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# Essential oil composition of *Artemisia abyssinica* from three habitats in Yemen

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**Abstract**
The essential oils from the aerial parts of *Artemisia abyssinica*, collected from three different locations in Yemen, were obtained by hydrodistillation and analyzed by gas chromatography – mass spectrometry. The essential oil from Taiz was dominated by davanone (49.4%) and camphor (29.6%), while samples from Sana'a and Alhodiadah had camphor as the major component (42.1% and 42.5%, respectively) with slightly lower concentrations of davanone (34.5% and 32.3%, respectively).

**Keywords:** *Artemisia abyssinica,* chemical composition, camphor, davanone, Yemen.

## 1. Introduction
*Artemisia abyssinica* Sch. Bip. ex A. Rich., known as "boitheran" in Yemen, is an aromatic, grey, silky-hairy plant with pale yellow flower-heads and is well known as a stimulant and an analgesic. It is short lived perennial plant, with sparingly branched stems that are grooved especially above. Leaves are alternate, grey-green, deeply bipinnatisect with linear segments, 4-10 cm long. It is widely spread on the high plateau from 2200 to 3600 m and often abundant on roadsides, alluvial plains and abandoned fields [1]. It is used in Yemen for treating headache and as insect repellent. In Saudi Arabia, the decoction of fresh whole plant is traditionally used to treat diabetes mellitus [2]. The plant has also been used in folk medicine as an anthelmintic, antispasmodic, antirheumatic and antibacterial agent [3]. Antioxidant, antileishmanial and antitrypanosomal activities have also been recorded for *A. abyssinica* essential oil [3]. In this report, we present the essential oil compositions for *A. abyssinica* from three different regions of Yemen, namely Taiz (higher than 1500 m), Sana'a (higher than 3000 m) and Alhodiadah (coastal region).

## 2. Materials and Methods
### 2.1 Plant Material
The aerial parts of *A. abyssinica* L. (Asteraceae) were collected in during September-October 2011, from Sana'a, Taiz and Hoeidiadah province, Yemen. The plant was identified by Hassan M. Ibrahim of the Botany Department, Faculty of Sciences, Sana'a University. Voucher specimens (comp-art-1a-c) have been deposited at the Pharmacognosy Department, Sana'a University, Yemen. Dried aerial parts from plants were hydrodistilled for 3 h in a Clevenger type apparatus according to the European Pharmacopoeia method [4]. The obtained oils were subsequently dried over anhydrous $Na_2SO_4$ and kept at 4 °C until analysis.

### 2.2 Gas Chromatographic-Mass Spectral Analysis
The essential oils of *A. abyssinica* were analyzed by GC-MS using an Agilent 6890 GC with Agilent 5973 mass selective detector [MSD, operated in the EI mode (electron energy = 70 eV), scan range = 40-400 amu, and scan rate = 3.99 scans/sec], and an Agilent ChemStation data system. The GC column was an HP-5ms fused silica capillary with a (5% phenyl)-polymethylsiloxane stationary phase, film thickness of 0.25 µm, a length of 30 m, and an internal diameter of 0.25 mm. The carrier gas was helium with a column head pressure of 48.7 kPa and a flow rate of 1.0 mL/min. Inlet temperature was 200 °C and interface temperature was 280 °C. The GC oven temperature program was used as follows: 40 °C initial temperature, hold for 10 min; increased at 3 °C/min to 200 °C; increased 2°/min to 220 °C. A 1% w/v solution of the sample in $CH_2Cl_2$ was prepared and 1 µL was injected using a split ratio of 1:30.

Identification of the oil components was based on their retention indices determined by reference to a homologous series of *n*-alkanes, and by comparison of their mass spectral fragmentation patterns with those reported in the literature [5] and stored on the MS library [NIST database (G1036A, revision D.01.00)/ChemStation data system (G1701CA, version C.00.01.080]. The percentages of each component are reported as raw percentages based on total ion current without standardization. The essential oil compositions of *Artemisia abyssinica* are summarized in Table 1.

