WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.990
Volume 4, Issue 8, 1171-1176. Research Article ISSN 2277– 7105

ESSENTIAL OIL CONSTITUENTS OF *SWERTIA CILIATA* D.DON EX G.DON. FROM KUMAUN HIMALAYA, UTTARAKHAND, INDIA.

Deepak Chandra*, Kundan Prasad, G. Bisht and Vinay Deep Punetha

Department of Chemistry, D.S.B. Campus K. U. Nainital, Uttrakhand – 263002.

Article Received on
12 June 2015,

Revised on 03 July 2015,
Accepted on 24 July 2015

***Correspondence for Author**
Deepak Chandra
Department of Chemistry, D.S.B. Campus K. U. Nainital , Uttrakhand – 263002.

ABSTRACT

Swertia (family- Gentianaceae) is a large genus of herbs distributed in the mountainous regions of tropical area at an altitude of 1200-3600m. The essential oil of leaves of *Swertia ciliata* (D.Don ex G.Don), were extracted by steam distillation. The quantitative and qualitative analysis of volatile essential oil constituents of the plant was done by Gas Chromatography (GC) and GC -Mass Spectrometry. A total of 54 components of the essential oil of *S. ciliata*. were identified, accounting for 96.59 % of the total oil. The main compounds found were Octadecanal 14.36 %, Nonanal 8.56%, β-Linalool 7.35%, 7-Octylidenebicyclo[4.1.0]heptane 6.94 %, Methyl-Myrtenate 4.21 %.

KEYWORDS: *Swertia ciliata*, essential oil, Gas Chromatography, Mass Spectrometry.

INRTODUCTION

Swertia (family- Gentianaceae) is a large genus of herbs distributed in the mountainous regions of tropical area at an altitude of 1200-3600m. The genus *Swertia* possessing 170 species,is one of the 70 generae of family Gentianaceae (Flora of China,1988). The genus *Swertia* is well known for its medicinal properties, as described in the Indian pharmacopoeia. *Swertia*, an important genus of family Gentianaceae, isdistributed in the mountains of tropical Asia, Europe,America and Africa. About 32 species of *Swertia* occur in Indian Himalayan Region (IHR) of which 16 species are reported from northwest Himalaya (Garg, 1987).

The genus *Swertia* contain different bitter principles, iridoids, and secoiridoids, for example amarogentin, swertiamrin, sweroside, amaroswerin and gentiopicroside, which are mainly responsible for its pharmacological activity. In India *Swertia* herbs are extensively used as a traditional remedy for chronic fever,anaemia, asthma,and liver disorder (Asthana *et. al.*

1991). *Swertia chirata* attracts special attention because of its varied use as bitter febrifuge and its antihelmintis, antimalarial and antidiarrhoeal activity (Neeraj and Bhakuni, 2000). *Swertia* is used in Indian Ayurvedic Herbal System to cure Fever as in Laghu sudarshana churna, Maha sudarshan Churna and in Tibetan folk medicine. *Swertia ciliata* Decoction of plant is given three times a day for 5-7 days to control cough, cold and fever (Joshi and Joshi, 2008). The plant was once found growing abundantly in the wild and was exported from India, now it has the status endangered species. Moreover, use of this herb by commercial houses on a large scale has resulted in extinction of the true *S. chirata* (Bhandari,et. al. 2006).

EXPERIMENTAL

Plant Material

The plant *Swertia ciliata* (D.Don ex G.Don) was collected in the month of September, 2013 from Munsiyari (an elevation of 2298 meters) 135 km away from Pithoragarh, Uttarakhand,India. The plant was authenticated by Botanical Survey of India (BSI), Dehradun. A voucher specimen (No.114851) was deposited in the Herbarium Section at BSI, Dehradun, India.

