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Phytochemical Analysis of *Polygonum amplexicaule* Essential Oil from Pithoragarh, Uttarakand, India

Chandan Ram, Pushpa Joshi, Kundan Prasad*, Deepak Chandra and Sapna

Department of Chemistry, Kumaun University, India

Address for Correspondence
Kundan Prasad, Department of Chemistry, D.S.B. Campus, Kumaun University, Nainital, Uttarakhand, India, Tel: +91 9690766978; E-mail: gicgarkha@gmail.com

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Abstract

Introduction: Polygonum amplexicaule (Polygonaceae) is an herbal drug used to treat fractures, rheumatism, osteoporosis, muscle injuries and pain. It has also been reported to be effective to treat atherosclerosis and its antibiotic and antivirus effects. Methods: The plant Polygonum amplexicaule including leaves, stem, and flowers were extracted by hydro distillation method for 6 hours using Clevenger apparatus. Results: Total fifty one compounds were identified constituting 96.09% of the total oil. The main compounds was Geraniol (19.91%), β-Linalool (19.63), Citronellol (16.22%), 2-Methyl-6-hepten-1-ol (7.77%), Heptan-2-ol (5.66).

Conclusion: The results data obtained in the present study suggest that an essential oil and whole plant possesses strong medicinal activities can be utilized for treatment of diseases.

Introduction

Polygonum is a medicinal large ordered by Estimated Frequency genus of Polygonaceae, it falls into about 300 species widely distributed around the world. The genus Polygonum contains many medicinal plants, such as *Polygonum multiflorum*, *Polygonum cuspidatum*, *Polygonum bistorta*, *Polygonum aviculare*, *Polygonum tinctorium* and *Polygonum amplexicaule* etc [1]. Additionally, many chemical substance grammatical constituent have been identified such as flavonoids, anthraquinones, stilbenes, glycolipids and terpenes [2]. *Polygonum amplexicaule* (Polygonaceae) is herbal drug used to treat fractures, rheumatism, osteoporosis, muscle injuries and pain. It has also been reported to be effective to treat atherosclerosis, antibiotic and antivirus effects were also examined with positive results. Leaves are used in dysentery and wounds. Roots are employed in treating cough and dysentery. Whole plant is believed to cause abortion, malignant diseases including Hepatocellular Carcinoma (HCC), but the scientific basis underlying its anti-HCC activity remains poorly understood [3,4].

Essential oil is a mixture of volatile and natural kernel, identified and characterized by the strong odor, produced by aromatic plant as secondary metabolite. Their metabolites have a wide range of applications and have been commercially important to the pharmaceutical, food and cosmetic industries. The composition of active rationale in herb has been the subject of many research studies. They are responsible for the wide aroma and therapeutic effects [5]. The curative efficiency of herbaceous plant depends on their quality, time of harvest, drying and storage procedure and on the climatic condition [5]. Liver equipment casualties are mainly caused by toxic chemicals, alcohol, infections and autoimmune disorders. *Polygonum amplexicaule* is appendage of the genus Polygonum having high antioxidant contents and it has traditional medicinal attributes in treatment of many complaint particularly liver damage.

The current study is aimed at characterizing the chemical component of the essential oil of *Polygonum amplexicaule* aril part. Therefore, we report for the first time the separation and identification of the components of areal part essential oils with the aid of GC, GC-MS and other spectroscopic techniques.

Materials and Methods

Plant material

The leaves of *Polygonum amplexicaule* was collected in the month of September 2017 from Kalamuni (Munsyari) near Pithoragarh, India in the Kumaon Himalayas. The plant was first identified in the Department of Botany, Kumaun University, Nainital. The plant was authenticated by Botanical Survey of India (BSI) and identification no. was 114846. The collected plant material was first washed with cold water to remove the soil particles and then shade dried. The dried material was finely powdered in the grinding machine and weighed in an electrical balance.

Chemicals

Petroleum ether, Hexane and anhydrous sodium sulphate and other chemicals and reagents used in this study was purchased Merck Chemical Co. Mumbai, India.

Isolation of essential oil

The plant *Polygonum amplexicaule* including leaves, stem, and flowers extracted by hydro-distillation method for 6 hours using clevenger apparatus. The oil was dried over anhydrous sodium sulphate and stored at room temperature in a sealed vial until analysis was performed. The percentage oil yield was calculated based on the dry weight of the plant. The oil yield was (0.10%).

