Title

# Constituents of *Artemisia tournefortiana* Rchb. Essential Oil from Iran.

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Abstract

The extraction of essential oil from the aerial parts of Artemisia tournefortiana was performed by hydrodistillation and identified by GC-MS methods. Twenty nine compounds were obtained that account for 97.3% of the total constituents in the essential oil. The main components were characterized by (E)-thujone (47.0%), sabinene (16.5%) and β-pinene (8.3%). This Artemisia was rich in monoterpenes.

Key words

*Artemisia tournefortiana*; Compositae; Essential oil; (E)-thujone; Sabinene; β-pinene.



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## Introduction

Over 250 species of *Artemisia* (Compositae) are distributed throughout the world and about 34 of these are documented in the flora of Iran, of which two are endemic: *A. melanolepis* Boiss. and *A. kermanensis* Podl. [1,2]. Some species are used in folk medicine; *A. annua* (Qinhaosu) is a traditional medicine herb of China. It is presently being cultivated on a commercial scale in China and Vietnam for its antimalarial sesquiterpene lactone artemisinin [3,4] and its essential oil. *A. austriaca* and *A. spicigera* are odorous herbs and used as antiseptics and stomachics in folk medicine [5]. The large genus *Artemisia* has been investigated chemically in which acetylenic compounds [6] and sesquiterpene lactones [7]. Three eudesmanolides was purified from extract of *A. tournefortiana* from Iran [8]. Sanz et al. found a new cis-eudesmanolide and three new eudesmane acids in extract of the aerial parts of *A.* tournefortiana [9]. Tourneforin, a novel eudesmanolide from *A. tournefortiana* has been reported [10]. A numerous reports appear in the literature on the essential oils of different species of *Artemisia* [11-34]. Although the volatile constituents of *A. tournefortiana* from Chinese, previously reported [34], no similarity exist between the major constituents of oils and the present work.

## Exprimental

**Plant material**: The aerial parts of *A. tournefortiana* were collected during the flowering stage in Firuzkuh, Hesarbon, province of Tehran, Iran, in October 2007. A voucher specimen (no. 59077) has been deposited at the Herbarium of the Research Institute of Forests and Rangelands (TARI), Tehran, Iran.

**Isolation of the oil:** The air-dried aerial parts *A. tournefortiana* (153.0 g) of the plant was subjected to separate hydrodistillation using a Clevenger-type apparatus for 3 hrs. After decanting and drying over anhydrous sodium sulfate, the corresponding yellowish colored oil was recovered in yields of 0.6 % w/w.

**Gas chromatography:** GC analysis was performed on a Shimadzu 15A gas chromatograph equipped with a spilt/spiltless (ratio 1:30), injector (250 °C) and a flame ionization detector (250 °C). $N_2$ was used as carrier gas (1 mL/min) and the capillary column used was DB-5 (50 m x 0.2 mm, film thickness 0.32 pin). The column temperature was kept at 60 °C for 3 min and then heated to 220 °C with a 5°C/min rate and kept constant at 220 °C for 5 min. Relative percentage amounts were calculated from peak area using a CR5 SHIMADSU CR PACK without the use of correction factors.

**Gas Chromatography-Mass spectrometry:** GC/MS analysis was performed using a Hewlett-Packard 5973 with a HP-5MS column (30 m × 0.25 mm, film thickness 0.25 μm). The column temperature was kept at 60°C for 3 min and programmed to 220°C at a rate of 5°C/min and kept constant at 220 °C for 5 min. The flow rate of Helium as carrier gas was 1 mL/min, final temperature 200 °C and detector temperature 250 °C; MS were taken at 70 eV (E1+ QIMS LMR UP LR mode electron ionization voltage), electron multiplier voltage 1800 eV; mass range, 30 to 350 amu; scan time and 2 scan/ sec.

**Identification of components**: The components of the oil were identified by comparison of their mass spectra with those of the computer library or with authentic compounds and confirmed by comparison of their retention indices either with those of authentic compounds or with data published in the literature [35]. The retention indices were calculated for all volatile constituents using a homologous series of C9 to C19 n-alkanes.

## Results and Discussion

The volatile components obtained from *A. tournefortiana* are listed in Table I in which the percentage and retention indices of the component are given. Twenty nine compounds were obtained that accounts for 97.3 % of the total constituents in the essential oil. The main components were characterized by (E)-thujone (47.0%), sabinene (16.5%) and β-pinene (8.3%).

