WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.990
Volume 4, Issue 10, 2670-2677. Research Article ISSN 2277– 7105

COMPARATIVE CHEMICAL COMPOSITION OF THE ESSENTIAL OILS OF *LANTANA CAMARA*LINN COLLECTED FROM THREE DIFFERENT HABITAT TYPES OF KUMAUN, HIMALAYAS

Kavita Rawat[a] *, Devendra Mishra[b], Vinay Deep Punetha[a], Deepak Chandra[a], Manoj Devrani[a], Pawan Dhapola[a], and Ganga Bisht[a]

[a]Department of Chemistry , D.S.B. Campus, K. U. Nainital, Uttrakhand.

[b]Birla Institute of Applied Sciences, Bhimtal, K. U. Nainital, Uttrakhand.

Article Received on
18 Aug 2015,

Revised on 09 Sep 2015,
Accepted on 30 Sep 2015

***Correspondence for Author**
Kavita Rawat
Department of Chemistry, D.S.B. Campus, K. U. Nainital, Uttrakhand.

ABSTRACT

Essential oil of leaves of *Lantana camara*was undertaken in this study, *Lantana camara*wascollected from three different locations of Uttarakhand, essential oil was extracted from the leaf sample using hydrodistillation method, Gas Chromatography coupled with mass spectrometer was used for chemical analysis of the extracted essential oil, 70 constituent were identified from all the three essential oil representing 92.80%, 91.06% and 92.45% of the total oil collected from Almora, Bhimtal and Haldwani region, essential oil collected from AlmoraBhimtal and Haldwani region contain 31, 39 and 41 constituents respectively. The constituent were mainly monoterpenes and sesquiterpenes, The major constituent found to be Nerolidol present in the essential oil collected from Almora and Bhimtal region representing 58.82% and 45.45% and E-caryophyllene, the major constituent present in the essential oil collected from Haldwani region, in the amount 16.0%, respectively.

KEYWORDS: Nerolidol, E-caryophyllene, chemical constituent, Essential Oil, GC-MS Mass spectroscopy.

INTRODUCTION

Lantana camara Linn, belongs to *Verbenaceae* family, *Verbenaceae* family comprise of about 650 species spreading over 60 countries.[1] Genus *Lantana* consists of about 150 species.[2] *Lantana camara*Linn also known as “wild sage” is a threat for native plant species therefore also commonly known as problem weed.[3] Essential Oil of *Lantana camara* and

plant extracts are used in herbal medicines for the treatment of various diseases like asthma, ulcers, tumors, leprosy, chicken pox, measles, cancer, high blood pressure, tetanus, stomachache, wound healing, biliary fever, toothache, antiseptic, rheumatism in human beings.[2-4] Essential oil is also reported to be antibacterial, antifungal, insecticidal, repellent to mosquitoes, flies and bees.[5] *L. camara*is a rich source of many bioactive molecules and the phytochemical studies have resulted in the isolation of many triterpenes, steroids and flavonoids.[6-7] This plant has been claimed to present activities antiprotozoal.[8] antibacterial and antifungical.[9-10] antioxidant.[11] insecticidal.[12] antiviral.[13] allelopathic properties.[14] The leaves of *Lantana camara* Linn. was used in the preparation of incense sticks for generating aroma when lighted during religious prayer in India, Putativehepatoprotectiveoleanolic acid.[15] pomonic acid.[16] and several triterpenoids were previously isolated from the plant.[17-18] among others activities, Previous research papers showed the of essential oil composition in *Lantana camara*from different habitat types.[19-20] *Lantana camara*Linn is widely distributed in Kumaon Himalayas of Uttarakhand, but there is no previous report regarding to the variation of essential oil composition of *Lantana camara*from Kumaun Himalayas of Uttarakhand.

EXPERIMENTAL

PLANT MATERIAL

The leaves of *Lantana camara*Linn. were collected in the month of April from three different location of kumaunhimalayas, mainly Almora, Bhimtaal and Haldwani, region. The plant was authenticated by Botanical Survey of India (BSI).