GC and GC/MS analyses and identification

Essential oil analysis was performed by GC-MS and GC-FID on a Shimadzu QP-2010 instrument, equipped with FID, in the

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Table1: Essential oil composition of Polygonum amplexicaule.

S.N.	Compound	Area %	Mol. Formula	Mol. Wt.	RI	Mode of identification
1.	2-Hexenal	0.83	$C_6H_{10}O$	98	814	a, b
2.	Hex-3-en-1-ol	0.88	$C_6H_{12}O$	100	868	a, b
3.	Heptan-2-ol	5.66	$C_7H_{16}O$	116	913	a, b
4.	α-Pinene	0.33	$C_{10}H_{16}$	136	933	a, b
5.	Benzaldehyde	0.13	C_7H_6O	106	960	a, b
6.	Bois de Rose oxide	0.07	$C_{10}H_{18}O$	154	968	a, b
7.	β-Pinene	0.06	$C_{10}H_{16}$	136	978	a, b
8.	2-methyl-1-Hepten-6-one	0.80	$C_8H_{14}O$	126	920	a, b
9.	3-secButylcyclohexene-1	0.38	$C_{10}H_{18}$	138	997	a, b
10.	2-Methyl-6-hepten-1-ol	7.77	$C_8H_{16}O$	128	995	a, b
11.	2,4-trans,trans-Heptadienal	0.08	$C_8H_{16}O$	128	1013	a, b
12.	Limonene	0.27	$C_{10}H_{16}$	136	1030	a, b
13.	Cis-Ocimene	0.07	$C_{10}H_{16}$	136	1038	a, b
14.	Phenylacetaldehyde	0.17	C_8H_8O	120	1045	a, b
15.	(E)-β-Ocimene	0.21	$C_{10}H_{16}$	136	1046	a, b
16.	cis-Linalool oxide	0.28	$C_{10}H_{18}O_2$	170	1069	a, b
17.	Octanol	0.14	$C_8H_{18}O$	130	1065	a, b
18.	α-Terpinolen	0.11	$C_{10}H_{16}$	136	1080	a, b
19.	β-Linalool	19.63	$C_{10}H_{18}O$	154	1082	a, b
20.	(-)-trans-Myrtanol	0.45	$C_{10}H_{18}O$	154	1180	a, b
21.	(-)-alpha-Terpineol	4.36	$C_{10}H_{18}O$	154	1143	a, b
22.	n-Decanal	0.18	$C_{10}H_{20}O$	156	1206	a, b
23.	1,3,4-Trimethyl-3-cyclohexenyl-1-carbox-aldehyde	0.50	$C_{10}H_{16}O$	152	1204	a, b
24.	Citronellol	16.22	$C_{10}H_{20}O$	156	1232	a, b
25.	Neral	0.21	$C_{10}H_{16}O$	152	1238	a, b
26.	Geraniol	19.91	$C_{10}H_{18}O$	154	1255	a, b
27.	Geranial	0.34	$C_{10}H_{16}O$	152	1268	a, b
28.	Cogeijerene	0.27	$C_{12}H_{18}$	162	1286	a, b
29.	Theaspirane A	0.19	$C_{13}H_{22}O$	194	1290	a, b
30.	1,1,3-trimethyl-1H-Indene	0.29	$C_{12}H_{14}$	158	1253	a, b
31.	1,5-Dimethyltetralin	0.23	$C_{12}H_{16}$	160	1341	a, b
32.	2-Undecen-1-al	0.11	$C_{11}H_{20}O$	168	1311	a, b
33.	(E)-beta-Damascenone	0.56	$C_{13}H_{18}O$	190	1379	a, b
34.	Spathulenol	1.64	$C_{15}H_{24}O$	220	1576	a, b
35.	(Z)-Jasmone	0.24	$C_{11}H_{16}O$	164	1394	a, b
36.	(E)-Caryophyllene	0.17	$C_{15}H_{24}$	204	1424	a, b
37.	Dehydro-β-ionone	0.06	$C_{13}H_{18}O$	190	1440	a, b
38.	(E)-β-Farnesene	0.26	$C_{15}H_{24}$	204	1452	a, b
39.	Germacrene D	1.20	$C_{15}H_{24}$	204	1480	a, b
40.	(E,E)-alpha-Farnesene	2.99	$C_{15}H_{24}$	204	1504	a, b
41.	Zonarene	0.90	$C_{15}H_{24}$	204	1526	a, b
42.	α-Calacorene	0.36	$C_{15}H_{20}$	200	1544	a, b
43.	(E)-Nerolidol	0.15	$C_{15}H_{26}O$	222	1561	a, b