Oxygenated monoterpenes constitute the major fraction of the oil (56.0%), while sesquiterpene hydrocarbons accounted to 3.0%. Monoterpene hydrocarbons and oxygenated sesquiterpenes amounted to 32.2% and 6.1% of the oil, respectively. This *Artemisia* is rich in monoterpenes.

In some studies on the essential oils of other *Artemisia* species, thujane derivatives were reported as the main constituents. These compounds were obtained to be major components of the oils of *A. absinthium* [11], *A. fragrans* [12], *A. herba-alba* [13], *A. khorassanica* [14], *A. verlotiorum* [15], *A. adamsii* [16], *A. afra* [17], *A. copa* [18], *A. douglasiana* [19], *A. ferganensis* [20], *A. moorcroftiana* [21], *A. nilagirica* [22], *A. roxburghiana* [23] and *A. vulgaris* [24].

Sabinene, the main component of the oil of *A. tournefortiana*, is also characteristic of the oils of *A. volgaris* [25], *A. dracunculus* [26], *A. afra* [27] and *A. wallichiana* [28].

Pinane drivatives are found in the oils of some *Artemisia* species, for example, α-pinene was found

Table 1- Percentage composition of aerial parts of *A. tournefortiana*

| Compound | RI | *A. tournefortiana* (%w/w) |
|---|---|---|
| α-thujene | 931 | 0.3 |
| α-pinene | 939 | 2.4 |
| sabinene | 976 | 16.5 |
| β-pinene | 980 | 8.3 |
| myrcene | 991 | 1.0 |
| α-phellandrene | 1005 | 1.2 |
| α-terpinene | 1018 | 0.3 |
| p-cymene | 1026 | 0.3 |
| limonene | 1031 | 0.9 |
| 1,8-cineole | 1033 | 1.4 |
| (Z)- β-ocimene | 1040 | t |
| (E)- β-ocimene | 1050 | 0.6 |
| γ-terpinene | 1062 | 0.4 |
| (Z)-thujone | 1102 | 3.0 |
| (E)-thujone | 1114 | 47.0 |
| α-campholenal | 1125 | t |
| (E)-pinocarveol | 1139 | 3.1 |
| (E)-sabinol | 1140 | 0.2 |
| camphor | 1143 | 0.6 |
| terpinen-4-ol | 1177 | 0.5 |
| α-terpineol | 1189 | 0.1 |
| citronellol | 1228 | t |
| geraniol | 1255 | 0.1 |
| α-copaene | 1376 | 0.1 |
| β-bourbonene | 1384 | 0.2 |
| (E)-β-farnesene | 1458 | 0.7 |
| germacrene D | 1480 | 0.9 |
| β-selinene | 1485 | 1.0 |
| γ-cadinene | 1513 | 0.1 |
| (E)-nerolidol | 1564 | 5.7 |
| torreyol | 1645 | 0.2 |
| α-bisabolol | 1683 | 0.2 |
| Total | | 97.3 |
| Group components | | |
| Monoterpene hydrocarbone | | 32.2 |
| Oxygen-containing monoterpene | | 56.0 |
| Sesquiterpene hydrocarbone | | 0.3 |
| Oxygen-containing sesquiterpene | | 6.1 |

t = trace < than 0.05%

in the oils of *A. annua* [29] and *A. biennis* [30], β-pinene in *A. absinthium* [11], *A. campestris* [31], *A. scoparia* [32] and *A. moorcroftiana* [21] and γ-terpinene in *A. scoparia* [33].

In our research, trans-thujone, sabinene and beta-pinene predominated in the oil *Artemisia* but α-pinene was only found as a minor constituent.

In previous studies on Chinese *A. tournefortiana* [34], the main components were 7,11-dimethyl-1,6,10-12 carbon leukotriene (56.20%) and α-pinene (18.63%), wheras no similarity exist with the present work.

## Conclusion

Twenty nine compounds were obtained that accounts for 97.3 % of the total constituents in the essential oil. The main components were characterized by (E)-thujone (47.0%), sabinene (16.5%) and β-pinene (8.3%). This *Artemisia* was rich in monoterpenes. The presence of thujones and terpene alcoholes in the oil can be of great importance in food industry [36] and antimicrobial activity [37] respectively. These results may partly justify the traditional use of this *Artemisia*.

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