Essential Oil Extraction

The fresh aerial parts of *Swertia ciliata* (5 kg) were chopped and steam- distilled using copper still fitted with spiral glass condensers. The distillate was saturated with NaCl and extracted with n-hexane. Anhydrous Na_2SO_4 was then added to dry the organic phase which was separate dusing separating funnel and finally the solvent was evaporated under reduced pressure. The percentage content of the oil was calculated on the basis of dry weight of plant material. The oil was then stored in screw-capped vials, under refrigeration until needed.

Gas Chromatographic Analysis (GC)

The oil was analysed by using a Shimadzu 2010 auto system GC. The column temperature was programmed at 80°C (holding time for 2 minute) to 210°C (holding time 5 minute) at 3°C min^{-1} and then 210°C - 300°C at 20°C min^{-1} with final hold time of 15 minute, using N_2 at 30.0 mL/min column head pressure as carrier gas, the injector temperature was 270°C and detector (FID, Flame ionization detector) temperature 280°C.

GC- M S Analysis and Identification

The GC-MS used was Autosystem 2010 GC (Rtx- 5, 30m x 0.25mm, i.d. FID 0.25µm) coupled with Shimadzu QP 2010 plus with thermal desorption system TD 20 with (Rtx-5)

fused silica capillary column (30 m x 0.25mm with film thickness 0.25µm). The column temperature was 80°C (holding time for 2 minute) to 210 °C (holding time 5 minute) at 3°C min^{-1} and then 210°C - 300°C at 20°C min^{-1} with final hold time of 21 minute, using helium as carrier gas. The injector temperature was 230°C and 0.2 µL in n-hexane, with split ratio of 1:30 MS were taken at 70 eV with a mass range of 40- 650 amu.

Identification of constituents were done on the basis of Retention Index (RI, determined with reference to homologous series of n-alkanes C8-C28, under identical experimental condition), MS library search (NIST and WILEY), and by comparison with MS literature data (Adams R.P. 2007). The relative amounts of individual components were calculated based on GC peak area (FID response) without using correction factor. Retention indices (RI) were determined with reference to a homologous series of normal alkanes, by using the following formula (Kovats, 1958).

$$KI = 100\ [\ n + (N-n)\ x\ \frac{\log t^1_R\ (unknown) - \log t^1_R\ (C_n)}{\log t^1_R\ (C_N) - \log t^1_R\ (C_n)}$$

t^1_R – the net retention time ($t_R - t_0$)

t_0 – the retention time of solvent (dead time)

t_R – the retention time of the compound.

C_N – number of carbons in longer chain of alkane

C_n– number of carbons in shorter chain of alkane

n - is the number of carbon atoms in the smaller alkane

N - is the number of carbon atoms in the larger alkane

RESULTS AND DISCUSSION

The GC and GC-MS analysis of leaf oil of *S. ciliata* resulted in the identification of 54 constituents. The compounds, together with their retention index and relative percentage concentration are presented in table **1**. The 0.10% v/w of pale yellow colour oil of S ciliata was extracted by steam distillation methods. The main compounds found were Octadecanal 14.36 %, Nonanal 8.56%, β-Linalool 7.35%, 7-Octylidenebicyclo[4.1.0]heptane 6.94 %, Methyl-Myrtenate 4.21 %. The oxygenated monoterpenes and sesquiterpene hydrocarbons found in the oil as major components while diterpenes were minor components.

Table-1 Essential oil composition of of *Swertia ciliata* D.Don ex G.Don.