**Table 1:** Chemical compositions of *Artemisia abyssinica* essential oils collected from three locations in Yemen.

| RI[a] | Compound | Percent Composition[b] | | |
|---|---|---|---|---|
| | | Taiz | Sana'a | Alhodiadah |
| 851 | Ethyl 2-methylbutanoate | 0.3±0.1 | 0.1±0.1 | 0.2±0.0 |
| 941 | α-Pinene | 1.1±0.4 | 0.5±0.3 | 1.1±0.2 |
| 952 | Isobutyl butanoate | 0.4±0.1 | 0.3±0.1 | 0.3±0.1 |
| 954 | Camphene | 0.8±0.3 | 0.5±0.2 | 0.9±0.2 |
| 976 | Sabinene | --- | --- | tr[c] |
| 993 | Myrcene | 0.1±0.1 | 0.7±0.3 | 0.1±0.0 |
| 1017 | α-Terpinene | 0.1±0.1 | 0.1±0.1 | 0.1±0.0 |
| 1025 | *p*-Cymene | 0.2±0.1 | 0.1±0.0 | 0.2±0.1 |
| 1029 | Limonene | 0.1±0.1 | --- | 0.1±0.0 |
| 1031 | 1,8-Cineole | --- | --- | 0.1±0.0 |
| 1059 | γ-Terpinene | 0.3±0.1 | 0.3±0.2 | 0.3±0.1 |
| 1067 | *cis*-Sabinene hydrate | 2.8±0.7 | 3.6±0.7 | 5.8±0.2 |
| 1087 | Terpinolene | tr | --- | 0.1±0.0 |
| 1098 | *trans*-Sabinene hydrate | 0.3±0.1 | 0.4±0.2 | 0.5±0.4 |
| 1101 | Linalool | 2.1±0.6 | 2.7±0.5 | 1.6±0.7 |
| 1124 | *cis-p*-Menth-2-en-1-ol | --- | --- | 0.1±0.0 |
| 1146 | Camphor | 29.6±0.8 | 42.1±3.3 | 42.5±2.3 |
| 1165 | Borneol | 0.2±0.1 | 1.0±0.4 | 0.6±0.1 |
| 1177 | Terpinen-4-ol | 2.0±0.5 | 3.8±0.8 | 3.9±0.3 |
| 1190 | α-Terpineol | 0.2±0.2 | 0.1±0.1 | 0.4±0.1 |
| 1285 | Bornyl acetate | 1.3±0.4 | 2.3±0.5 | 2.3±0.3 |
| 1379 | Ethyl (*Z*)-cinnamate | 0.5±0.2 | 0.2±0.1 | 0.2±0.1 |
| 1467 | Ethyl (*E*)-cinnamate | 1.9±0.6 | 0.5±0.2 | 0.5±0.1 |
| 1567 | (*E*)-Nerolidol | 5.1±0.9 | 4.0±0.6 | 4.5±0.7 |
| 1595 | Davanone | 49.4±5.8 | 34.5±3.5 | 32.3±2.0 |
| 1733 | Chamazulene | 0.7±0.4 | 1.2±0.5 | 0.3±0.1 |
| | Total Identified | 99.5 | 99.3 | 98.8 |

[a] Retention Indices on HP-5ms fused silica capillary column.

[b] The compositions are based on averages (± standard deviations) for three separate injections for each sample of *Artemisia abyssinica* essential oil.

[c] tr = "trace" (< 0.05%).

## 3. Results and Discussion

A total of 26 compounds were identified in the essential oils of *A. abyssinica* from Yemen, accounting for about 99% of the compositions (Table 1). *A. abyssinica* essential oils were rich in camphor and davanone with lesser amounts of (*E*)-nerolidol, *cis*-sabinene hydrate, terpinen-4-ol, linalool, and bornyl acetate. The *A. abyssinica* oils from Yemen are remarkably different in composition from those reported from different samples from Ethiopia: which were rich in 4-hydroxycyclohexanemethanol (21.3%) and α-terpinolene (9.2%) [6]; yomogi alcohol (38.5%), artemisyl acetate (24.9%), and artemisia alcohol (6.7%) [7]; and 4,5-dihydroxyocta-3,5-diene-2,7-dione (55.0%) [8]. Clearly there is wide variation in the volatile components of *A. abyssinica*, which can be attributed to (a) individual genetic variability, (b) variation among different plant parts and developmental stages, or (c) variation due to environmental conditions [9,10].

## 4. Conclusions

The essential oil compositions for *Artemisia abyssinica* collected from three different habitats in Yemen have been determined by GC-MS. While the compositions of the Yemeni samples are qualitatively similar, they are remarkably different from *A. abyssinica* samples from Ethiopia. It would be interesting to see analyses of *A. abyssinica* oils from other geographical locations.

## 5. References


1. Wood JRI. *A Handbook of the Yemen Flora*, Royal Botanic Garden, Kew, UK, 1997, 300.
2. Mossa JS. Phytochemical and biological studies on *Artemisia abyssinica* and anti-diabetic herb used in Arabian folk medicine. Fitoterapia 1985; 56:311-314.
3. Abad JM, Bedoya LM, Apaza L, Bermejo P. The *Artemisia* L. genus: A review of bioactive essential oils. Molecules 2012; 17(3):2542-2566.
4. Council of Europe *European Pharmacopoeia*, 3rd Ed., Council of Europe Press, Strasbourg 1997, 121-122
5. Adams RP. Identification of Essential Oil Components by Gas Chromatography/Mass Spectrometry, 4th Ed. Allured Publishing, Carol Stream, IL, USA, 2007.
6. Burits M, Asres K, Bucar F. The antioxidant activity of the essential oils of *Artemisia afra*, *Artemisia abyssinica and Juniperus procera*. Phytotherapy Research 2001;

15:103-108.
7. Tariku Y, Hymete A, Hailu A, Rohloff J. Essential-oil composition, antileishmanial, and toxicity study of *Artemisia abyssinica* and *Satureja punctata* ssp. *punctata* from Ethiopia. Chemistry & Biodiversity 2010; 7:1009-1018.
8. Nibret E, Wink M. Volatile components of four Ethiopian *Artemisia* species extracts and their *in vitro* antitrypanosomal and cytotoxic activities. Phytomedicine 2010; 17:369-374.
9. Sharopov FS, Sulaimonova VA, Setzer WN. Composition of the essential oil of *Artemisia absinthium* from Tajikistan. Records of Natural Products 2012; 6(2):127-134.
10. Eisenman SW, Juliani HR, Struwe L, Simon JE. Essential oil diversity in North American wild tarragon (*Artemisia dracunculus* L.) with comparisons to French and Kyrgyz tarragon. Industrial Crops and Products 2013; 49:220-232.