ARTEMISIA AFRA HERBA

Definition

Artemisia Afra Herba consists of the aerial parts of *Artemisia afra* Jacq. ex Willd. (Asteraceae).

Synonyms

Vernacular names
wilde als (A), wormwood, unhlonyane (Xh, Z, Ts), lengana (S)

Description

Macroscopical[1]

Figure 1 – Live plant

Highly aromatic perennial shrub reaching a height of 2 metres; aerial parts deciduous in regions experiencing cold winters, regenerating from the base in spring; **leaves** finely-divided, silver-grey due to the presence of fine hairs, up to 80mm long × 40mm wide; **flowers** (Jan-June) inconspicuous, yellow, borne at the ends of branches in globose capitula ±3mm in diameter.

Figure 2 – line drawing

Microscopical

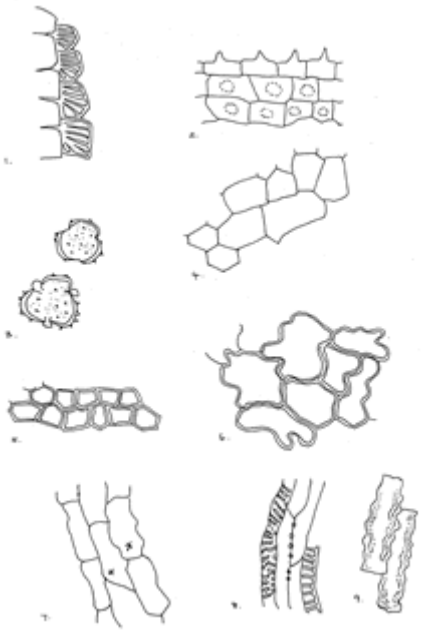

Figure 3 – microscopical features

Characteristic features are: the very abundant unicellular thin-walled clothing hairs, loose in the powdered drug or attached to fragments of the lamina, forming a tangled mass; the glandular trichomes of leaf and stem with unicellular stalk and multicellular heads ±50 microns in diameter; the abundant tricolporate yellow brown pollen grains, ±20 microns in diameter; the fragments of the corolla with striated outer epidermis and papillate inner epidermis; the small block-like cells of the stamen filament; the epidermal cells of the lamina with sinuous slightly thickened walls; the fibrous layer of the anther.

1. Fibrous layer of anther
2. Corolla showing papillate inner epidermis

[1] Hilliard, O.M. (1977). Compositae in Natal. Pp. 360-361. University of Natal Press, Pietermaritzburg.

3. Tricolporate yellow-brown pollen grains, ±20µ in diameter
4. Polygonal epidermal cells of upper leaf lamina
5. Small block-like cells of stamen filament
6. Epidermal cells of lower leaf lamina with sinuous slightly thickened walls
7. Fragment of corolla (tubular floret) with microcrystals of calcium oxalate
8. Vessels of stamen filament
9. Fragments of corolla with striated outer epidermis

Crude drug

Occurs in bundles of fresh or dried material comprising leaves, smaller stems, and flowers in season. The whole plant is grey in colour and highly aromatic, the taste extremely bitter.

Geographical distribution

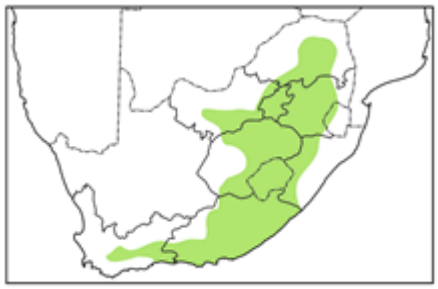

Figure 4 – distribution map

Widespread in all provinces of South Africa except the Northern Cape, also Lesotho, Swaziland and northwards into tropical Africa; usually in montane habitats along forest margins and streamsides.