Essential oil extraction

The leaves of *Lantana camara*linn. collected from the three different habitat types were extracted by hydro distillation method for 6 hours using Clevenger apparatus with 1000 g of leaves of each sample. The oil was dried with anhydrous sodium Sulphate and stored at 2^{o} C in a sealed vial until analysis was performed**.** The percentage yield was calculated based on the dry weight of the leaf. The oil yield in the essential oil collected from Almora, Bhimtal and Haldwani region were 0.7%, 0.12%, and 0.2%, respectively.

GC-FID and GC-MS analysis

Essential oil analysis was performed by using GC-MS and GC-FID was performed on a Shimadzu QP-2010 instrument, equipped with FID, in the same conditions, except hydrogen was used as the carrier gas. The percentage composition of the oil samples were computed

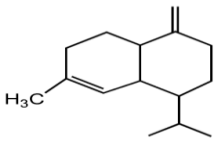
from the GC peak areas without using correction for response factors. The oils were analyzed using a Shimadzu GC/MS Model QP 2010 Plus, equipped with a Rtx-5MS (30 m ×0.25 mm; 0.25 mm film thickness) fused silica capillary column. Helium was used as carrier gas adjusted to 1.21 ml/min at 69.0 KPa; splitless injection of 1 mL, of a hexane solution; injector and interface temperature were 270^{o}C; oven temperature programmed was 50–280^{o}C at 3 C/min. EIMS: electron energy, 70 eV; ion source temperature was 230^{o}C.

Identification of constituents were done on the basis of Retention Index (RI, determined with reference to homologous series of n-alkanes C7-C28, under identical experimental condition), MS library search (NIST and WILEY), and by comparison with MS literature data.[20] 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 alkane,

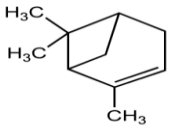
RESULT AND DISCUSSION

The essential oil from the leaves of *Lantana camara*were analyzed by GC-FID, GC-MS and NMR. A total of 70 constituents were identified from the essential oil collected, from three different region of Kumaun, representing 92.80%, 91.06% and 92.45%, of the total oil collected from Almora, Bhimtal, and Haldwani region. Results showed that the total constituents identified from the three essential oil, were 31, 39 and 41 respectively. Nerolidol was the major constituents present in the essential oil collected from Almora (Sample1) and Bhimtal (Sample2) region, representing 58.82% and 45.45% of the total oil identified followed by E-caryophyllene (16.0%) the second major constituent present in the essential oil collected from Haldwani (Sample 3) region, The identified constituents of the oil are listed in Table in order of their elution in Rtx-5 column.The major constituents were neroildol 58.82 %, (E)- caryophyllene 16.0 %, α- humulene 14.89%, and β –elemene 8.74%, The constituent present in a lesser amount are as follows, α-humulene 5.54%, phytol 5.30%, bicyclogermacrene 4.69%, p-cymene 4.27%, germacrene D 4.24, α-pinene 3.83%, and β-elemene 3.70%, β –pinene 2.93%, caryophyllene oxide 2.46%, trans-sesquisabinene hydrate 2.36%, (E,E)- α-farnesene 2.06%, α- thujene 2.00%, α-copaene 1.96%, phytone 0.93%, germacrene B 1.82%, spathulenol 1.71%, cubebol 1.70, cedroxyde1.56%, β –Copaene 1.51%, Curcumene 1.56%, Humulene epoxide II 1.50%, Cadinol 1.48%, Limonen1.33%, 3-Carene 1.27%, α- Pinene oxide 1.22%, δ- Cadinene 1.21%, β-chamigrene 1.04%, germacrene 1.01%, The miner constituents present in less than 1%, were β-selinene 0.96%, tricyclodec-3-ene

