

COMPOSITION OF THE ESSENTIAL OILS OF *Lycium barbarum* AND *L. ruthenicum* FRUITS

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Water-distilled essential oils from the fruits of *Lycium barbarum* and *L. ruthenicum* were analyzed by GC-MS. The main components in the oil of *L. barbarum* were found to be hexadecanoic acid (47.5%), linoleic acid (9.1%), β -elemene (5.4%), myristic acid (4.2%), and ethyl hexadecanoate (4.0%). The essential oil of *L. ruthenicum* has heptacosane (14.3%), ethyl linoleate (10.0%), hexacosane (7.0%), nonacosane (6.2%), and ethyl hexadecanoate (5.8%) as the main compounds.

Key words: *Lycium barbarum*, *Lycium ruthenicum*, essential oil, GC/MS, Solanaceae.

Lycium fructus has been used as a remedy since ancient times in many countries, especially in China for its emmenagogue, diuretic, antipyretic, tonic, aphrodisiac, hypnotic, and hepatoprotective effects [1–7]. The genus *Lycium* (Solanaceae) is represented by eight species in Turkey (*L. barbarum* L., *L. europaeum* L., *L. ruthenicum* Murray, *L. depressum* Stocks, *L. schweinfurthii* Dammer, *L. anatolicum* A. Baytop et R. Mill, *L. shawii* Roemer et Schultes and *L. chinense* Miller). *L. anatolicum* is endemic in Turkey [8].

Lycium species of Turkey have not so far been studied for their chemical or pharmacological properties. Two *Lycium* species, *L. barbarum* and *L. ruthenicum*, have been subjected to pharmacognostical investigations [9]. The chemical, antioxidant, and cytotoxic properties of the two species were investigated during the said study. Here, we report on the analysis of the fruit oils of *Lycium barbarum* and *L. ruthenicum*. To the best of our knowledge, this is the first study of their essential oils.

EXPERIMENTAL

The essential oil composition of the fruits of *Lycium chinensis* has previously been reported, with ethyl hexadecanoate, 1-octadecanone, tetrapyrazine, 2-furancarboxaldehyde, and ethyl linoleate as the main constituents [10].

In the present work, similar to the previously reported result, fatty acids and their esters, and a sesquiterpene: hexadecanoic acid (47.5%), linoleic acid (9.1%), β -elemene (5.4%), myristic acid (4.2%), and ethyl hexadecanoate (4.0%) were found to be the main constituents in the essential oil of *L. barbarum*. The essential oil of *L. ruthenicum* was characterized by the occurrence of heptacosane (14.3%), ethyl linoleate (10.0%), hexacosane (7.0%), nonacosane (6.2%), and ethyl hexadecanoate (5.8%) as the main constituents.

Twenty-one compounds from the essential oil of *L. barbarum* and 18 compounds from the oil of *L. ruthenicum* were identified by GC/MS, representing 84% and 80.4% of the total oil, respectively (Table 1).

The fruits of *Lycium barbarum* and *L. ruthenicum* were collected from Eskisehir in October 2001 and from Malatya in August 2001, respectively. The voucher specimens are kept at the Herbarium of the Faculty of Pharmacy, Anadolu University in Eskisehir, Turkey (ESSE14218 and ESSE14219, resp.).

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TABLE 1. Composition of the Essential Oils (%) of *Lycium barbarum* and *L. ruthenicum*

RRI	Compounds	<i>L. barbarum</i>	<i>L. ruthenicum</i>	RRI	Compounds	<i>L. barbarum</i>	<i>L. ruthenicum</i>
1203	Limonene	0.2	N.d.	2273	Selin-11-en-4 α -ol	0.3	N.d.
1452	1-Octen-3-ol	0.4	N.d.	2300	Tricosane	N.d.	2.5
1548	(<i>E</i>)-2-Nonenal	0.9	N.d.	2384	Farnesylacetone	0.5	4.6
1553	Linalool	0.2	N.d.	2400	Tetracosane	N.d.	3.9
1600	β -Elemene	5.4	N.d.	2503	Dodecanoic acid	1.5	N.d.
1600	Hexadecane	N.d.	0.8	2509	Methyl linoleate	N.d.	5.6
1661	Safranal	0.4	N.d.	2538	Ethyl linoleate	2.5	10.0
1798	Methyl salicylate	1.1	N.d.	2600	Hexacosane	N.d.	7.0
1827	(<i>E,E</i>)-2,4-Decadienal	N.d.	0.8	2613	Ethyl linolenate	0.9	N.d.
1868	(<i>E</i>)-Geranylacetone	1.8	1.1	2622	Phytol	N.d.	3.0
1958	(<i>E</i>)- β -Ionone	0.5	N.d.	2670	Myristic acid	4.2	N.d.
2037	2-Pentadecanone	1.3	N.d.	2700	Heptacosane	N.d.	14.3
2100	Heneicosane	0.2	0.9	2800	Octacosane	N.d.	5.2
2131	Hexahydrofarnesylacetone	N.d.	2.7	2900	Nonacosane	1.1	6.2
2200	Docosane	N.d.	1.5	2931	Hexadecanoic acid	47.5	N.d.
2226	Methyl hexadecanoate	N.d.	4.5	3290	Linoleic acid	9.1	N.d.
2262	Ethyl hexadecanoate	4.0	5.8				

RRI: Relative retention indices calculated against *n*-alkanes.

N.d.: not detected.

% calculated from TIC data.

The air-dried fruits of *Lycium barbarum* and *L. ruthenicum* were hydrodistilled for 3 h using a Clevenger-type apparatus to obtain essential oils in 0.09% and 0.07% yield on a dry weight basis, respectively.

The oils were analyzed by GC-MS using a Hewlett-Packard GC-MSD system. An HP-Innowax FSC column (60 m \times 0.25 mm *i.d.*, with 0.25 μ m film thickness) was used with helium as carrier gas (1 mL/min). The GC oven temperature was kept at 60°C for 10 min, programmed to 220°C at a rate of 4°C/min, then kept constant at 220°C for 10 min, and then programmed to 240°C at a rate of 1°C/min. *n*-Alkanes were used as reference point in the calculation of the relative retention indices (RRI). The split ratio was adjusted at 50:1. The injector temperature was 250°C. MS was recorded at 70 eV. The mass range was from *m/z* 35 to 425. A library search was carried out using the Wiley GC/MS Library and the in-house Baser Library of Essential Constituents. Relative percentage amounts were calculated from total ion chromatograms (TIC) by the computer (Table 1).

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