

Aromatic plants of Kenya: volatile constituents of leaf oils of *Sphaeranthus suaveolens* (Forsk) D.C. and *S. bullatus* Mattf

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The essential oils isolated by hydrodistillation from *Sphaeranthus suaveolens* (Forsk) D.C. (0.47%) and *S. bullatus* Mattf. (0.5%) were analyzed by GC and GC-MS. Seventy eight compounds consisting about 95% of the oil of *S. suaveolens* were identified while 97 constituents accounting for about 83% were identified from the leaf oil of *S. bullatus*. The major constituents of the leaf oil of *S. suaveolens* was *cis*-pinocamphone (63.5%) while those of *S. bullatus* oil were thymol (22.0%), bornyl acetate (8.1%) and germacrene-D (7.9%).

Key words: *Sphaeranthus suaveolens* (Forsk) D.C., *S. bullatus* Mattf., Composite, Volatile constituents, GC-MS, *cis*-Pinocamphone, Thymol.

INTRODUCTION

Sphaeranthus suaveolens (Forsk) D.C. (Family Composite, Astraceae) is a trailing hairless herb with ascending stem bearing elliptic, toothed leaves smelling of apples and nearly entire continuous wings; inflorescence globose, pale purple terminal, 8-14 mm diameter, bracts minutely hardly or not. The plant is common near fresh water often in dry streambeds [1].

Sphaeranthus bullatus Mattf on the other hand is a woody annual, cobwebby on young nodes, hairless, later with continuous toothed stem wings; leaves oblong deeply toothed, with bulgy surface, smelling of peppermint; inflorescence globose, small hairy 9-12 mm diameter on narrow winged stalks. This plant is common in wooded or disturbed grassland sometimes near water [1].

A decoction of the leaves of *S. suaveolens* is rubbed into the body of a person with malaria. The decoction of the whole plant is also drunk as a cough remedy [2].

The leaves of *S. bullatus* are pounded with other plants for cure of stomachache. The decoction of the leaves is also given to adolescents as a tonic.

The extract of the aerial parts of *S. suaveolens* and *S. bullatus* has afforded common sterols, thiopheneacetylenes, eudesmanolides and carvotecenone derivatives among others [3].

In our previous work the constituents of essential oil of *S. cyathuloides* were reported [4]. We have now studied the volatile constituents of *S. suaveolens* and *S. bullatus* and wish to report on the same.

EXPERIMENTAL

Plant material and isolation procedure

Leaves of *S. suaveolens* and *S. bullatus* were collected in June 1993 in Nairobi. The identity of the plant specimens was established at the National Herbarium,

Nairobi, Kenya. Voucher specimens were deposited at the Department of Pharmacology and Pharmacognosy, University of Nairobi.

Semi-dried materials (100g) of leaves were subjected to hydrodistillation for 3 hours in a Clevenger-like apparatus to give the essential oils. The oils were dried over anhydrous sodium sulphate and stored at 40°C.

Gas chromatography

The essential oils were analyzed by Hewlett-Packard 5890 gas chromatography equipped with FID and coupled to a Hewlett-Packard 3393A integrator. Analytical conditions were: a fused - silica column (51m x 0.22 mm i.d.) coated with methylsilicone (film thickness 0.12 mm; Hewlett-Packard); helium as carries gas, the oven temperature was held at 40°C for 5 min, then programmed from 40°C to 180°C to 5°C/min subsequently from 180°C to 280°C to 20°C/min, then isothermal at 280°C for 10 minutes; detector temperature was 250°C; the samples were injected on the GC column in the splitless mode.

Gas chromatography - Mass spectrometry

The GC-MS analysis was carried out on a VG Masslab 12 - 250 instrument equipped with a Hewlett-Packard 5790 GC and a data system at an ionization voltage of 7.0 eV and in the Electron impact mode using helium as carrier gas and the other GC analytical conditions identical to those mentioned above.

The identity of the constituents was established by computer mass spectral library search, comparison of MS with those published in the literature, comparison of retention times with those of reference compounds, and peak enhancement [5].

RESULTS AND DISCUSSION

Table I and II show results of the analysis of essential oils from *S. bullatus* and *S. suaveolens* respectively.

