Volatile constituents of *Thalassia testudinum* Banks ex König Leaves

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Abstract

The volatile constituents from the sea grass *Thalassia testudinum* was analyzed by GC and GC/MS. One-hundred-forty-two constituents were identified which constituted more than 95% of the oil composition, all of them reported for the first time in this species. The most prominent volatile compound was ethyl (Z)-1-propenyl disulfide (31% of the total composition).

Key Word Index

Turtle grass, *Thalassia testudinum*, Hydrocharitaceae, essential oil composition, ethyl (Z)-1-propenyl disulfide.

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Rec: April 2008
Acc: August 2008

1041-2905/10/0005-0421$14.00/0—

Table I. Volatile compounds in *Thalassia testudinum* leaves

Compound	RI	%
3-methylbutanal	653	0.3
2-methylbutanal	665	0.4
1-penten-3-ol	683	1.1
1-penten-3-one	686	0.4
pentanal	705	0.5
2-ethylfuran	707	0.6
acetoin	720	t
acetal	730	0.1
isopentanol	741	0.1
(E)-3-penten-2-one	745	0.2
dimethyl disulfide	753	0.2
(E)-2-pentenal	754	0.1
(1H)-pyrrole	762	0.1
(Z)-2-pentenol	774	1.1
3-hexanone	784	t
2-hexanone	792	t
hexanal	802	3.4
ethyl (Z)-1-propenyl disulfide	813	31.0
2-methylpyridine	816	t
2-furfural	835	t
(E)-2-hexenal	855	1.7
(Z)-3-hexenol	859	0.5
isovaleric acid	885	t
p-xylene	865	0.2
2,6-dimethypyridine	884	t
3-heptanone	887	t
hexanol	890	0.4
2-heptanone	892	0.5
(Z)-4-heptenal	901	0.3
heptanal	903	0.8
valeric acid	909	t
(E,E)-2,4-hexadienal	910	0.2
methyl (Z)-1-propenyl disulfide	922	2.8
α-pinene	939	0.2
4-decanol	946	0.1
camphene	954	t
methyl (E)-1-propenyl disulfide	956	2.6
3-ethylpyridine	959	t
benzaldehyde	961	0.4
dimethyl trisulfide	970	0.2
heptanol	971	0.1
sabinene	975	0.1
β-pinene	979	0.2
1-octen-3-ol	980	0.1
3-octanone	984	0.1
6-methyl-5-hepten-2-one	986	0.1
2-pentylfuran	991	1.1
2-octanone	993	t
octanal	998	t
decane	1000	t
α-phellandrene	1002	t
(E,E)-2,4-heptadienal	1011	0.2
α-terpinene	1015	0.1
hexanoic acid	1019	0.1
p-cymene	1025	0.3
limonene	1029	0.5
1,8-cineole	1031	3.1
2,2,6-trimethylcyclohexanone	1034	0.4
5-ethyl-2(5H)-furanone	1036	0.5
benzyl alcohol	1037	t
γ-terpinene	1060	0.3
acetophenone	1065	0.3
o-tolualdehyde	1068	t
octanol	1069	t
2-pyrrolidinone	1076	0.1
2-nonanone	1090	0.1
linalool	1097	0.7
nonanal	1101	0.3
isophorone	1121	0.1
trans-pinocarveol	1139	0.1
camphor	1145	1.4
(Z)-2-nonenal	1149	t
4-ethylbenzaldehyde	1164	0.4
borneol	1169	0.4
ethyl benzoate	1172	0.2
2,5-dimethylbenzaldehyde	1175	0.3
terpinen-4-ol	1177	0.5
α-terpineol	1189	0.6
methyl salicylate	1192	t
safranal	1197	0.2
dodecane	1200	0.1
decanal	1203	0.1
β-cyclocitral	1223	0.7
dimethyl tetrasulfide	1232	0.1
geraniol	1253	t
linalyl acetate	1258	t
bornyl acetate	1289	0.1
2-undecanone	1294	0.1
(1H)-indole	1296	0.1
tridecane	1300	t
trans-carvyl acetate	1340	t
α-terpinyl acetate	1349	2.2
eugenol	1359	1.4
α-ylangene	1375	t
α-copaene	1377	0.1
β-maaliene	1382	0.1
β-elemene	1390	0.6
2-dodecanone	1396	t
tetradecane	1400	0.1
methyl eugenol	1404	0.9
dedecanal	1409	t
β-caryophyllene	1418	1.9
methyl undecanoate	1427	t
(E)-α-ionone	1430	0.1
α-*trans*-bergamotene	1435	t
dihydro-β-ionone	1436	0.2
(E)-cinnamyl acetate	1446	t
geranylacetone	1455	0.4
α-humulene	1455	0.3
ethyl (E)-cinnamate	1467	0.1
germacrene D	1486	0.2
(E)-β-ionone	1489	7.2
pentadecane	1500	2.5
tridecanal	1510	0.3
δ-cadinene	1522	t
dihydroactinidiolide	1533	0.5
β-calacorene	1545	0.1
elemicin	1557	t
(E)-nerolidol	1564	t
(E)-2-tridecenal	1569	0.2
spathulenol	1578	0.2
caryophyllene oxide	1589	1.1
hexadecane	1600	0.3
teradecanal	1614	0.5
benzophenone	1628	t
β-eudesmol	1653	0.1
selin-11-en-4-α-ol	1660	0.2
tetradecanol	1673	0.8
heptadecane	1700	1.2
pentadecanal	1713	1.9
pentadecanol	1773	0.3
hexahydrofarnesyl acetone	1846	1.7