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44.	Viridiflorol	0.57	$C_{15}H_{26}O$	222	1594	a, b
45.	T-Muurolol	1.07	$C_{15}H_{26}O$	222	1645	a, b
46.	Cadalene	0.58	$C_{15}H_{18}$	198	1677	a, b
47.	Heptadecanal	0.33	$C_{17}H_{34}O$	254	1899	a, b
48.	4'-tert-butyl-2',6'-dimethyl- Butyrophe-none	0.14	$C_{16}H_{24}O$	232	1781	a, b
49.	Hydrofol acid	2.13	$C_{14}H_{28}O_2$	228	1769	a, b
50.	Heptadecanal	0.77	$C_{17}H_{34}O$	254	1899	a, b
51.	2-Nonadecanone	0.84	$C_{19}H_{38}O$	282	2046	a, b
		96.09				

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

same conditions. The percentage composition of the oil sample was computed from the GC peak areas without using correction for response factors. The oil was analyzed using a Shimadzu GC/MS Model QP 2010 Plus, equipped with Rtx-5MS (30 m × 0.25 mm; 0.25 mm film thickness) fused silica capillary column. Helium (99.999%) was used as a carrier gas adjusted to 1.21 ml/min at 69.0 K Pa, split less injection of 1 µ mL, of a hexane solution injector and interface temperature was 270 °C, oven temperature programmed was 50-280 °C at 3 °C/min. Mass spectra was recorded at 70 eV. Ion source temperature was 230 °C.

The identification of the chemical constituents was assigned on the basis of comparison of their retention indices and mass spectra with those given in the literature [5]. Retention Indices (RI) were determined with reference to a homologous series of normal Alkanes, by using the following formula [6].

$$KI = 100\ [n + (N-n)\ \mathrm{X}\ \frac{\log t_R^1(\text{Unknown}) - \log t_R^1(C_n)}{\log t_R^1(C_N) - \log t_R^1(C_n)}]$$

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

The GC and GC-MS analyses of essential oil of *Polygonum amplexicaule* resulted in the identification of fifty one compounds (Table 1). The oil yield was (0.10%) by raw material weight. Both, the major as well as minor constituents were identified by their retention indices and comparison of their mass spectra. Total fifty one (51) compounds were identified constituting 96.09% of the total oil. The main compounds was Geraniol (19.91%), β-Linalool (19.63), Citronellol (16.22%), 2-Methyl-6-hepten-1-ol (7.77%), Heptan-2-ol (5.66%), (-)-alpha-Terpineol (4.36%) and (E,E)-α-Farnesene (2.99%). The main minor compounds was β-Pinene (0.06%), Dehydro-β-ionone (0.06%), Bois de Rose oxide (0.07%), Cis-ocimene (0.07%), trans,trans-2,4-Heptadienal (0.08%), α-Terpinolen (0.11%) and 2-Undecen-1-al (0.11%). The presence of Geraniol (19.91%), β-Linalool (19.63), Citronellol (16.22% show good source of natural these terpenoids. Geraniol has been suggested to represent a new class of chemoprevention agents for cancer. Other biological activities such as antimicrobial, anti-oxidant, anti-inflammatory and some vascular effects have also been investigated [7].Geraniol has antibacterial, antiseptic, anti-inflammatory, *in vivo* and *in vitro* anticancer against in leukemia, hepatoma, melanoma and pancreatic cancer cell lines, and activity on lipid metabolisms and Mevelonate metabolisms. In this review, article highlights the important pharmacological activities of plant essential oil geraniol [8].

Many reports have described the racemate form of linalool monoterpene and its effect on the brain neurotransmitters glutamic acid, -y-aminobutyric acid (GASA), acetylcholine and dopamine. Moreover, linalool has been reported to exhibit a local anesthetic activity, related to its effects on the nicotinic receptor-ion channel, and to be effective against several bacteria and fungi [9,10].

The essential oil and antioxidant phytochemical from *Polygonum amplexicaule* showed a qualitative and quantitative make-up of constituents. Clinically, this herb can be a good source of herbal medicine for the treatment of diseases indigenously. The study will also help to generate a database of species which can be exploited scientifically and judiciously in the future by local people and so that ecological balance is maintained. The results obtained in the present study suggest that the essential oil of *Polygonum amplexicaule* possesses medicinally active compounds. This is the first report on the plants *Polygonum amplexicaule* at high altitudes of Munsyari, Kumaon Himalayas.

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