S. No	Compound	Area %	Mol. formula	Mol. Wt.	R.I.	Mode of identification
1	β-pinene	1.69	$C_{10}H_{16}$	136	936	a,b
2	2-pentyl furan	2.35	$C_9H_{14}O$	138	991	a,b
3	Limonene	0.93	$C_{10}H_{16}$	136	1030	a,b
4	β-Linalool	7.35	$C_{10}H_{18}O$	154	1082	a,b
5	Nonanal	8.56	$C_9H_{18}O$	142	1112	a,b
6	2-Cyclooctenone	3.10	$C_8H_{12}O$	124	1113	a,b
7	Cucumber alcohol	2.60	$C_9H_{16}O$	140	1164	a,b
8	Bomeol	0.60	$C_{10}H_{18}O$	154	1173	a,b
10	Bomeol	0.60	$C_{10}H_{18}O$	154	1173	a,b
9	α-Terpineol	3.46	$C_{10}H_{18}O$	154	1195	a,b
11	Nerol	0.50	$C_{10}H_{18}O$	154	1229	a,b
12	Pulegone	1.12	$C_{10}H_{16}O$	152	1241	a,b
13	Geranyl vinyl ether	1.31	$C_{12}H_{20}O$	180	1250	a,b
14	β-Cyclohomocitra	0.15	$C_{11}H_{18}O$	166	1256	a,b
15	Capric alcohol	1.24	$C_{10}H_{22}O$	158	1258	a,b
16	Dec-(2E)-enal	0.87	$C_{10}H_{18}O$	154	1265	a,b
17	3-Methylenehexahydro-1-benzofuran-2(3H)-one	0.68	$C_9H_{12}O_2$	152	1274	a,b
18	Methyl-Myrtenate	4.21	$C_{11}H_{16}O_2$	180	1296	a,b
19	Undecanal	0.68	$C_{11}H_{22}O$	170	1303	a,b
20	Tridecane	0.51	$C_{13}H_{28}$	184	1313	a,b
21	3-Decenoic acid	2.91	$C_{10}H_{18}O_2$	170	1380	a,b
22	β- Bourbonene	0.12	$C_{15}H_{24}$	204	1382	a,b
23	2,4-Diisopropenyl-1-methyl-1-vinylcyclohexane	1.34	$C_{15}H_{24}$	204	1398	a,b
24	Tetradecane	0.22	$C_{14}H_{30}$	198	1400	a,b
25	(+)-Longifolen	0.43	$C_{15}H_{24}$	204	1402	a,b
26	(2E)-2-Dodecenal	0.24	$C_{12}H_{22}O$	182	1410	a,b
27	Iraldeine	0.95	$C_{13}H_{20}O$	192	1429	a,b
28	Isobornyl isobutyrate	0.44	$C_{14}H_{24}O_2$	224	1431	a,b
29	α-Guaiene	0.80	$C_{15}H_{24}$	204	1438	a,b
30	Damascenone	0.30	$C_{13}H_{18}O$	190	1440	a,b
31	α- Farnesene	2.04	$C_{15}H_{24}$	204	1458	a,b
32	β-Santalene	0.30	$C_{15}H_{24}$	204	1459	a,b
33	α.-Selinene	2.48	$C_{15}H_{24}$	204	1474	a,b
34	Germacrene -D	0.19	$C_{15}H_{24}$	204	1480	a,b
35	Isocaryophillene	2.89	$C_{15}H_{24}$	204	1494	a,b
36	Eremophila-1(10),8,11-triene	1.23	$C_{15}H_{22}$	202	1507	a,b
37	Dispiro[4.2.4.2]tetradecane	2.11	$C_{14}H_{24}$	192	1508	a,b
38	7-Octylidenebicyclo[4.1.0]heptane	6.94	$C_{15}H_{26}$	206	1522	a,b
39	Caryophyllene oxide	0.77	$C_{15}H_{24}O$	220	1587	a,b
40	Z-9-Tetradecenal	1.81	$C_{14}H_{26}O$	210	1609	a,b
41	Cetane	0.39	$C_{16}H_{34}$	226	1612	a,b

