaf/stem may be added to boiling water and the vapours inhaled to relieve nasal or bronchial congestion.

Pharmacology/bioactivity

The bioactivity of Southern African subspecies of *Mentha longifolia* does not appear to have been the subject of scientific study. Investigation of populations elsewhere has demonstrated:

Antimicrobial activity:

Against the following organisms: *Aspergillus flavus* (aqueous extract)[6], *Bacillus subtilis, Streptococcus sobrinus* (ethyl acetate extract), *Staphylococcus epidermidis*, *Escherichia coli* (95% ethanol extract)[7], *Staphylococcus aureus* (95% ethanol and water extracts)[8]. In these and other studies no activity could be demonstrated against the following:

1. Fungi: *Aspergillus flavus, A. fumigatus, Scopulariopsis brevicaulis* (water extract)
2. Yeasts: *Candida albicans, C. krusei, C. parapsilosis, C. pseudotropicalis, C. stellatoidea, C. vaginalis, C. tropicalis, Cryptococcus neoformans* (water extract)
3. Bacteria: *Bacillus subtilis, Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa, Staphylococcus aureus, Salmonella typhosa, Shigella dysenteriae, Mycobacterium tuberculosis* (water, 80% ethanol, 95% ethanol extracts)[9,10]

Aqueous extracts from Western Cape populations of *Mentha longifolia*, tested in our laboratories, showed no activity against *Staphylococcus aureus, Pseudomonas aeruginosa, Candida albicans or Mycobacterium smegmatis* in the concentrations used.

In vitro antimicrobial activity of the essential oil (conc. 20.0%) obtained from Yugoslavian plants was assessed against a number of organisms. [11] Equivocal results were obtained for the following bacterial species:

Bacillus subtilis, Escherichia coli, Micrococcus flavus, Salmonella enteriditis, S. typhi, Sarcina lutea, Shigella sonnei, Staphylococcus aureus, S. epidermidis, Pseudomonas aeruginosa.

Activity was demonstrated in the same study against 5 fungal species: *Epidermophyton floccosum, Microsporum canis, Trichophyton*

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[6] Chaumont, J.P. and Senet, J.M. (1978). Antagonistic properties of higher plants against fungal parasites of man from food contaminants: screening of 200 fungi. *Plant. Med. Phytother.* **12**: 186-196.

[7] Diaz, R., Quevedo-Sarmiento, J., Ramos-Cormenzana, A., Cabo, P. and Cabo, J. (1988). Phytochemical and antibacterial screening of some species of Spanish Lamiaceae. *Fitoterapia* **59(4)**: 329-333.

[8] Gotshall, R.Y., Lucas, E.H., Lickfeldt, A. and Roberts, J.M. (1949). The occurrence of antibacterial substances active against *Mycobacterium tuberculosis* in seed plants. *Journal of Clinical Investigation* **28**: 920-923.

[9] Jawad, A.M., Jaffer, H.J., Al-Naib, A., Saber, H. and Razzak, A.A.W. (1988). Antimicrobial activity of some Iraqi plants. *Fitoterapia* **59(2)**: 130-133.

[10] Ikram,M. and Haq, I. (1980). Screening of medicinal plants for antimicrobial activity. Part 1. *Fitoterapia* **51**: 231-235.

[11] Mimica Dukic, N., Bozin, B., Sokovic, M., Mihailovic, B. and Matavulj, M. (2003). Antimicrobial and antioxidant activities of three *Mentha* species essential oils. *Planta Medica* **69(5)**: 413-419.

mentagrophytes, T. rubrum and *T. tonsurans* and one yeast (*Candida albicans*) (MIC in all cases 8.0 µl/ml).

Mutagenic activity

Ethanolic (95%) extracts at a concentration of 10,0 mg/plate showed weak activity against *Salmonella typhimurium* TA98 (Number of revertant colonies 20-100) and moderate activity against *S. typhimurium* TA100 (number of revertant colonies 100-200)[12]

Cytotoxicity

No cytotoxicity could be demonstrated against Chinese Hamster V79 cells, using methanolic extracts at a concentration of 100mcg/ml. [13]

Effects on G-I tract

A phenolic fraction obtained during extraction of the dried aerial parts promoted bile secretion and inhibited intestinal motility in the male mouse, when given intraperitoneally at a dosage of 10,0 ml/kg. The glycoside fraction, at a similar dosage, stimulated intestinal motility. [14]

Antioxidant activity

Aqueous-alcoholic extracts of the shade-dried inflorescence showed antioxidant activity (LC_{50} 29,0 mcg/ml)[15] *In vitro* antioxidant activity of the oil (12.5µg.ml) was not demonstrated [11].

