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Comparison of Essential Oil Constituents of *Scirpus Littoralis* Schrad. and *Scirpus Wardianus* J. R. Drumm. from Iran

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Abstract: The essential oils obtained by hydrodistillation of aerial part of *S. littoralis* and *S. wardianus* grown in Iran were analyzed by GC/MS. Twenty seven components of *S. littoralis* and *S. wardianus* representing 85.5% and 86% of the oils were identified respectively. The major components in both oils were cyperene and cyperotundone, representing 18.7% and 14.8% in *S. litoralis* and 24.1% and 11.1%, in *S. wardianus*. Both oils were richer in sesquiterpene hydrocarbon and oxygenated sesquiterpene.

Keywords: *Scirpus littoralis*, *Scirpus wardianus*, Essential oil composition, Cyperene, Cyperotundone

Introduction

The plant genus *scirpus* consists of a large number of aquatic, grass-like species in the family *cyperceae* and grows in wetlands and moist soil. *Scirpus* species are often planted to inhibit soil erosion and provide habitat for other wildlife[1]. They have been extensively used in constructed wetlands for wastewater treatment because they can efficiently remove nutrients and pathogens from effluent[2-7]. Also, some species of *Scirpus* may have a relatively low ability to take up heavy metals, for example, *S. robustus* that efficiently removes selenium (Se) from contaminated water demonstrating potential for Se phytoremediation by wetlands[8,9]. On the other hand, it has been reported that the rhizomes of *S. yagara* Ohwi, as a commonly used traditional Chinese medicine (TCM), have the therapeutic functions of promoting

blood circulation, removing stagnation, relieving pain, *etc*. It has been used solely or as an important ingredient in some traditional prescriptions for the treatment of hyperemesis gravidarum, postpartum abdominal pain, dyspepsia and amenorrhea[10]. Two species of this genus, which grow wild in the east and southern east of Iran, are *Scirpus littoralis* Schrad. and *Scirpus wardianus* J. R. Drummond[11,12]. To date, no information on the chemical composition of the essential oil of *S. littoralis* and *S. wardianus* of Iran origin is available. So we decided to examine this oil.

Experimental

The aerial parts of the *S. littoralis* species were collected between Zabol and Takht adalat around Hamun Lake in Province of Sistan va Balutchestan, Iran, in April 2007 at the flowering stage and *S. wardianus* from around Hirmand River, Province of Sistan va Balutchestan, Iran, in June 2007. Voucher specimens have been deposited at the herbarium of Research Institute of Forests and Rangelands (TARI).

Hydrodistillation

The aerial parts of the plant after grinding had been submitted to hydrodistillation with a Clevenger type apparatus according to the standard procedure described in the European Pharmacopoeia[13]. The essential oil had been co-distilled with water for 3 h, collected, dried under anhydrous sodium sulfate and stored at 4 ºC until used. The yield of the oil was 1.5% and 1.2% (v/w), based on dry plant weight.

Gas chromatography-mass spectrometry

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[14,15]. Relative percentage was calculated from TIC by the computer.

Results and Discussion

Data obtained from qualitative and quantitative determination of the oil samples are shown in Table 1. Twenty seven components were identified in the oil of *S. littoralis* which represented 85.5% of the total composition of the oil. Cyperene (18.7%) was the dominant constituent. The second major compound was cyperotundone (14.8%). Also, the oil had significant amounts of isorotundene (8.2%), *β*-selinene (5.6%), isocyperol (5.3%) and *β*-pinene (4.5%).

Chemical analysis of the oil of *S. wardianus* resulted in the identification of twenty seven components, accounting for 86% of the oil content (Table 1). The main constituents of the oil were cyperene (24.1%), cyperotundone (11.1%), cyperol (6.1%), isorotundene (5.9%), mustacone (5.1%) and isocyperol (4.8%).

Table 1. Percentage compound of the oil of *S. littoralis* and *S. wardianus*

Composition	RI[a]	1	2
α-Pinene	937	1.7	2.3
α-Sabinene	970	0.1	-
β-Pinene	974	4.5	3.1
Sabinene hydrate trans	1060	0.2	0.7
Camphor	1126	-	0.9
Borneol	1155	-	-
Cyprotene	1345	0.1	0.1
Cypera-2,4-diene	1351	-	0.3
α-Cubebene	1360	2.5	3.1
β-Cubebene	1387	0.1	-
α-Copaene	1387	-	0.2
Cyperene	1390	18.7	24.1
β-Damascone	1394	0.2	0.4
β-Caryophyllene	1418	0.3	-
Caryophyllane-2-6- *β*-oxide	1425	0.4	0.7
α-Humulene	1454	-	0.1
Rotundene	1460	-	-
β-Selinene	1485	5.6	3.3
α-Selinene	1492	0.1	-
α-Calamenene	1498	-	-
α-Muurolene	1499	-	0.2
t-Calamenene	1512	4.1	1.8
β-Calamenene	1514	-	-
δ-Cadinene	1517	0.6	-
α-Calaocrene	1542	-	-
Isorotundene	1560	8.2	5.9
Caryophyllene oxide	1576	0.2	0.4
Isocyperol	1593	5.3	4.8
Cyperol	1600	1.5	6.1
t-Cadinol	1616	2.5	3.1
Cubenol-1-epi	1619	0.1	0.2
α-Muurolol	1630	1.5	2.7
t-Muurolol	1632	2.2	0.3
Cubenol	1636	0.2	-
α-Cadinol	1640	2.4	1.8
Caryophyllene epoxide	1660	0.1	-
Mustacone	1670	3.4	5.1
Cyperotundone	1680	14.8	11.1
α-Cyperone	1706	3.9	3.2
Total	--	85.5	86

1 = S. littoralis, 2 = S. wardianus, a: Kovats Index

According to these results, in both species *S. littoralis* and *S. wardianus* sesquiterpene hydrocarbons (56.6% and 52.9%, respectively) and oxygenated sesquiterpenes

(22.2% and 25.7%, respectively) were the predominant groups. As can be seen, the monoterpene fraction of both oils was relatively small, representing (6.7%) and (7.4%), respectively of the total oils.

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