Quality standards

Identity tests

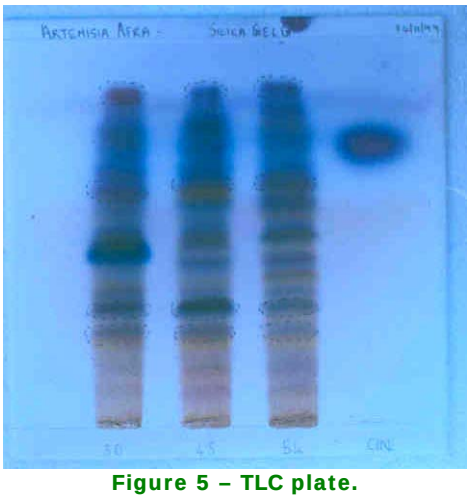

Figure 5 – TLC plate.

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

R_f values of major compounds: 0,25 (grey); 0,31 (blue grey); 0,61 (mauve); 0,86 (purple); cineole: 0,84 (blue-purple)

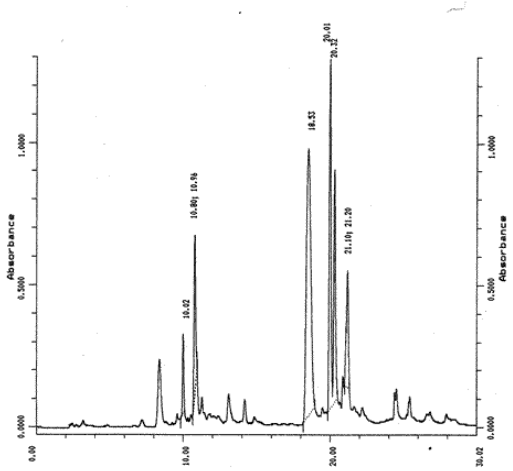

Figure 6 – HPLC spectrum

HPLC on C_{18} column, method according to Appendix 2b.

Major compounds:
Methanol extract: (Figure 6)
Retention times (mins): 10.02; 10.80; 18.53; 20.01; 20.32

Ethanol (70%) soluble extractive value: not less than 8,0% (range 8,39-30,34%)

Volatile oil content: not less than 0,67% (V/W)
The volatile oil content of 3 collections analysed in our laboratories ranged from 0,67-2,0%. Previous analyses found oil yield to vary between 0,3 and 0,5%[2].

Purity tests

Assay

Not yet available

Major chemical constituents

[2] See Ref 1. of Major Reference works.