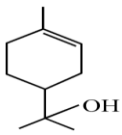
0.75%, α- muurolol 0.76%, trans- muurolol 0.64%, linalool 0.63%, zonarene 0.57%, viridiflorol 0 .47%, oplopanone 0.47%, neo- thujan-3-ol 0.46%, eucalyptol 0.46%, myrcene 0.45%, alloaromadendrene 0.39%, α- muurolene 0.35%,gingiberene 0.33%, E- β- ocimene 0.32%, neo-intermedeol 0.32%, α-muurolene 0.35%, α-gingiberene 0.33%, β –costol 0.28%, *α*- terpineo l0.31%, *α*- bergamotene 0.24%, Z-β-farnesene 0.23%, trans-α-bergamotol 0.23%, bergamotol 0.23%, methyl salicylate 0.21%, methyl salicylate 0.21%, trans verbenol 0.19%, trans-verbenol 0.19%, γ- terpinene 0.18%, longifolenaldehyde 0.18%, linalool acetate 0.17%, Z-β- ocimene 0.16%, 2-ethylbutanal 0.15 %, palmitic acid 0.15%, β –curcumene 0.15%, trans- *α*- guaiol 0.14%, α- cis- muurola-4,5-diene 0.14%, oct-1-en-3-ol 0.13%, α-terpineol 0.13%,



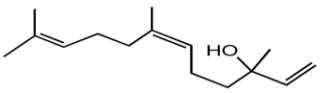
ϒ - CADINENE



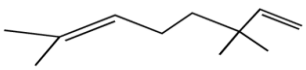
α-PINENE



α-TERPENOL



NEROLIDOL



LINALOOL

Table 01.Chemical constituents of essential oil of the leaves of *L. camara*.

S.No.	CONSTITUENTS	SAMPLE-1	SAMPLE-2	SAMPLE-3	R.I	MODE OF I
1	2-Ethylbutanal	-	.15	-	852	852
2	3-Methylheptan- 2-one	-	t	-	901	901
3	α- Pinene	T	-	3.83	931	931
4	α- Thujene	-	-	.23	933	933
5	Sabinene	T	.12	2.00	972	972
6	β –Pinene	T	-	2.93	978	978
7	Myrcene	-	-	.45	979	979
8	Oct-1-en-3-ol	-	.13	-	982	982
9	3-Carene	-	-	1.27	1010	1010
10	p-Cymene	T	t	4.27	1023	1023
11	Limonene	T	-	1.33	1027	1027
12	Z-β- Ocimene	-	.16	-	1028	1028
13	Eucalyptol	-	-	.46	1030	1030
14	E- β- Ocimene	-	-	.32	1031	1031
15	γ- Terpinene	-	-	.18	1048	1048
16	Linalool	T	t	.63	1100	1100
17	trans-Verbenol	-	.19	-	1146	1146

18	α- Terpineol	-	-	.13	1191	1191
19	Methyl salicylate	-	-	.21	1194	1194
20	Tricyclodec-3-ene	.75	-	-	1378	1378
21	α-Copaene	-	.96	1.96	1379	1379
22	cis- Muurola-4,5-diene	.14	-	-	1396	1396
23	β –Elemene	3.72	7.27	8.74	1400	1400
24	α-Zingiberene	-	.33	-	1402	1402
25	α- Bergamotene	.24	-	-	1426	1426
26	E-Caryophyllene	10.42	10.94	16.0	1427	1427
27	β –Copaene	-	.80	1.51	1429	1429
28	β –Curcumene	-	.15	-	1430	1430
29	Z-β-Farnesene	.10	-	.23	1433	1433
30	α- Humulene	5.54	6.07	14.89	1459	1459
31	Alloaromadendrene	.30	.39	-	1462	1462
32	1-methyl-5-methylene-1,6-cyclohexadiene	1.70	-	-	1485	1485
33	Curcumene	1.56	-	-	1486	1486
34	β-Chamigrene	-	1.04	-	1487	1487
35	Bicyclogermacrene	.38	.62	4.69	1488	1488
36	β-selinene	-	-	.96	1489	1489
37	Germacrene D	-	-	4.24	1492	1492
38	α- Muurolene	-	.35	-	1499	1499
39	(E,E)- α- Farnesene	.77	.23	2.06	1503	1503
40	Cubebol	.59	.92	1.70	1521	1521
41	δ- Cadinene	.59	-	1.21	1527	1527
42	Zonarene	-	.57	-	1528	1528
43	Germacrene B	-	-	1.82	1563	1563
44	Nerolidol	58.82	45.45	.44	1577	1577
45	Viridiflorol	-	-	.47	1590	1590
46	Spathulenol	-	.28	1.71	1594	1594
47	Caryophyllene oxide	1.31	-	2.46	1596	1596
48	Humulene epoxide II	-	.29	1.50	1616	1616
49	trans-Sesquisabinene hydrate	-	2.36	1.13	1619	1619
50	Germacrene	.45	-	1.01	1622	1622
51	Guaiol	.14	.14	-	1629	1629
52	Cadinol	-	-	1.48	1635	1635
53	Neo-Intermedeol	-	.32	-	1652	1652
54	α- Muurolol	-	.76	-	1666	1666
55	trans- Muurolol	-	-	.64	1677	1677
56	trans- α- Bergamotene	.20	-	-	1697	1697
57	trans- α- Bergamotol	T	-	.23	1714	1714
58	β –Costol	-	.28	-	1717	1717
59	Longifolenaldehyde	-	.18	-	1732	1732
60	7-Acetyl-2-hydroxy-2-methyl-5-isopropylbicyclononane	.27	-	-	1744	1744
61	Oplopanone	-	.47	-	1748	1748
62	Linalool acetate	.17	-	-	1764	1764
63	α- Pinene oxide	.64	1.22	.32	1787	1787

