Volatile Constituents of the Flower and Fruit Oils of *Pittosporum tobira* (Thunb.) Ait. Grown in Iran

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The volatile components of the flower and fruit oils from *Pittosporum tobira* (Thunb.) Ait. grown in Iran, obtained through hydrodistillation, were analyzed by GC/MS. Sixteen compounds (representing 90.7% of the oil) and seventeen constituents (representing 89.9% of the oil) were identified in the flower and fruit oils, respectively. While the flower oil contained α-pinene (38.6%), *n*-nonane (11.8%), (*E*)-nerolidol (9.0%) and (*E*)-β-ocimene (7.7%), the fruit oil contained α-pinene (30.2%), *n*-nonane (12.2%), germacrene-D (12.0%), α-cubebene (7.6%) and β-cubebene (5.1%) as the main compounds.

Key words: Pittosporum tobira (Thunb.) Ait., Essential Oil, GC/MS Analysis

Introduction

The genus *Pittosporum* belongs to the family Pittosporaceae and comprises 160 species that are distributed in the warm and temperate regions of the Earth. Out of those, two species (*P. tobira* and *P. undulatum*) are cultivated as evergreen ornamental plants in Iran. *P. tobira* (Thunb.) Ait., locally named Mikhak-e Hindi, is a strongly aromatic species which is now naturalized in different parts of Iran (Ghahreman, 2001; Mozaffarian, 1996).

A review of the chemical constituents of *P. tobira* showed that the volatile components isolated from the flowers of the plant have been only addressed by one study in the past. In 1990, Zhaolin *et al.* reported that the oil from the flowers of Chinese *P. tobira* consisted mainly of benzyl acetate (Zhaolin *et al.*, 1990). On the other hand, no investigations have been found on the essential oil from the fruits of *P. tobira*.

The objective of the present work is to carry out the detailed analysis of the Iranian *P. tobira* flower and fruit oils by GC/MS, which have not been done previously.

Materials and Methods

Plant material

Fresh flowers and fruits of *P. tobira* were separately collected in April and August 2001 from Tehran, Iran. Voucher specimens have been deposited in the Herbarium of the Pharmacognosy Department, School of Pharmacy, Tehran University of Medical Sciences.

Isolation of the volatile oils

Fresh flowers and fruits of the plant (100 g) were separately hydrodistilled in a Clevenger type apparatus for 4 h. The oils were dried over anhydrous sodium sulfate and stored under N_2 in a sealed vial until required.

GC/MS analysis

The oils were analyzed by GC/MS using a Hewlett-Packard 6890/5972 system with a HP-5MS capillary column (30 m × 0.25 mm, 0.25 μm film thickness). The carrier gas was helium with a flow rate of 1 ml/min. The oven temperature was held at 60 °C for 3 min, programmed at 6 °C/min to 220 °C and then held at this temperature for 3 min. Mass spectra were taken at 70 eV. Mass range was from *m/z* 35 to 350 amu. The injector temperature was 240 °C. Relative percentage amounts were

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calculated from the total area under the peaks by the software of the apparatus.

Identification of the compounds

Identification of the components was based on retention indices and computer matching with the Wiley275.L library, as well as by comparison of the fragmentation patterns of the mass spectra with those reported in the literature (Adams, 1995; Swigar and Silverstein, 1981; Jennings and Shibamoto, 1980).

Retention indices were determined using retention times of *n*-alkanes that have been injected to the same instrument and under the same chromatographic conditions.

Results and Discussion

The hydrodistillation of the flowers and fruits of *P. tobira* gave yellowish oils with a yield of 0.25% and 0.3%, respectively, based on fresh weights. Sixteen compounds (90.7%) and seventeen constituents (89.9%) were identified in the flower and fruit oils, respectively. The identified compounds of the oils, their retention indices and percentage composition are given in Table I where the components are listed in order of their elution on the HP-5MS column.

From Table I, it is evident that the compositions of the oils are different qualitatively and quantitatively. However, the components can be divided into two major groups. The first one (RI range: 935–1055) was composed of monoterpene hydrocarbons. The second one was formed of sesquiterpene hydrocarbons (RI range: 1350–1550) and sesquiterpenoid alcohols (RI range: 1570–1650). As indicated in Table II, mono- and sesquiterpenoids are the main components of the oils. In the flower oil, the monoterpenes (57.1%) were the main components and the sesquiterpenoids (16.1%) had the low percentage but in the fruit oil, both monoterpenes (40.2%) and sesquiterpenoids (36.1%) were the major constituents. α-Pinene (38.6%), *n*-nonane (11.8%), (*E*)-nerolidol (9.0%) and (*E*)-β-ocimene (7.7%) were the main constituents in the flower oil, while α-pinene (30.2%), *n*-nonane (12.2%), germacrene-D (12.0%), α-cubebene (7.6%) and β-cubebene (5.1%) were the major components in the fruit oil.

Table I. Chemical composition of the flower and fruit oils of *Pittosporum tobira*.

Compound[a]	RI[b]	Content (rel.%)	
		Flower	Fruit
n-Nonane	901	11.8	12.2
α-Pinene	937	38.6	30.2
β-Pinene	978	4.2	4.3
Myrcene	993	6.2	5.1
Limonene	1031	0.4	0.6
(*E*)-β-Ocimene	1051	7.7	–
n-Undecane	1102	4.6	1.4
Benzyl acetate	1168	1.1	–
α-Cubebene	1355	1.0	7.6
α-Copaene	1382	0.2	2.6
β-Cubebene	1396	–	5.1
β-Elemene	1398	1.3	–
α-Humulene	1461	0.1	–
allo-Aromadenderene	1469	–	3.3
Germacrene-D	1490	3.3	12.0
γ-Cadinene	1522	–	1.1
δ-Cadinene	1531	0.5	1.9
α-Cadinene	1545	–	0.6
(*E*)-Nerolidol	1572	9.0	–
Spathulenol	1587	–	0.2
Viridiflorol	1604	0.7	1.3
α-Cadinol	1650	–	0.4
Total		90.7	89.9

[a] Compounds listed in order of elution.
[b] RI (retention index) measured relative to *n*-alkanes (C_9–C_{18}) on HP-5MS column under conditions listed in the Materials and Methods section.

Table II. Percentage of particular classes of compounds in the flower and fruit oils of *Pittosporum tobira.*

Group of compounds	Flower (%)	Fruit (%)
Monoterpene hydrocarbons	57.1	40.2
Sesquiterpene hydrocarbons	6.4	34.2
Sesquiterpenoid alcohols	9.7	1.9
n-Alkanes	16.4	13.6
Aromatic compounds	1.1	–
Total	90.7	89.9

In conclusion, the flower oil of *P. tobira* is characterized by the high content of α-pinene, *n*-nonane and the presence of (*E*)-nerolidol and (*E*)-β-ocimene, whereas the fruit oil is characterized by high contents of α-pinene, *n*-nonane, germacrene-D and α-cubebene and the presence of β-cubebene.

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