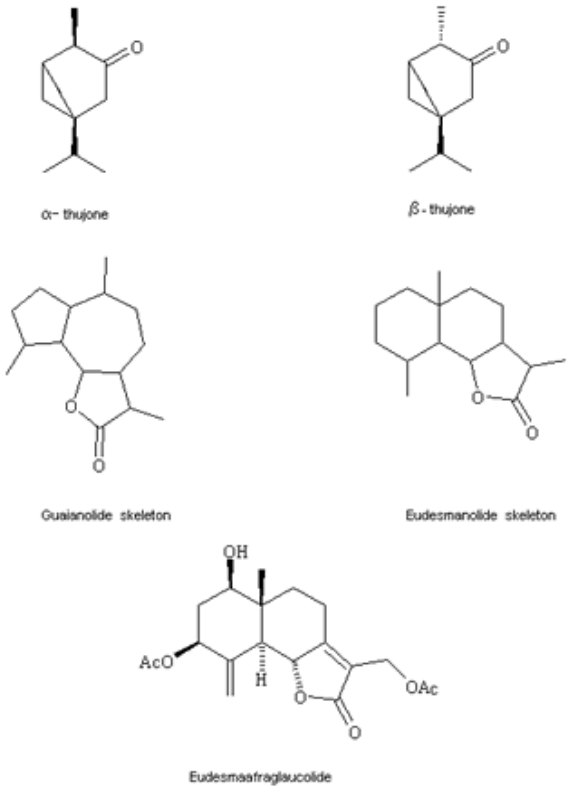

Figure 7 – chemical constituents

Microchemical tests in our laboratories indicated the presence of tannins and saponins but not of alkaloids nor of cardiac, cyanogenic or anthraquinone glycosides. Other studies have identified the triterpenes α- and ß-amyrin and friedelin as well as the alkanes ceryl cerotinate and n-nonacosane in the leaves of South African collections of *Artemisia afra*[3]. Investigation of leaf exudate flavonoids revealed the presence of two luteolin methyl ethers[4]. In an analysis of the sesquiterpene lactones of this species, 10 guaianolides and 5 glaucolides were detected in the overground parts of the plant [5] .
Analyses of the essential oils obtained from the leaves of a number of South African populations of this species have demonstrated considerable variation in oil composition. The major components of the oil appear to be α- and β-thujone (27.3-60.1%), 1,8-cineole (1.3-13.7%), camphor (4.6-23.1%) and α-pinene[6]. Other studies record the presence of yet higher concentrations of these components in oils obtained from wild populations of *Artemisia afra*: 1,8-cineole (50.4%), α-thujone (74.91-75.28%), β-thujone (21.49-22.44%), camphor (22.9%)[7].

Dosage forms

Used mainly as an aqueous decoction or infusion applied externally or taken orally, the extremely bitter taste being masked by the addition of sugar or honey. Fresh leaf may be added to boiling water and the vapours inhaled.

Medicinal uses

Internal

For the treatment of cough, croup, whooping cough, influenza, fever, diabetes, gastro-intestinal disorders and intestinal worms.

External

As an inhalation for the relief of headache and nasal congestion or a lotion to treat haemorrhoids. In traditional practice, fresh leaf is inserted into the nostrils to relieve nasal congestion or placed in boiling water as a steam bath for menstrual pain or after childbirth. Warmed leaves may be applied externally as a poultice to relieve inflammation and aqueous infusions administered *per rectum* or applied as a lotion to treat haemorrhoids.

Pharmacology/bioactivity

Antihistaminic and narcotic analgesic effects have been reported following preliminary tests (T.G. Fourie, *pers. comm.* in [8]). The volatile oil obtained from overground parts of *Artemisia afra* showed antimicrobial activity against a range of bacteria and fungi of public health or agricultural significance[6]. The same study demonstrated antioxidant activity of the oil, in preventing decolouration of β-carotene and linoleic acid.

Assays for antimalarial activity of extracts obtained from the dried aerial parts of Tanzanian plants showed weak activity against *Plasmodium falciparum* of petrol ether and dichloromethane extracts but no activity of methanolic extracts (hypoxanthine uptake assay)[9]. Investigation of antitumour activity in the mouse, of fresh leaf extracts (50% ethanol) of South African

[3] Silbernagel, E., Spreitzer, H.and Buchbauer, G. (1990). Non-volatile constituents of *Artemisia afra*. *Monatsch Chem.* **121(5)**: 433-436.
[4] Wollenweber, E., Mann, K., and Valant-Vetschera, K.M. (1989). External flavonoid aglycones in *Artemisia* and some further Anthemidae (Asteraceae). *Fitoterapia* **60(5)**: 460-463.
[5] Jakupovic, J., Klenmeyer, H., Bohlmann,F. and Graven, E. (1988). Glaucolides and guaianolides from *Atremisia afra*. *Phytochemistry* **27**: 1129-1134.
[6] Graven, E., Deans, S., Mavi, S., Gundidza, M.G. and Svoboda, K.P. (1992). Antimicrobial and antioxidative properties of the volatile (essential) oil of *Artemisia afra* Jacq.. *Flavour and Fragrance Journal* **7**: 121-123.
[7] Graven, E., Webber, L., Venter, M. and Gardiner, J.B. (1990). The development of *Artemisia afra* Jacq. as a new essential oil crop. *Journal of Essential Oil Research***2**: 215-220.
[8] Hutchings, A.. (1996). Zulu Medicinal Plants pp. 326-327. University of Natal Press, Pietermaritzburg.
[9] Weenen, H., Nkunya, M.H.H., Bray, D.H., Mwasumbi, L.B., Kinabo, L.S. and Kilimali, V.A. (1990). Antimalarial activity of Tanzanian medicinal plants. *Planta Medica* **56(4)**: 368-370.

collections of *A. afra*, showed no activity against Leuk-L-1210 and Sarcoma-WM256 (IM) lines[10].