64	Neo- Thujan-3-ol	.56	-	.46	1811	1811
65	Cedroxyde	-	1.56	-	1819	1819
66	Phytone	-	.30	.93	1843	1843
67	Eudesm-11-en-4-alpha,6-alpha-diol	-	.30	-	1900	1900
68	Palmitic acid	-	.15	-	1969	1969
69	Phytol	3.44	5.30	1.42	2116	2116
70	Palmitaldehyde, diallylacetal	-	.31	-	2148	2148
	Total	**92.8%**	**91.06%**	**92.45%**		

a=RI; b=MS; c=^{1}H NMR, d=^{13}C NMR, t=trace (<.1%).

Table-02 Essential oil of *Lantana camara*linn, contain the following classes of chemical compounds.

S.N	CHEMICAL COMOSITIONS	SAMPLE-1	SAMPLE-2	SAMPLE-3
1	Monoterpene hydrocarbon	-	.28	16.81
2	Oxygenated monoterpenes	1.37	1.41	2.00
3	Sesquiterpene hydrocarbons	24.71	29.72	58.31
4	Oxygenated sesquiterpenes	61.31	53.31	12.77
5	Oxygenated diterpenes	3.44	5.30	1.42
6	Others	1.97	1.04	1.14

Table-1 shows that the essential oil collected from Almora (sample1) and Bhimtal (sample2) region were dominated by oxygenated sesquiterpenes (61.31% and 53.31% respectively) followed by sesquiterpene hydrocarbons (24.71% and 29.72% respectively). Essential oil collected from Haldwani (sample3) region were dominated by sesquiterpene hydrocarbons (58.31%) followed by oxygenated sesquiterpenes and monoterpene hydrocarbons (12.77% and 16.81% respectively). In addition phytol the only oxygenated diterpene was present in the amount of 3.44%, 5.30% and 1.42% in the essential oil collected from Alomra and Bhimtal region respectively. Nerolidol was the major component in the essential oil collected from Almora and Bhimtal region (58.82% and 45.45% respectively) reported for the first time in such high concentrations and thus in future the essential oil of *L. camara* collected from the Almora and Bhimtal region could be the new source of nerolidol.

E-caryophyllene was the second major component present in the essential oil collected from Almora and Bhimtal region (10.42% and 10.94% respectively) while it was present as major component (16.0%) followed by α- Humulene (14.89%) in the essential oil collected from Haldwaniregion.The amount of humulene is found to be 5.54% from the leaf essential oil collected from Almora region, while the essential oil collected from Bhimtal region, it was present in the amount of 6.07%. β –elemene was present in the amount of 3.72%, 7.27% and

8.74%, in the essential oil collected from AlmoraBhimtal and Haldwani region respectively. Other major components were bicyclogermacrene 4.69%, p-cymene 4.27%, germacrene-D 4.24%, and caryophyllene oxide 2.46% , present in the essential oil collected from Haldwani region.

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.

