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COMPOSITION OF ESSENTIAL OIL OF LEAVES OF *Persea americana* CULTIVATED IN IRAN

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Persea americana Mill. (Lauraceae) is a tree plant, also called avocado. It is chiefly grown in temperate regions and sparsely grown in tropical regions of the world; it is native to the Central American region and is appreciated worldwide because of its special organoleptic characteristics and nutritional value [1, 2]. It is recommended for anemia, exhaustion, hypercholesterolemia, hypertension, gastritis, and gastroduodenal ulcer [3]. The leaves have been reported as an effective antitussive and antidiabetic, and for relief of arthritis pain, by traditional medicine practitioners of the Ibibio tribe in South Nigeria. Analgesic and antiinflammatory properties of the leaves have been reported [4]. The chemical composition of the essential oils of some *Persea* spices has been investigated before. β-Caryophyllene (43.9%) and valencene (16.0%) are the most abundant compounds in the oil of *P. americana* from Nigeria [5]. Methyl chavicol (syn., estragole) (53.9%) is the major component in the oil of *P. americana* var. *drymifolia* cv. Duke from Cuba [2]. (*E*)-Avocadodienofuran (15.3%), (*E*)-avocadenynofuran (13.2%), and β-caryophyllene (11.0%) were the major components in the oil of *P. indica* Spreng [6]. In another study, the oil of *P. americana* revealed that (*Z*)-nerolidol, (*E,E*)-2,4-decadienal, (*E,E*)-α-farnesene, β-caryophyllene, caryophyllene oxide, and α-copaene were the major components [1]. The major components in the volatile leaf oils of *P. podadenia* Blake grown in the Sierra Madre Occidental, Mexico, were α-pinene (20%), δ-3-carene (16%), limonene (12%), myrcene (10%), α-terpinene (10%), camphene (9%), β-pinene (8%), and α-phellandrene (8%) [7]. Estragole (methyl chavicol) was the chief constituent in the essential oil of *Aguacato* (the Mexican Avocado tree) [8].

This paper reports the chemical constituents of the leaf essential oil of *P. americana* cultivated in the north of Iran for the first time.

Identification of constituents of the oil was made by comparison of their mass spectra and retention indices (RI) with those given in the literature and authentic samples [9]. Relative percentage amounts were calculated from the GC peak area using a Shimadzu C-14A chromatopac apparatus. The identified constituents can be seen in Table 1. Thirty-six components were characterized, accounting for 97.7% of the oil. As is shown, the oil consists of 54.5% monoterpenes, 0.6% oxygenated monoterpenoids, 37.7% sesquiterpenes, and 4.9% oxygenated sesquiterpenoids with methyl eugenol (31.2%), β-caryophyllene (16.9%), estragole (9.0%), δ-cadinene (4.8%), β-pinene (4.2%), and α-pinene (3.2%) as the major components in the oil.

Plant Material. The leaves of Avocado (*Persea americana*) were collected in February 2006 from Ramsar, Province of Mazandran, North of Iran, where the Avocado trees were cultivated. Voucher specimens have been deposited at the Herbarium of the Research Institute of Forest and Rangelands (TARI), Tehran, Iran.

Extraction of the Essential Oil. The air-dried leaves of Avocado were subjected to hydrodistillation using a Clevenger–type apparatus for 4 h. After decanting and drying of the oil over anhydrous Na_2SO_4, the corresponding pale-yellow oil was isolated in a yield of 0.15% (w/w).

GC Analysis of the oil was carried out using a Shimadzu 15A gas chromatograph equipped with a 30 m × 0.25 mm DB-5 column, film thickness 0.25 μm, temperature programmed at 60°C (3 min) – 220°C (5 min) at 5°C/min. N_2 was used as carrier gas (1.0 mL/min). The split injector (ratio 1:30) and the flame ionization detector (FID) temperatures were set at 250°C.

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TABLE 1. Percentage Composition of the Essential Oil of Leaves of *Persea americana* (Avocado)

Compound	RI	%	Compound	RI	%
α-Pinene	939	3.2	*allo*-Aromadendrene	1460	0.4
Sabinene	975	0.7	(*E*)-Cadina-1(6),4-diene	1477	0.8
β-Pinene	979	4.2	γ-Muurolene	1480	0.8
β-Myrcene	991	0.2	Germacrene-D	1485	3.0
α-Phellandrene	1003	1.5	β-Selinene	1490	0.7
p-Cymene	1025	0.3	(*E*)-Muurola-4(14),5-diene	1494	1.7
β-Phellandrene	1030	0.5	Bicyclogermacrene	1500	1.5
1,8-Cineole	1031	0.6	α-Muurolene	1500	0.7
γ-Terpinene	1060	0.2	(*E,E*)-α-Farnesene	1506	0.7
Estragole (= methyl chavicol)	1196	9.0	γ-Cadinene	1514	0.7
α-Cubebene	1351	1.2	δ-Cadinene	1523	4.8
β-Copaene	1377	1.2	(*E*)-Cadina-1(2),4-diene	1535	1.0
β-Cubebene	1388	0.5	(*E*)-Nerolidol	1563	1.8
β-Elemene	1391	0.6	Globulol	1585	0.4
Methyl eugenol	1404	31.2	α-Acorenol	1633	0.5
β-Caryophyllene	1419	16.9	α-Muurolol	1646	1.0
(*Z*)-Muurola-3,5-diene	1450	1.0	Valerianol	1658	0.8
α-Humulene	1455	3.0	Occidenol	1678	0.4

GC/MS Analysis was performed using Hewlett-Packard 6890/5973 GC/MS equipment with a 30 m × 0.25 mm, film thickness 0.25 μm HP-5MS column. Helium (99.999%) was used as carrier gas (1.0 mL/min). The temperature program was as in GC. MS spectra were taken at 70 eV. The GC/MS apparatus was equipped with Chemstation software and Wiley 275 library.

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