

# Essential Oil Analysis of *Haussknechtia elymaitica* Boiss Fruits, an Endemic Plant from Iran

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*The chemical composition of the essential oil obtained from the fruits of Haussknechtia elymaitica Boiss., an endemic plant growing wild in Iran, was analysed by gas chromatography–mass spectrometry for the first time. Overall, ten volatile natural components were identified on the basis of their mass spectra characteristics and retention indices in which beta-bisabolene (51.1%), trans-asarone (25.0%) and lavandulyl acetate (10.2%) were the major constituents.*

*Keywords: Haussknechtia elymaitica, essential oil, GC-MS analysis, Umbelliferae, beta-bisabolene*

There is a growing interest in essential oil applications in food, chemistry, pharmacy, medicine and perfumery and it has led to the dramatic increase in demand for these products, particularly over the last decades [1,2].

The Umbelliferae family is one of the most interesting families within plant kingdom. It has 3000 species belonging to 300 genera. It is rich in essential oils and other secondary metabolites and embodies interesting genera of high pharmaceutical and economic value. Umbelliferae family is well represented in the Iranian flora. Iran, the second largest country among the Persian Gulf countries, has different climates and geographical conditions that result in the growth of numerous plant species. At present more than 8000 plant species grow in Iran among them 114 genera and 420 species belong to Umbelliferae family [3-5].

*Haussknechtia elymaitica* Boiss., an endemic Iranian plant from this family has been chosen in our study to give an overview about the content and constituents of its fruits essential oils for the first time. *H. elymaitica* is the unique species of the genus. The popular Persian name of the plant is johour or white celery. This is a 2-3 m. semi-tall glabrous and perennial plant with large bipinnatisect basal leaves and numerous flowers that grouped in globose umbels situated on the usually simple or slightly branched stems. It is a monotypic genus just found in southwestern provinces of Iran. This herb morphologically similar to some *Dorema* species and differ from them mainly in having thin leaves and different fragrance. Plant parts have been used in some native foods in the western parts of Iran [6,7].

There are two reports on the phytochemical analysis and biological and pharmacological studies on this Iranian monotypic species in the literature. Biological and pharmacological studies on the aerial parts of this genus revealed antibacterial and inhibitory activities on both humoral and cell-mediated immune responses by acting on the lymphocyte proliferation and IL-2 secretion in animal models [8,9]. The flavour composition in *H. elymaitica* aerial parts has been studied before [8].

The present paper deals with the detailed identification of the essential oil of the ripened fruits of *H. elymaitica* from Kohgiluyeh and Boyer-Ahmad Province, Iran by GC-MS, the most reliable technique for essential oil analysis.

## Experimental part

### Materials and methods

Ripened fruits of *H. elymaitica* were collected on September 2011 from plants growing wild in Gachsaran, ca. 10 km East of Genaveh Lori Village, 50° 53.51' E, 30° 27.42' N in Kohgiluyeh and Boyer-Ahmad Province, Iran at an altitude of ca. 1550 m. The plant specimen was identified by Department of Biology, Science and Research Branch, Tehran Islamic Azad University, Iran and a voucher specimen of the plant with number 1376 is deposited in the Avicenna herbarium of this department. The dried and ripened fruits of the plant (100 g) were chopped in distilled water and its hydro-distilled fraction was isolated by hydrodistillation for 3 h. Essential oil sample was homogenized and dried over anhydrous sodium sulfate and stored in a fridge [2,10].

GC/MS analysis was performed on a Hewlett Packard 5972A mass selective detector coupled with a Hewlett Packard 6890 gas chromatograph, equipped with a cross-linked 5% PH ME siloxane HP-5MS capillary column (30m × 0.25 mm, film thickness 0.25µm).

The GC operating conditions were as follows: carrier gas, helium with a flow rate of 2 mL/min; column temperature, 60-275°C at 4°C/min; injector and detector temperatures, 280°C; volume injected, 0.1µL of the oil; split ratio, 1:25.

The MS operating parameters were as follows: ionization potential, 70 eV; resolution, 1000; ion source temperature, 200°C.

Identification of components in the oil was based on GC retention indices relative to *n*-alkanes and computer matching with the Wiley 275.L library, as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature [10-12].

## Results and discussions

The essential oil was a clear, pale yellow liquid bearing the characteristic pungent and cool aromatic odor of Umbelliferae family plants. The essential oil content of the plant was 0.2% (w/w) yield. Ten natural compounds were identified, accounting for 98.8% of the oil. The identities of the components of the oil, the percentages (%) and retention indices (RI) are given in table 1.

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**Table 1**  
LIST OF THE COMPONENTS OF *H. elymaitica* FRUIT ESSENTIAL OIL

No.	Compound	%	RI
1	<i>alpha</i> -pinene	0.2	936
2	<i>beta</i> -myrcene	0.1	989
3	<i>alpha</i> -phellandrene	5.1	1005
4	<i>alpha</i> -terpinene	0.1	1016
5	lavandulyl acetate	10.2	1292
6	neryl acetate	2.1	1362
7	<i>trans</i> -methyl isoeugenol	4.7	1500
8	<i>beta</i> -bisabolene	51.1	1510
9	<i>alpha</i> -farnescene	0.2	1532
10	<i>trans</i> -asarone	25.0	1698

The major constituents of the oil were beta-bisabolene (51.1%), trans-asarone (25.0%), lavandulyl acetate (10.2%) and alpha-phellandrene (5.1%). Other components were present in amounts less than 5%. Contrary to the previous report that trans-asarone and trans-methyl isoeugenol were present as major compounds in the oil of *H. elymaitica* aerial parts [8], in the present study these compounds were found in lesser amounts. The major compounds of our oil have been previously detected in other taxa belonging to the Umbelliferae family [13-15]. beta-bisabolene, the most prominent compound of the oil and trans-asarone, which was found as a second oil major component, have been found in the essential oil of *Daucus carota* aerial parts [13,14]. The third main component of the oil, lavandulyl acetate, was previously found in *Zeravschania pastinacifolia* aerial parts oil [15].

### Conclusions

More than 50% of the oil constituents of *H. elymaitica* fruits belongs to the sesquiterpenes. Essential oil of *H. elymaitica* is a valuable source of beta-bisabolene and trans-asarone. These active natural constituents can be used in pharmaceutical industries. beta-bisabolene demonstrated bactericidal activities and asarone is a potential candidate for managing of cognitive impairment such as Alzheimer's disease [16,17].

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