REFERENCE

1. Adams R. P (2001). Identification of Essential oil by Gas Chromatography Quadrupole Mass Spectrometry. Allured Publishing Corporation, Carol Stream. USA.
2. R. Seth, M. Mohan, P. Singh, S. Z. Haider, S. Gupta, I. Bajpai, D. Singh and R. Dobhal Chemical composition and antibacterial properties of the essential oil of Lantana camaralinn. From Uttrakhand (India), Asain Pac. J. Trop. Biomed, 2012; S1407-S1411.
3. E. L. Ghisalberti Lantana camara L. (Verbenaceae), Fitoterapia, 2000; 71: 467-486.
4. L. Mishra and H. Laatsch Triterpenoids, essential oil and photo-oxidative 28 13-lactonization of oleanolic acid from Lantana camara, Phytochemistry, 2000; 54: 969-974.
5. A.K. Tripathi and B. N. Shukla Antifungal activity of some plant extracts against Fusariumoxysporumsp. Causing wilt of linseed, J. Mycol. Plant Pathol, 2002; 32: 266-267.
6. S. Sharma, A. Singh and O.P. Sharma An improved procedure for isolation and purification of lantadene A, the bioactive pentacyclictriterpenoid from Lantana camara leaves, J. Med. Aromatic Plant Sci., 1999; 686-688.
7. S. Begum, S.Q. Zehra and B.S. Siddiqui Two new pentacyclictriterpenoids from Lantanacamara Linn. Chem. Pharma. Bull., 2008; 56: 1317-1320.
8. D.K. Verma, S.K. Singh and V. Tripathi A rare antibacterial flavones glucoside from Lantanacamara, Indian Drugs, 1997; 34: 32-35.
9. C. Clarkson, V.J. Matharaj, N.R. Crouch, O.M. Grace, P. Pillay, M.G. Matsabisa, N. Bhagwandin, P.J. Smith and P.I. Folb In vitro antiplasmodial activity of medicinal plants native to or naturalized in South Africa, J. Ethnopharmacol, 2004; 92: 177-191.
10. M. J. Deena and J. E. Thoppil (2000). Antimicrobial activity of the essential oil of lantana, fitoterapia.

11. O. O. Sonibare and I. Effiong Antibacterial activity and cytotoxicity of essential oil of Lantana camaraL. leaves from Nigeria, African J. Biotecnol, 2008; 7: 2618-2620.
12. J. Benites, C. Moiteiro, G. Miguel, L. Rojo, J. Lopez, F. venancio, L. Ramalho, S. Feio, S. dandlen, H. Casanova and I. Torres Composition and biological activity of the essential oil of Peruvian Lantana camara, J. Chilea Chem. Soc., 2009; 54: 379-384.
13. V. K. Dua, A. C. Pandey and A. P. Dash Adulticidal activity of essential oil of Lantana camara leaves against mosquitoes, Ind. J. Med. Res., 2010; 131: 434-439.
14. C. Garcia, E. G. Acosta, A. C. Carro, B. M. C. R. Fernandez, R. Bomben, C. B. Duschatzky, M. Perotti, C. Schuff and E. B. Damonte Virucidal activity and chemical composition of essential oils from aromatic plants of central west argentina, Nat. Prod. Commun, 2010; 5: 1307-1310.
15. M. Verdeguer, M.A. Blazquez and H. Boira Phytotoxic effects of Lantana camara, Eucalyptus camaldulensis and Eriocephalusafricanus essential oils in weeds of Mediterranean summer crops, Biochem. System. Ecol., 2009; 37: 362-369.
16. L.N. Mishra and A. Ahmad Triterpenoid from Shorearobusta resin, Phytochemistry, 1997; 45: 575.
17. L. Mishra and H. Laatsch *19β→28*- Lactonization of pomonic acid from Lantana camararoots, Z. Naturforsch, 1999; 55: 768-770.
18. B.S. Siddiqui, W. M. Raza, S. Begum, S. Siddiqui and S. Firdous Pentacyclictriterpenoids from Lantaacamara, Phytochemistry, 1995; 38: 681-685.
19. J.A. Pino, M. Rolando, R. Aristides, R. Carlo and M.M. Pilar Chemical compostion of the essential oil of Lantana camara L. from Cuba, J. Esst. Oil Res., 2004; 16: 216-218.
20. A.J. Sundufu and H. Shoushan Chemical compostion of the essential oils of LantanacamaraL. occurring in south China, Flav. Fragr. J., 2003; 19: 229-232.