

Compositional Variation of the Essential Oils of *Artemisia afra* Jacq. from three Provinces in South Africa - A Case Study of its Safety

Adebola O. Oyedele^{a*}, Anthony J. Afolayan^b and Anne Hutchings^c

^aDepartment of Chemistry, University of Zululand, KwaDlangezwa, 3886, South Africa

^bDepartment of Botany, University of Fort Hare, Alice, 5700, South Africa

^cDepartment of Botany, University of Zululand, KwaDlangezwa, 3886, South Africa

aoyedeleji@pan.zulu.ac.za

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Safety of *Artemisia afra* has been a controversial issue due to its high thujone content. Despite the declaration of the World Health Organization in the 1970s of the plant being unsafe for consumption, it is still commonly used in folklore medication in South Africa, especially in winter. Essential oils were isolated by hydrodistillation from the twigs of *A. afra* plants from different locations in the Eastern Cape, Free State and KwaZulu-Natal. Analyses of the oils by GC and GCMS revealed compositional variations in the levels of α - and β -thujone, 1,8-cineole and camphor. α -Thujone was the major component of the essential oils of *A. afra* from Philippolis (Free State) and Keiskammahoek (Eastern Cape) (62-74%), while the camphor content was very low (≤ 0.1 -0.6%). The samples from Gqumabhe, Hogsback (Eastern Cape) and Empangeni (KwaZulu-Natal) had low α -thujone contents (3.7-20.0%) while 1,8-cineole (13.8-49.5%) and camphor (13.9-21.2%) were the main components of the essential oils. It was further observed that the concentration of α -thujone increased significantly in the dry leaves when compared with the fresh leaves. This implies that fresh leaves are better used for infusion than dry leaves. This study reveals that not all *A. afra* contain high concentrations of α - and β -thujone.

Keywords: *Artemisia afra*, essential oil, α - and β -thujone, 1,8-cineole, camphor.

Most *Artemisia* species, like other medicinal essential oil plants, such as *Salvia officinalis* (sage), *Tanacetum vulgare* (tansy), *Thuja occidentalis* (yellow cedar), *Juniperus* species (juppers), *Chamaecyparis* species (cypresses), and *Anillea millefolium* (yarrow), are classified as being toxic due to their high thujone content [1a]. Essential oils containing thujone have been used in traditional medicine in treating common cold (cedar leaf oil, wormwood oil), as anthelmintics (tansy, wormwood, mugwort), for digestive problems and as carminatives (sage, cedar, tansy, mugwort), and for the treatment of fever, cough, rheumatism and acne (cedar) [1a-1d,2a].

Artemisia afra Jacq. (umhlonyane), family Asteraceae, known as African woodworm, is one of the plants most widely used in herbal remedies in Southern Africa due to its availability throughout the year [2b-2c]. The herb is used to treat various types of chest infections, cough, cold, colic, heartburn, flatulence, whooping cough and gout. Most often, the

leaves and stems are used in the form of either a tea (infusion) or decoction [2b,3a-3c]. Furthermore, the plant is used to treat patients with asthma (as an inhalation therapy) and respiratory infections (infusion therapy) in the Hospice Clinic within the KwaZulu-Natal region.

A. afra has been reported to contain α - and β -thujone in high concentrations [2c,3b-3d]. Thujone has been identified as a volatile organic compound emitted by vegetation to the atmosphere [3e]. Plants containing thujone, when used regularly and in large quantities, in addition to causing yellow-tinged vision, produce behavioral changes, convulsions, brain cortex lesions and renal failure [3f,3g]. Symptoms of prolonged ingestion include vomiting, restlessness, convulsion and fatty degeneration of the liver. However, the solubility of thujone in water is extremely low, hence its safety when used by traditional healers and locals [3h]. Thujones are known to be among the bioactive constituents of the essential oil [3i,4]. The LD₅₀ (s.c.)