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SHORT COMMUNICATION

VOLATILE CONSTITUENTS OF ESSENTIAL OILS OF *ELEOCHARIS PAUCIFLORA* (LIGHT) LINK AND *ELEOCHARIS UNIGLUMIS* (LINK) J.A. SCHULTES GROWING WILD IN IRAN

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ABSTRACT. The investigation of the volatile compounds of essential oils of *Eleocharis pauciflora* (Light) Link and *Eleocharis uniglumis* (Link) J.A. Shultes by gas chromatography/mass spectrometry (GC/MS) led to the identification of 20 and 23 compounds, respectively. The presented essential oils were characterized by the abundance of sesquiterpene hydrocarbons and oxygenated sesquiterpenes, while the fraction of monterpenens was low. The main constituents of *E. pauciflora* essential oil were cyperene (35.4%), cyperotundone (12.7%), isorotundene (9.3%) and cyperol (7.8%). Essential oil of *E. uniglumis* was dominated by cyperene (28.8%), cyperotundone (8.9%), isorotundene (8.7%), cyperol (8.5%), isocyperol (6%) and α-cubebene (4.6%).

KEY WORDS: *Eleocharis uniglumis* (Light) Link**,** *Eleocharis pauciflora* (Link) J.A. Shultes, Essential oil, Cyperene**,** Cyperotundone

INTRODUCTION

Cyperaceae are the third largest monocotyledonous family [1] and constitute a specialized group of plants, particularly in relation to their generative structure [2]. The majority of the species of *Cyperaceae* are anemophilous and their flowers generally have no scent because of their tiny, inconspicuous flowers and hidden or reduced perianth [3].

Genus *Eleocharis* comprised of more than 250 of the *Cyperaceae* (sedge) family. They are commonly known as spikerushes, although spikesedges is a more technically appropriate name and most scientists who study them in earnest refer to them as such. The genus has a geographically cosmopolitan distribution, with centers of diversity in the Amazon and adjacent eastern slopes of the South American Andes, northern Australia, eastern North America, California, Southern Africa, and subtropical Asia [4]. Their subterraneous parts comprise roots and stems (rhizomes or stolons) simple, unramified stalks that end in a dense spiciform inflorescence formed by numerous, very inconspicuous flowers form their aerial parts [3]. *Eleocharis* species spread by growth of their horizontal stems, as well as by dispersal of seeds and tubers or, in some species, by proliferation of the culm tip [5-7]. The vast majority of *Eleocharis* species grow in aquatic or mesic habitats from sea level to higher than 5,000 meters in elevation. Species of the genus are often prominent components of wetland ecosystems and have served as models for research on physiological adaptations to aquatic environments [8-14]. Also it has been reported that some of the species of *Eleocharis* have great allelopathy effect and inhibit growth of other plants [15, 16].

Two species of genus *Eleocharis* that are identified in Iran are *Eleocharis pauciflora* (Light) Link and *Eleocharis uniglumis* (Link) J.A. Schultes [17]. The *E. pauciflora* is commonly found in the river and lagoons of western north of Iran, whereas *E. uniglumis* grows in different regions from eastern north to eastern south [18]. To the best of our knowledge there is no record of any previous work on the oil composition of this Iranian grown plant, so in this paper we

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report the qualitative and quantitative composition of the volatile oils of *E. pauciflora and E. uniglumis.*

EXPERIMENTAL

Plant material. The aerial parts of the *E. pauciflora* plants were collected from west of Arak, Province of Markazi, and *E. uniglumis* from Kandavan, Alborz Mountains range, Iran, at the flowering stage in May and June of 2008. Voucher specimens have been deposited at the herbarium of Research Institute of Forests and Rangelands (TARI).

Oil Isolation. The aerial parts of the plants after grinding had been submitted to hydrodistillation with a Clevenger type apparatus according to the standard procedure described in the European Pharmacopoeia [19]. The essential oil had been distilled with water for 3 h, collected, dried under anhydrous sodium sulfate and stored at 4 ºC until used. The yields of the oils from *E. pauciflora* and *E. uniglumis* based on dry plant weight were 1.5% and 1.2% (v/w), respectively.

GC–MS analysis and identification of compounds. The essential oils were analyzed by gas chromatography coupled to mass spectrometry (GC–MS) (Hewlett-Packard computerized system comprising a 6890 gas chromatograph coupled to a 5973 mass spectrometer) using a capillary column, Hp-5Ms (5% phenylmethyl siloxane) (30 m × 0.25 mm, film thickness 0.25 µm). Oven temperature was programmed 60 ºC for 20 min, and then increased to 220 ºC at a rate of 4 ºC/min, finally holding at 220 ºC for 20 min. Helium was used as carrier gas at a flow rate of 1 mL/min. The ionization energy was 70 eV with a scan time of 1 s and mass range of 40–300 amu. Retention indices for all the compounds were determined according to the Kovats method using *n*-alkanes as standards. The identification of the oil components was accomplished by comparison of their GC retention indices as well as their mass spectra with corresponding data of authentic compounds or of components of reference oils [20, 21]. Relative percentage was calculated from TIC by the computer.

