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Short Communication

Chemical constituents of essential oil of *Senecio bombayensis* flower

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Abstract: The essential oil composition of the flower of *Senecio bombayensis* was analysed by gas chromatography and gas chromatography/mass spectrometry. Forty-six compounds representing 98.2% of the total oil were identified. The main constituents are linalool (26.3%), *β*-cedrene (14.5%), *E*-*β*-farnesene (10.8%), 2,5-dimethoxy-p-cymene (7.0%), *E*-*β*-ocimene (5.9%), terpinen-4-ol (5.1%) and *Z*-*β*-ocimene (4.7%). The oil is rich in sesquiterpene hydrocarbons (38.1%), followed by oxygenated monoterpenes (32.3%), monoterpene hydrocarbons (17.7%), oxygenated sesquiterpenes (6.0%) and others (4.1%).

Keywords: *Senecio bombayensis*, Asteraceae, essential oil, terpenes, terpenoids

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INTRODUCTION

Senecio bombayensis Balakr. Syn. *S. grahamii* of the family Asteraceae is an erect, herbaceous, much branched herb distributed in the Western Peninsula and Rajputana of India [1] and commonly found amidst of the grasses [2]. The essential oil compositions of endemic species of the genus *Senecio* from this region have been reported. The major components from the essential oil of aerial parts of *S. bombayensis* were reported, with thymol, methyl ether, terpin-4-ol, *α*-copaene, cis-thujone and α-humulene as major constituents [3]. For oil of *S. belgaumensis* (aerial parts), 1-undecanol, *β*-caryophyllene, *p*-cymene, *α*-humulene and *cis*-ocimene were reported as major constituents [4] while from the flower, 1-undecanol, *β*-caryophyllene, caryophyllene oxide and *γ*-terpinene were reported as major constituents [5]. The aim of this study is to investigate the terpenoid profile of the essential oil of the flower of *S. bombayensis*.

MATERIALS AND METHODS

The flowers of *S. bombayensis* were collected at Amboli (c800-m elevation), Maharashtra, India in November 2012. The plant was identified by Dr Harsha Hegde, Scientist of Regional Medical Research Centre, Belgaum (voucher specimen no. RMRC-908). The fresh plant material (200 g) was hydro-distilled for 3 hr using a Clevenger-type apparatus. The oil was dried over anhydrous Na_2SO_4 and stored at -4°C until analysis. The yield of the oil was 0.2% (v/w).

The analysis of the oil was carried out on a Varian 450 gas chromatograph equipped with flame ionisation detector and stationary phase CP Sil-8-CB (30 m × 0.25 mm i.d., 0.25- µm film thickness) under the experimental conditions reported earlier [6, 7]. Nitrogen was used as the carrier gas at a flow rate of 1.0 mL/min. Temperature programming was 60-220° at 3°/min for injector and detector temperatures were 230° and 250°. The injection volume was 1.0 µL of 1% solution in *n*-hexane (split ratio = 1: 50).

The analysis of the oil by gas chromatography-mass spectrometry was carried out on Thermo Scientific Trace Ultra gas chromatograph interfaced with Thermo Scientific ITQ 1100 mass spectrometer. A column fitted with TG-5 (30 m × 0.25 mm i.d., 0.25-µm film thickness) was used and the oven temperature was programmed between 60-220° at 3°/min. using helium as a carrier gas at 1.0 mL/min. The injector temperature was 230° and injection volume was 0.1 µL of 1% solution in *n*-hexane (split ratio = 1:50). The mass spectra were taken at 70 eV with a mass scan range of 40-450 amu. The mass spectrometric parameters were those reported earlier [8, 9].

Identification of constituents were done on the basis of retention indices (determined with reference to homologous series of *n*-alkanes C_8-C_{28}, under identical experimental condition), mass spectra library search (NIST 08 MS Library version 2.0 f and WILEY MS 9th Edition), and by comparison with mass spectra literature data [10]. The relative amounts of individual components were calculated based on gas chromatographic peak area (flame ionisation detector response) without using correction factor.

RESULTS AND DISCUSSION

Forty-six compounds comprising 98.2% of the total oil constituents were characterised and identified according to their mass spectra and their relative retention indices determined on a non-polar stationary phase capillary column. The identified compounds are listed in Table 1 in elution order from the TG-5 column, along with the per cent composition of each component and its retention index. Sesquiterpene hydrocarbons as a major class of components constitute 38.1%, followed by oxygenated monoterpenes (32.3%), monoterpene hydrocarbons (17.7%), oxygenated sesquiterpenes (6.0%) and others (4.1%). The major constituents are linalool (26.3%), *β*-cedrene (14.5%), *E*-*β*-farnesene (10.8%), 2,5-dimethoxy-p-cymene (7.0%), *E*-*β*-ocimene (5.9%), terpinen-4-ol (5.1%) and *Z*-*β*-ocimene (4.7%).