Toxicity

The essential oil obtained from a Spanish collection of *Mentha longifolia*, administered intraperitoneally to the mouse, had an LD_{50} of 437,4mg/kg[16], but toxicological information relating to the whole herb is lacking.
In view of the common occurrence of chemical races in the Lamiaceae[17] and the detection of pulegone as a major constituent of the essential oils obtained from some *Mentha longifolia* populations (see 9.0 above), studies of the composition of South African *M. longifolia* oils are urgently needed. Recent research suggests that pulegone (*d*-isomer) is "metabolised in the liver to menthofuran, via a highly reactive metabolite which binds irreversibly to the components of liver cells in which metabolism takes place, quickly destroying the liver"[18].
Pulegone (*d*-isomer) has in addition been shown to rapidly destroy cytochrome P_{450} in the rat[19]. It would therefore be prudent for the time being to discourage the use in South Africa of *Mentha longifolia,* by patients with a history of liver disease or those taking cytochrome P_{450} inducing drugs e.g. ethanol,

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[12] Alkofahi, A.S., Abdelaziz, A., Mahmoud, I, Abuirjie, M., El-Oqla,A. and Hunaita, A. (1990). Cytotoxicity, mutagenicity and antimicrobial activity of forty Jordanian medicinal plants. *International Journal of Crude Drug Research* **28(2)**: 139-144.
[13] Hirobe, C., Palevitch, D., Tayeka, K. and Itokawa, H. (1994). Screening for antitumour activity of crude drugs (IV): Studies on cytotoxic activity of Israeli medicinal plants. *Natural Medicine* **48(2)**: 168-170.
[14] Mimica-Dukic, N., Jacovljevic, V., Mira, P. Gasic, O. and Szabo, A. (1996). Pharmacological studies on *Mentha longifolia* phenolic extracts. *International Journal of Pharmacognosy* **34(5)**: 359-364.
[15] Lamaison, J.L., Petitjean-Freytet, C., Duband, F. and Carnat, A.P. (1991). Rosmarinic acid content and antioxidant activity of French Lamiaceae. *Fitoterapia* **62(2)**: 166-171)
[16] Perez Raya, M.D., Utrilla, M.P., Navarro, M.C. and Jiminez, J. (1990). *Phytotherapy Research* **4(6)**: 232-234.
[17] Evans, W.C. (1996). Trease and Evans' Pharmacognosy (14th edition). London, W.B. Saunders Co. Ltd.
[18] Thomassen, D. *et al.* (1990). Menthofuran-dependent and independent aspects of pulegone hepatotoxicity: roles of glutathione. *Journal of Pharmacology and Experimental Therapeutics* **253(2)**: 567-572. In: Tisserand, R. and Balacs, T. (1995). Essential Oil Safety: a guide for health care professionals. London, Churchill Livingstone.
[19] Moorthy, B. (1991). Toxicity and metabolism of R-(+)-pulegone in rats: its effects on hepatic cytochrome P_{450} *in vivo* and *in vitro. Journal of the Indian Institute of Science* **71(1):** 76-78

progestagens, phenobarbitone, phenytoin, nitrazepam, carbamazepine and diphenhydramine. Potentially hepatotoxic drugs such as paracetamol, isoniazid, methyldopa and indomethacin should not be taken concomitantly with *Mentha longifolia* preparations.

Contraindications

Until such time as the secondary chemistry of indigenous populations of *Mentha longifolia* has been elucidated, and the occurrence of high pulegone races excluded, self-medication during pregnancy with preparations of this herb is not recommended.

Adverse reactions

None documented or reported by traditional practitioners and herbalists.

Precautions

See 12.0 E above

Dosage

Internal

An infusion is made by adding one part by volume of fresh herb to four parts by volume of boiling water. Allow to cool, strain and refrigerate. If dried material is used, the infusion should be made with one part by volume of herb to ten parts by volume of boiling water.
Adults: half a teacupful (90ml) three times daily
Children 2-12 years: one quarter teacupful (45ml) three times daily
Infants: one tablespoonful (10ml), diluted with boiled cooled water, three times daily.

External

An infusion, prepared as described above, may be applied to the skin. A handful of fresh leaf, placed in a bowl of boiling water, may be used as an inhalation.Treatment may be continued for one week. If symptoms persist, additional or alternative therapy should be sought.