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Chemical Composition of Volatile Oils from the Endocarp and Hulls of Persian Bay Laurel Fruit: A Fragrant Herb Used In Traditional Iranian Medicine

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ABSTRACT

The hydro-distilled volatile oils, obtained from dried **e**ndocarp and hulls of Persian bay laurel (*Laurus nobilis* var. *angustifolia*) from Laueaceae family were analyzed by GC/MS. Thirteen and twelve compounds consisting 81.6% and 89.1% of the total components were identified of the oils obtained with a yield of 3% and 1.2% (w/w) respectively. Differences of some compounds between endocarp and hulls oils were evinced. While the oil of endocarp contained 1,8-cineole (46.7%), *α*-terpinyl acetate (7.4%), *β*-pinene (7.3%) and α-phellandrene (4.7%), the oil of hulls contained 1,8-cineole (40.5%), *trans*-β-ocimene (22.1%), caryophyllene oxide (6.9%) and *α*-terpinyl acetate (5.0%).

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Introduction

Lauraceae is one of the primitive flowering plants families that is comprised of 52 genera and more than 3000 species [1]. This family is rich in secondary metabolites and volatile oils and embodies numerous genera of high economic, medicinal and edible values [1-3]. Therefore *Laurus nobilis* var. *angustifolia* or bay laurel from this family has been chosen to give an overview about the content and composition of the fruit volatile oils. ***Laurus*** is a small genus consisting of two species of evergreen and ornamental trees. *L. nobilis* is a plant from sub tribus Laurineae, tribus Litseae, Lauroideae subfamily [2-4]. The popular Persian name of the plant is "Barg-e Boo". This is a small tree with fragrant leaves and small fruits that possess aromatic properties [4,5]. It is found in many parts of Iran, Mediterranean region, Europe and America. Volatile oils of bay laurel leaves and fruits have been used in food, perfume and soap industries for many years. These plant parts have been used in some remedies and dosage forms in Iran and the world [2,4-7]. Bay laurel fruit is mentioned in traditional Iranian medicine (TIM) manuscripts and books like Ibn Sina's Canon of Medicine as "Ghar" or "Habb-ol Ghar". It was considered as an antinociceptive, anti-asthmatic, anti-urolithiasis, diuretic and detoxifier and introduced as a warm and dry traditional remedy in this book. Fruit hulls were considered less warm than inner parts according to TIM that may be due to their constituents. The TIM system is based on some canons and one of the most important ones is temperament or Mezaj. It is a dominant, fundamental and characteristic quality which categorized several elements in primary warm, cold, wet and dry qualities. Consequencing and interactions of these four opposite elements may result in the final balanced temperament. More details are introduced well in the Ibn Sina's Canon of Medicine [8].

Pharmacological and biological studies on bay laurel leaves and fruits revealed antioxidant, bactericidal, fungicidal, food preservative, antidandruff, insect repellant, hepatoprotective, anti-rheumatism and wound healing activities [2-7, 9-11].

There are several reports on the phytochemical surveys of bay laurel parts. Some scientific studies on the species of this genus showed the presence of compounds belonging to the groups of volatile and fixed oils, resins, flavonoids, tannins, sesquiterpene alcohols, alkaloids, vitamins and minerals [2-7,10-15].

The flavor composition in bay laurel fruits has been the subject of a few investigations [4,10,15-18], in spite of their long established pharmaceutical uses in TIM [8]. The present paper deals with the detailed analysis of the volatile oils of the different dried parts including **e**ndocarp and hulls of bay laurel fruits from Isfahan, Iran by GC-MS. This is the first report on the volatile composition of these parts of ***L. nobilis* var. *angustifolia*** fruits in details separately to find differences of their constituents. This idea is originated from an old belief of TIM.

Materials and Methods

Plant materials

Bay laurel ripe fruits were collected from harvested trees in the campus of the Isfahan University of Medical Sciences, Isfahan, Iran at an altitude of *ca.* 1600 m on October. The plant specimen was identified as *Laurus nobilis* var. *angustifolia* by Department of Biology, Faculty of Sciences, Isfahan University, in Isfahan, Iran. A voucher specimen of the plant with number 2659 is deposited in the herbarium of our school. The fresh ripe fruits were cut, peeled and separated manually into the **e**ndocarp and hulls parts. They were dried in the shade.

Volatile oil preparation

The dried **e**ndocarp and hulls parts of the fruits (100 g each) were chopped in distilled water and their volatile fractions were isolated by hydrodistillation for 3 h with a clevenger-type apparatus according our previous method. Oil samples were homogenized and dried over anhydrous sodium sulfate and stored at 2-4°C [19,20].