Table I. Continued

Compound	RI	%	Compound	RI	%
pentadecanoic acid	1869	t	hexadecanoic acid	1983	t
hexadecanol	1876	0.6	ethyl hexadecanoate	1992	t
nonadecane	1900	t	geranyl linalool	2006	t
(E,E)-farnesyl acetone	1915	0.3	heneicosane	2100	0.2
methyl hexadecanoate	1922	t	phytol	2112	0.9

t : < 0.1%

Plant Name, Source and Part

Thalassia testudinum Banks *ex* König (Hydrocharitaceae) plants were collected in March 2007 from "La Concha" Beach (22°05'45"N / 82°27'15"W) and identified by Areces J.A., Ph.D., Instituto de Oceanología (La Habana). A voucher sample (No. IdO39) has been deposited in the Herbarium of the Cuban National Aquarium.

Leaves were washed with distilled water and air-dried for about three days. The oil was obtained from 100 g of leaves by simultaneous distillation-solvent extraction with 25 mL of diethyl ether for 3 h (previously distilled). The extract was dried over anhydrous sodium sulfate and concentrated with a Kuderna-Danish apparatus to 0.9 mL, and then to 0.2 mL with a gentle stream of nitrogen.

Introduction

Thalassia testudinum is a sea grass, commonly known as turtle grass (1), which plays an important role in marine ecosystems, supplying nursery grounds for many invertebrate and fish species, stabilizing the sediments of near shore coast, etc. (2). This plant is the largest and most robust sea grass in Florida and the Caribbean. The leaves are ribbon-like, are about 1.3 cm wide and up to 35 cm long, and grow in water up to 25 m and salinities as low as 20 ppt. It prefers shallower water up to 10 m and salinities between 25–40 ppt (3).

Previous studies have shown that luteolin 7-β-D-glucopyranosyl-2"-sulfate (thalassiolin A), isolated from *T. testudinum* (collected in the Bahamas coasts) has antibiotic activity against Zoosporic fungi (4). Moreover, a recent study demonstrated that thalassiolin A, chrysoeriol 7-β-D-glucopyranosyl-2"-sulfate (thalassiolin B) and apigenin 7-β-D-glucopyranosyl-2"-sulfate (thalassiolin C), represent a new series of HIV integrase inhibitors (5). A review of the literature reveals that the volatiles of this plant have not been the subject of previous studies.

Process

An HP 6890 GC with a FID, equipped with an HP-5MS fused silica column (30 m x 0.25 mm x 0.25 μm) was used. The column temperature was programmed as follows: 70°C isothermal for 2 min, 70°C to 230°C at 4°C/min, then held for 10 min. Helium carrier gas was used at a flow rate of 0.9 mL/min. The injector and detector were maintained at 230°C. Sample injection volume was 0.3 μl with a split ratio of 1:10. Linear retention indices were calculated using n-paraffin standards.

An HP 6890 Series II equipped with a mass selective detector HP-5973N was employed. A same capillary column and temperature program as in the GC-FID technique was used. Mass spectra were recorded in the electron-impact mode at 70 eV by 1.8 scans/s, and the mass range used was m/z 35–400; ion source and connecting parts temperature: 230°C.

Compounds were identified as far as possible from the best match to their mass spectrum in the NBS/Wiley and NIST libraries or in-house FLAVORLIB library, and confirmed in many compounds by their relative retention indices. Whenever possible, retention indices and mass spectra were also compared with those of authentic samples. Mass spectra from the literature were also compared (6). Quantitative analysis was made by the normalization method from the electronic integration of the FID peak areas without the use of correction factors.

The identified compounds in the leaf oil of *T. testudinum* are listed in Table I. One-hundred-forty-two constituents were identified which constitute more than 95% of the composition, all of them reported for the first time in this species. The most prominent volatile compound was ethyl (Z)-1-propenyl disulfide (31%).

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