No *in vitro* antimicrobial activity of aqueous extracts of South African collections of *A. afra* against *Pseudomonas aeruginosa, Candida albicans, Staphylococcus aureus* or *Mycobacterium smegmatis* was observed, in the concentrations used for disc assays in our laboratories. A more recent *in vitro* investigation of antibacterial activity of aqueous, ethanolic (EtOH) and hexane extracts of dried leaf recorded inhibitory activity of EtOH extracts against *Staphylococcus aureus* and *Bacillus subtilis,* but not against *Escherichia coli* or *Klebsiella pneumoniae.*[11]. Water and hexane extracts showed no activity in this assay. In the same study anti-nematodal activity was demonstrated *in vitro* against *Caenorhabditis elegans*, by water and EtOH extracts, at concentrations of 1.0mg/ml and 2.0mg/ml. A hexane extract proved inactive at both concentrations. The same study found water and ethanol extracts to be inactive in an *in vitro* assay for anti-amoebic activity (*Entamoeba histolytica*)

The results of an investigation of cytotoxicity and antiviral activity of 16 South African plant species [12] showed that aqueous extracts of *Artemisia afra* were cytotoxic, at higher concentrations used in the assay, to HeLa, Vero, Jurkat E6.1, AA-2 and CEM-SS cells. Similar extracts, in a cell culture antiviral assay, were found not to reduce the infectivity of either Coxsackie B2 virus or HSV-1.

Adverse reactions

The toxicity of thujone, a common component of the essential oils of *Artemisia*, *Salvia, Thuja* and *Tanacetum* species, is well known. The effects of excessive or prolonged ingestion include restlessness, vomiting, vertigo, tremor, convulsions and fatty degeneration of the liver, a syndrome formerly known as "absinthism" because of its prevalence in Paris café society absinthe drinkers of the late 19th century. The production of absinthe containing thujone was banned in France in 1915 and current agricultural research is aimed at selection of low-thujone races of *Artemisia* for oil production. The toxicity of the α-isomer (LD_{50} s.c. in mice: 87.5mg/kg) appears to be greater than that of the β-isomer (LD_{50} s.c. in mice: 442.2 mg/kg)[13]. The solubility of thujone in water is however extremely low[11] and it is doubtful if sufficient quantities of either isomer would be present in an aqueous extract, as used in traditional practice in South Africa, to cause concern. Nevertheless, it would be prudent to limit the use of this herb to short courses (no more than two weeks). Both the UK and EC "standard permitted proportion" of α- and/or β-thujone in food flavourings is 0.0005g/kg[14].

Contraindications

Thujone isomers are reported to be abortifacient and emmenagogic[15] and the use of this herb during pregnancy is not recommended. Traditional healers and herbalists confirm this view.

Precautions

See adverse reactions above.

Dosage

An infusion may be made with two tablespoonsful (±7.0g) of dried ground herb to which is added one litre of boiling water. The mixture is strained when cold. If fresh herb is used, four tablespoonsful of chopped leaf are infused with one litre of boiling water.

[10] Charlson, A.J. (1980). Antoneoplastic constituents of some Southern African plants. *Journal of Ethnopharmacology* **2(4)**: 323-335.

[11] McGaw, L.J., Jager, A.K. and van Staden, J.V.(2000). Antibacterial, anthelmintic and anti-amoebic activity of South African medicinal plants. *Journal of Ethnopharmacology* **72(1/2)**: 247-263.

[12] Treurnicht, F. T. (1997). An evaluation of the toxic and potential antiviral effects of some plants used by South Africans for medicinal purposes. MSc thesis, University of Stellenbosch.

[13] Anon. (1989). The Merck Index (11th edition): pp. 1479-1480. Merck &Co., Inc., Rahway, USA.

[14] Tisserand, R. and Balacs, T. (1995). Essential oil safety: a guide for health care professionals. Pp.199-200. Churchill Livingstone, Edinburgh.

[15] Newall, C.A., Anderson, L.A. and Phillipson, J.D. (1996). Herbal medicines: a guide for health care professionals. pp. 231-232. The Pharmaceutical Press, London.