The essential oil profile reported [3] from the aerial parts of *S. bombayensis* in terms of major compounds is somewhat similar to that found this study, although the relative amounts of the components are different. The oxygenated monoterpene and sesquiterpene hydrocarbon contents are greater in flower oil while amounts of monoterpene hydrocarbons, oxygenated sesquiterpenes and other type of compounds are not as great as compared to those present in the oil from the aerial parts. Moreover, the compounds thuja-2,4(10)-diene, 1,3,8-*p*-menthatriene, 4-oxoisophorone, *n*-decanol, *α*-cubebene, *β*-elemene, *γ*-muurolene, 6,11-oxido-acor-4-ene, *α*-acorenol, *α*-muurolol and 7-epi-*α*-eudesmol are not present in the aerial part oil. Further, tricyclene, *α*-phellandrene, *α*-

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Table 1. Chemical composition of essential oil of *S. bombayensis* flower

Compound	RI	%	Identification
α-Thujene	906	0.1	RI, MS
α-Pinene	907	0.2	RI, MS
Fenchene	919	0.4	RI, MS
Thuja-2,4 (10)-diene	923	0.8	RI, MS
Sabinene	936	0.2	RI, MS
β-Pinene	939	0.6	RI, MS
Myrcene	949	0.5	RI, MS
p-Cymene	980	0.9	RI, MS
Limonene	984	3.1	RI, MS
Z-*β*-Ocimene	991	4.7	RI, MS
E-*β*-Ocimene	1001	5.9	RI, MS
Linalool	1056	26.3	RI, MS
cis-Thujone	1060	t	RI, MS
1,3,8-*p*-Menthatriene	1080	0.3	RI, MS
4-Oxoisophorone	1107	1.5	RI, MS
Terpinen-4-ol	1144	5.1	RI, MS
α-Terpineol	1161	0.8	RI, MS
trans-Dihydrocarvone	1177	0.1	RI, MS
Thymol, methyl ether	1213	0.7	RI, MS
Carvacrol, methyl ether	1223	1.9	RI, MS
n-Decanol	1279	t	RI, MS
α-Cubebene	1350	t	RI, MS
α-Copaene	1381	t	RI, MS
β-Cubebene	1399	0.3	RI, MS
β-Elemene	1402	0.1	RI, MS
α-Cedrene	1424	0.2	RI, MS
β-Cedrene	1434	14.5	RI, MS
2,5-dimethoxy-*p*-cymene	1441	7.0	RI, MS
α-Humulene	1474	0.1	RI, MS
E-*β*-Farnesene	1478	10.8	RI, MS
γ-Muurolene	1498	1.0	RI, MS
γ-Curcumene	1504	2.7	RI, MS
cis-*β*-Guaiene	1520	0.2	RI, MS
α-Zingiberene	1523	0.3	RI, MS
α-Muurolene	1529	0.2	RI, MS
E,*E*-*α*-Farnesene	1538	0.3	RI, MS
δ-Cadinene	1555	0.4	RI, MS
6,11-oxido-acor-4-ene	1568	0.6	RI, MS
α-Calacorene	1577	0.3	RI, MS
cis-Dihydro occidentalol	1642	1.1	RI, MS
β-Oplopenone	1652	0.6	RI, MS
1,10-di-*epi*-cubenol	1656	1.7	RI, MS
1-*epi*-*γ*-Eudesmol	1669	0.3	RI, MS
α-Acorenol	1673	0.3	RI, MS
α-Muurolol	1688	0.7	RI, MS
7-*epi*-*α*-Eudesmol	1701	0.4	RI, MS
Total identified		98.2	
Monoterpene hydrocarbons		17.7	
Oxygenated monoterpenes		32.3	
Sesquiterpene hydrocarbons		38.1	
Oxygenated sesquiterpenes		6.0	
Others		4.1	

Note: RI = retention index relative to C_8-C_{25} *n*-alkanes on TG-5 column; MS = mass spectrum from NIST and Wiley library and the literature; t = trace (< 0.1%)

terpinene, γ-terpinene, naphthalene, *trans*-pulegol, isobornyl acetate, methyl acetate, isomenthyl acetate, eugenol, neryl acetate, β-maaliene, *ar*-curcumene, *E*-β-ionone, *trans*-β-guaiene and caryophyllene oxide are present in the aerial part oil of *S. bombayensis* [3] but not detected in flowers oil. As expected, apart from the phytochemical group of substances typical for a taxon, its chemical profile also depends on the plant part as well as the stage of plant development. The qualitative and quantitative changes in individual or groups of substances, in addition to the disappearance or appearance of some compounds as new constituents, are a common occurrence [11].

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