42	Heptadecane	0.53	$C_{17}H_{36}$	240	1700	a,b
43	α-Humulen	0.44	$C_{15}H_{24}$	204	1716	a,b
44	Palmitaldehyde	1.53	$C_{16}H_{32}O$	240	1800	a,b
46	Phytone	1.98	$C_{18}H_{36}O$	268	1841	a,b
47	n-Nonadecane	0.45	$C_{19}H_{40}$	268	1910	a,b
48	Octadecanal	14.36	$C_{18}H_{36}O$	268	1999	a,b
49	Eicosane	0.68	$C_{20}H_{42}$	282	2009	a,b
50	10-Methylicosane	1.13	$C_{21}H_{44}$	296	2045	a,b
51	Heneicosane	0.27	$C_{21}H_{44}$	296	2109	a,b
52	Nonadecyl alcohol	0.31	$C_{19}H_{40}O$	284	2153	a,b
53	n-Tetracosane	1.44	$C_{24}H_{50}$	338	2407	a,b
54	7-Hexylicosane	2.06	$C_{26}H_{54}$	366	2542	a,b
	Total Identified	96.59				

a=Retention Index (RI), b=MS (GC-MS)

Essential oils are valuable natural products, which are used as raw materials in many fields including perfumes, cosmetics, aromatherapy, phytotherapy, spices and nutrition (Buchbauer, 2000). Aromatherapy is the therapeutic use of fragrances or at least mere volatiles to cure diseases, infections and indispositions by means of inhalation (Buchbauer et al., 1993). This has recently attracted the attention of many scientists and encouraged them to screen plants to study the biological activities of their oils from chemical and pharmacological investigations to therapeutic aspects. Hopefully, this will lead to new information on plant applications and new perspective on the potential use of these natural products.

ACKNOWLEDGEMENT

The authors are grateful to AIRF , Jawaharlal Nehru University , New Delhi for the Gas Chromatography coupled with Mass Spectrometry (GC-MS), and Gas Chromatography with flame ionization detection (GC-FID) analysis facilities.

REFERENCES

1. Adams R. P., 2001. Identification of Essential oils by Gas Chromatography Quadrupole Mass Spectrometry. Allured Publishing Corpoartion, Carol Stream, USA.
2. Asthana R.K., N. K. Sharma, D. K. Kulshreshtha and S. K.Chatterjee, Phytochemistry, 1991; 30: 1037.
3. Bhandari, P., A. P.Gupta, B. Singh and V. K. Kaul, HPTLC determination of swertiamarin and amarogentin in Swertia species from the Western Himalayas. J. Planar Chrom., 2006; 19: 212-215.
4. Anonymous, Flora of China. Republicea Popularis Sinicae, Science Press: 1988, pp.344.

5. G. Buchbauer, The detailed analysis of essential oils leads to the understanding of their properties. Perfumer & Flavorist, 2000; 25: 64–67.
6. G. Buchbauer, W. Jager, L. Jirovetz, J. Imberger and H. Dietrich, Therapeutic properties of essential oils and fragrances. In Bioactive volatile compounds from plants, Teranishi R, Buttery R, Sugisawa H (eds), 1993; 161.
7. Garg S, 1987. Gentianaceae of the North West Himalaya (a revision). International Bioscience Monograph 17. Today and Tomorrow. Publication Co, New Delhi.
8. Joshi Kunjani and Joshi Ananda, Swertia L. Gentianaceae in Nepal Himalaya: Checklist, Phytogeography, Ethnobotany and Conservation Status. Ethnobotanical Leaflets, 2008; 12: 361-372.
9. Joshi P., and V. Dhawan, Swertia chirayita – an overview. Curr. Sci., 2005; 89: 635-640.
10. Kovats, E., Characterization of organic compounds by gas chromatography. Part 1. Retention. indices of aliphatic halides, alcohols, aldehydes and ketones. Helv. Chim. Acta, 1958; 41: 1915-32.
11. Leslie, E.R. and J. I. Chungath, Studies in Swertia chirata. IndianDrugs, 1988; 25: 143-147.
12. Neerja, P., D. C. Jain and R. S. Bhakuni, Phytochemicals from genus Swertia and their biological activities. Indian J. Chem., 2000; 39: 565-586.