TABLE I. Chemical constituents of the leaf of *Sphaeranthus bullatus*

COMPONENT	%	COMPONENT	%
E-2-hexenal	t	<i>trans</i> -theaspirane	0.04
(Z)-3-hexenol	t	<i>cis</i> -theaspirane	t
hexanol	t	myrtenyl acetate	0.2
α -thujene	t	eugenol	0.6
α -pinene	0.4	neryl acetate	0.01
camphene	0.2	α -cubebene	0.07
oct-1-en-3-ol	0.3	(E)- β -damascenone	0.03
sabinene	0.06	α -copaene	0.2
β -pinene	0.1	β -bourbonene	2.1
octan-3-ol	0.1	β -elemene	0.1
myrcene	0.3	unknown	0.06
α -phellandrene	1.5	thymoquinol diethyl ether	1.3
α -terpinene	0.02	unknown	0.4
p-cymene	1.5	β -caryophyllene	0.4
1,8-cineole	0.2	sesquiterpene (M = 204)	0.5
limonene	0.15	geranyl acetate	0.1
oct-1-en-3-yl formate	0.1	aromadendrene	0.02
α -terpinene	0.01	sesquiterpene (M = 204)	0.2
<i>trans</i> -sabinene hydrate	0.03	α -humulene	2.0
non-1-ene-3-ol	0.04	(E)- β -farnesene	0.5
terpinolene	t	amorphane?	0.5
<i>cis</i> -sabinene hydrate	0.02	germacrene-D	7.9
nonanal	t	unknown	0.4
linalool	0.7	bicyclogermacrene	1.0
oct-1-en-3-yl acetate	1.6	α -muurolene	0.2
<i>trans</i> -p-menth-2-en-1-ol	0.02	cubebol	0.9
octan-3-yl acetate	0.1	<i>trans</i> -calamenene	0.2
<i>trans</i> -p-menta-2,8-dien-1-ol	0.02	δ -cadinene	1.8
camphor	0.15	α -cadinene	t
<i>trans</i> -pinocarveol	0.02	unknown	0.1
<i>cis</i> -p-menth-2-en-1-ol	0.02	spathulenol	0.8
borneol	4.5	β -caryophyllene oxide	0.1
<i>cis</i> -myrtanal	0.02	salvia-4 (14)-en-1-one	0.07
terpin-1-en-4-ol	0.6	viridiflorol	0.4
myrtenal	0.2	unknown	1.3
<i>trans</i> -dihydrocarvone	0.8	<i>epi</i> -cubanol	0.4
α -terpineol	0.3	T-cadinol	0.4
<i>cis</i> -dihydrocarvone	2.5	T-muurolol	0.4
myrtenol	1.3	torreyol	0.1
oct-1-en-3-yl propionate	3.4	cubanol?	0.4
octan-3-yl propionate	0.2	α -cadinol	0.7
bornyl formate	8.1	valeranone	0.3
carvone	0.06	unknown	0.6
unknown	0.2	geranyl tiglate	t
carvotapacetone	t	unknown	0.3
piperitone	0.1	unknown	0.04
<i>trans</i> -myrtanol	t	hexahydrofarnesyl acetate	0.1
myrtenyl formate	1.2	unknown	0.1
isopiperitenone	0.1	unknown	0.01
thymol isomer	0.8	unknown	0.04
bornyl acetate	0.1	unknown	0.01
thymol	22.0	unknown	0.17
carvacrol	0.2	alkane	t
unknown	t		

t = trace

TABLE II. Chemical constituents of the leaf oil of *Sphaeranthus suaveolens*

COMPONENT	%	COMPONENT	%
3-methylbutanol	t	α -campholenol	1.6
2-methylbutanol	t	γ -campholenyl formate	0.4
hexanal	0.04	carvone	t
<i>trans</i> -2-hexanal	0.06	thymol methyl ether	0.3
<i>cis</i> -3-hexanal	0.05	<i>trans</i> -2-hydroxy pinocamphone	0.11
hexanol	0.08	carvacrol methyl ether	t
α -thujene	0.01	α -campholenyl formate	0.5
benzaldehyde	0.03	thymol	t
α -pinene	5.9	γ -campholenyl acetate	0.13
camphene	0.04	<i>trans</i> -theaspirane	0.04
verbenene	t	<i>cis</i> -theaspirane	0.03
1-octen-3-ol	0.045	α -campholenyl acetate	0.3
sabinene	0.3	7- α -silphiperfol-5-ene	t
β -pinene	0.03	eugenol	0.04
deshydro-1,8-cineole	0.05	sesquiterpene (M = 204)	0.4
myrcene	0.15	<i>trans</i> -damascenone	t
phenylacetaldehyde	0.1	α -copaene	0.9
<i>p</i> -cymene	0.5	β -bourbonene	0.14
1,8-cineole	1.7	β -elemene	0.12
limonene	1.7	thymoquinol dimethyl ether	2.8
<i>cis</i> -ocimene	0.03	cascarilladiene	t
<i>trans</i> -ocimene	0.15	β -caryophyllene	4.4
γ -terpinene	0.03	geranyl acetate	0.05
<i>trans</i> -sabinene hydrate	0.05	sesquiterpene (M = 204)	0.5
γ -campholenal	0.2	α -humulene	0.4
<i>cis</i> -sabinene hydrate	t	β -ionone	0.02
nonanal	t	germacrene-D	0.9
linalool	0.3	sesquiterpene (M = 204)	0.3
3-methylbutyl 2-methylbutrate	t	α -muurolene	t
α -campholenal	0.8	sesquiterpene alcohol	0.4
<i>trans</i> - <i>p</i> -mentha-2,8-dien-1-ol	0.06	δ -cadinene	0.15
<i>cis</i> -verbenol	0.1	β -caryophyllene oxide	0.1
<i>trans</i> -verbenol	0.8	α -humulene-1,2-epoxide	0.08
<i>trans</i> -pinocamphone	0.6	sesquiterpene alcohol (M = 222)	0.1
<i>cis</i> -pinocamphone	0.6	two unknowns	0.2
γ -campholenol	1.5	T-cadinol	0.04
terpinen-4-ol	0.2	T-muurolol	0.04
α -terpineol	0.05	pentadecanal	0.04
myrtenol	0.04	hexahydrofarnesyl acetate	0.04
<i>cis</i> -piperitol	0.04		

t = trace

Seventy eight compounds consisting about 95% of the oil of *S. suaveolens* (0.47%) were identified.

The main constituents were *cis*-pinocamphone (63.5%) α -pinene (5.9%) and β -caryophyllene (4.4%).

Ninety seven components consisting about 83% of the oil of *S. bullatus* (0.5%) were identified. The major constituents in this oil were thymol (22.0%), bornylacetate (8.1%) and germacrene-D (7.9%).

Although some of the compounds appeared in both essential oils in the present study, the major constituents differed widely. The composition of essential oil of *Sphaeranthus cyathuloides* also differs from those of *S. suaveolens* and *S. bullatus* [4].

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