RESULTS AND DISCUSSION

Table 1 shows the constituents of the essential oil, their percentage composition and their Kovats Index (KI) values listed in order of elution. Twenty constituents, representing 98.5% of the total components of essential oil of *E. pauciflora* were identified. The first constituent was cyperene (35.4%), the second cyperotundone (12.7%). Other major compounds of the essential oil were isorotundene (9.3%) and cyperol (7.8%). As can be seen, in *E. pauciflora* sesquiterpene hydrocarbons (53.5%) and oxygenated sesquiterpenes (40%) were in abundance. The percentage of remaining sixteen compounds ranged from 0.2 to 3.7%.

More than twenty compounds were identified in the essential oil of *E. uniglumis*, such as 2 monoterpenes, 10 sesquiterpene hydrocarbons and 11 oxygenated sesquiterpenes which represented 97.2% of the total composition of essential oil. Sesquiterpene hydrocarbons comprised 49.1% of the oil, while oxygenated sesquiterpenes 43.6% of one. Main constituent in essential oil of *E. uniglumis* was cyperene (28.8%). Significant amounts were detected for cyperotundone (8.9%), isorotundene (8.7%), cyperol (8.5%), isocyperol (6%) and α-cubebene (4.6%). The monoterpene fractions of both essential oils were relatively small, representing 5 and 5.5%, respectively, of total oil.

There are few reports about chemical composition on the essential oil of species from genus *Eleocharis*. In 2005, Magalhaes *et al.* [22, 23] for the first time reported the volatile constituents of *Eleocharis sellowiana* and *Eleocharis elegans* from southern Brazil. No floral volatile was detected from *E. sellowiana* inflorescences. On the other hand, it was identified six

sesquiterpenes, two long chain alkanes, two long chain aldehydes and one fatty acid ester as floral volatiles in *E. elegans*. However, it was not reported any percentage of identified compounds [22].

Table 1. Percentage composition of essential oils of *E. pauciflora* and *E. uniglumis*.

Composition	RI[a]	RI[24]	RI[25]	*E. pauciflora*	*E. uniglumis*
α-Pinene	937	937	936	1.8	2.8
α-Sabinene	970			-	-
β-Pinene	974	980	980	3.2	2.7
Sabinene hydrate trans	1060			-	-
Camphor	1126			-	-
Borneol	1155	1150		-	-
Cyprotene	1345	1345	1352	0.2	-
Cypera-2,4-diene	1351	1351		1.2	-
α-Cubebene	1360	1360		3.6	4.6
β-Cubebene	1387			-	-
α-Copaene	1387			-	-
Cyperene	1390	1390	1396	35.4	28.8
β-Damascone	1394			-	-
β-Caryophyllene	1418		1670	-	0.1
Caryophyllen-2-6-b-oxide	1425			-	-
α-Humulene	1454	1454	1454	-	0.3
Rotundene	1460			-	-
β-Selinene	1485	1486	1488	1.9	2.7
α-Selinene	1492			-	-
α-Calamenene	1498			-	0.4
α-Muurolene	1499			-	-
T-Calamenene	1512		1529	1.7	3.2
β-Calamenene	1514			-	0.2
δ-Cadinene	1517	1517	1522	-	0.1
α-Calaocrene	1542			0.2	-
Isorotundene	1560	1560		9.3	8.7
Caryophyllene oxide	1576			0.3	0.1
Isocyperol	1593	1590		3.7	6.0
Cyperol	1600	1600		7.8	8.5
T-Cadinol	1616	1616		2.7	3.6
Cubenol-1-epi	1619			-	0.1
α-Muurolol	1630	1630		1.6	4.0
T-Muurolol	1632	1632		2.2	0.7
Cubenol	1636			-	-
α-Cadinol	1640	1640		3.0	3.5
Caryophyllene epoxide	1660			-	-
Mustakone	1670		1676	2.7	4.7
Cyperotundone	1680	1680	1694	12.7	8.9
α-Cyperone	1706	1710	1755	3.3	2.5
Total	--			98.5	97.2

RI[a]: calculated retention index relative to C_9–C_{23} *n*-alkanes on HP-5MS column, RI [24] literature retention indices on HP-5 Column, RI [25] literature retention indices on DB-5 column.

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