GC-MS conditions

GC/MS analysis was performed on a Finnigan MAT Incos-50 instrument mass selective detector coupled with a Hewlett Packard 6890 gas chromatograph, equipped with a DB-5 fused silica capillary column (25 m × 0.25 mm, film thickness 0.25 μm).

The GC operating conditions were as follows: carrier gas, helium with a flow rate of 1.5 mL/min; the oven temperature was programmed 5 min isothermal at 60°C and then from 60˚-280ºC at 4ºC/min; injector and detector temperatures, 280ºC; volume injected, 0.1 μL of the oil; split ratio, 1:25.

The MS operating parameters were as follows: ionization potential, 70 ev; ionization current, 2 A; ion source temperature, 150ºC; resolution, 1000 [21].

Identification of constituents

The identification of constituents in the oils was based on GC retention indices relative to *n*-alkanes and computer matching against the library spectra built up using pure substances and components of known essential oils, as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature [19-22].

Results and discussion

The volatile oils of the **e**ndocarp and hulls of the fruit were clear and pale yellow and pale green liquid respectively bearing the characteristic pungent and aromatic odor of Lauraceae plants. The volatile oil contents of the fruit parts were 3% and 1.2% (w/w) based on dried weight of samples respectively. Thirteen compounds were identified in endocarp volatile oil, accounting for 81.6% of the oil and twelve compounds were identified in hulls volatile oil, accounting for 89.1% of the oil. The identities of the components of the oils, their percentages and retention indices are listed in Table 1.

Table 1. Percentage composition of the endocarp and hulls volatile oils of Persian bay laurel fruits

No.	Compound	Endocarp(%)	Hulls(%)	RI
1	α-pinene	3.9	2.8	937
2	β-pinene	7.3	-	978
3	α-phellandrene	4.7	-	1022
4	1,8-cineole	46.7	40.5	1034
5	*trans*-β-ocimene	-	22.1	1049
6	isobornyl acetate	2.6	-	1280
7	n-tridecane	-	2.4	1291
8	α-terpinyl acetate	7.4	5	1348
9	β-elemene	3.5	2.1	1389
10	methyl eugenol	2.1	-	1405
11	β-caryophyllene	-	2.6	1416
12	valencene	-	0.4	1485
13	viridiflorene	0.9	-	1500
14	caryophyllene oxide	0.2	6.9	1579
15	viridiflorol	0.7	0.5	1596
16	α-cadinol	-	0.1	1658
17	cis-α-santalol	0.5	-	1672
18	cis-nuciferol	-	2.7	1727
19	8-cedran-13-al	0.1	-	1780

The major constituents of the endocarp oil were 1,8-cineole (46.7%), *α*-terpinyl acetate (7.4%), *β*-pinene (7.3%) and *α*-phellandrene (4.7%). Other components were present in amounts less than 4%. 1,8-cineole (40.5%), trans-β-ocimene (22.1%), caryophyllene oxide (6.9%) and *α*-terpinyl acetate (5.0%) were found to be the major constituents of the hulls oil. These results are nearly similar to the qualitative results obtained from other investigations in Tunisia and Turkey [6,10,16,18] although due to the different climatic and weather conditions of Isfahan province in Iran, some of the oil components are different from previous sample oils [2,13,14,17].

As can be seen in the table 1, endocarp and hulls volatile oils of the plant fruits are fairly similar. Out of 19 compounds identified in these studies, there were six compounds that were common to both of the oils. The most important difference in the oil constituents of the endocarp and hulls of *L. Nobilis* var. *angustifolia* is the lack of *trans*-β-ocimene in the endocarp oil. As we mentioned before the fruit hulls according to the Ibn Sina's manuscripts are less warm than the inner parts of the fruits and existence of *trans*-β-ocimene in the hulls may the relief key of its warm activities. More chemical and pharmacological investigations need to evaluate these claims.

Endocarp and hulls volatile oils of Persian bay laurel fruits are valuable sources of 1,8-cineole and trans-β-ocimene. 1,8-cineole which was found with high percentage in our oils is a terpene oxide and has been reported in the several oils of *L. Nobilis* [2-7,9-11,13,14,16-18]. It was lower by almost half in our oils. It demonstrated anti-biofilm and percutaneous penetration activities and is also an antiinflammatory and antinociceptive agent [23,24]. Mentioned antinociceptive effects of bay laurel fruits in TIM may be due to this natural terpene oxide.

Conclusion

The present study has elucidated the chemical constituents of the volatile oils from the endocarp and hulls of Persian bay laurel fruit or *Laurus nobilis* var. *angustifolia, a* pharmaceutically effective herb used in TIM. These two oils can serve as potentially good sources of natural medicines and cosmetics with a traditional background.

Conflict of interest

Authors certify that no actual or potential conflict of interest in relation to this article exists.

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