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Comparison of Chemical Composition of Essential oil of *Tanacetum longifolium* from two different altitudes of Western Himalaya of Uttrakhand, India

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The chemical profile of the hydro distilled essential oil obtained from the aerial parts of *Tanacetum longifolium* from two different attitudes of Kumaun Himalaya was analyzed by capillary GC-FID and GC-MS. The essential oils of aerial parts led to the identification of 42 constituents accounting for 93.5% and 91.7% of the total oil composition from two different altitudes and regions respectively. The α-bisabolol (7.4%) cadina-1, 4-diene (15%) β- eudesmol (24.8%) were present in one sample while γ-eudesmol (6.9%) β- eudesmol (10.4%) α-bisabolol (10.8%) were the principle components of another sample.

Keyword: *Tanacetum* essential oil, Asteraceae, α-bisabolol, β- eudesmol.

1. Introduction

The genus *Tanacetum* (tribe Anthemideae), commonly known as tansy belongs to the family Asteraceae. The genus *Tanacetum* is represented by six species *viz. T. nubigenum*, *T. tibeticum*, *T. longifolium, T. arteminiodes*, *T. gracile* and *T. senecionis* in Kumaon and Garhwal regions in 3600-4300 m elevation[1,2]. *Tanacetum longifolium* Wall. (syn *Tanacetum dolichophyllum*. Kitam) is an erect hairy herbaceous plant with pinnatisect radical leaves and bright yellow heads. This aromatic herb generally grows in alpine meadows and the time of flowering is August to October. Traditionally, *T. longifolium* is used in preparation of incense and fragrant materials by the local inhabitants in Uttarakhand[3]. *Tanacetum* species are reported to possess anthelmintic, carminative, stimulant, antispasmodic and anti-migrant properties[4,5,6]. In earlier investigation on *T. nubigenum* collected from two alpine/ sub-alpine regions of Himalaya, revealed existence of two stable chemotypes**.** The chemotype-I, collected from Milam glacier (Pithoragarh) was shown to be dominated by bornyl acetate (39.7 %), borneol (10.6 %), (*E*)-β-farnesene (6.6 %) and 1, 8-cineole (5.8 %); whereas the chemotype-II, collected from Pindari glacier (Bageshwer), was dominated by (3*R*, 6*R*)-linalool oxide acetate (69.4 %), β-eudesmol (3.2 %). On the contrary, *T. nubigenum* collected from Chamoli of Garhwal Himalaya was shown to contain (-)-*cis*-chrysanthenol (37.0 %), sabinene (10.7 %), (-)-*cis*chrysanthenyl acetate (5.8 %), (-)-*cis*-chrysanthenyl isobutyrate (5.7 %), (-)-*cis*chrysanthenyl- α-methylbutyrate (2.8 %), (-)-*cis*-

chrysanthenyl angelate (0.6 %) and small quantities of substituted camphor (3.0 %)[7,8,9].

Previous study also showed that two new long chain alkyl *p*-coumaric acid esters along with eicosanyl *trans-p*-coumarate were isolated from chloroform extract of the roots of *Tanacetum longifolium*[10]. and naturally occurring linear sesquiterpene (tanacetene) with a long chain ester have been isolated from hexane and chloroform extract of root and aerial parts of *T.longifolium*[11]. The previous report also showed that the essential oil has very good antibacterial activity[12].The present communication reveals the variation in chemical composition of *T.longifolium* collected from two different altitudes.

2. Materials and methods

2.1 Collection of Plant material: The fresh aerial parts of *T. longifolium*, were collected from world famous Milam glacier at the height of 3600mt and Munsyari at the height of 2700mt in August 2008. Plants herbaria were identified from Botanical Survey of India, Dehradun.

2.2 Oil isolation: The fresh plant materials (1.0 kg each sample) were subjected to steam distillation using a copper electric still, fitted with spiral glass condensers. The distillates were saturated with NaCl and extracted with *n*-hexane and dichloromethane. The organic phase was dried over anhydrous Na_2SO_4 and the solvent was distilled off in a rotary vacuum evaporator at 30° C.

2.3 GC and GC-MS analysis:

The GC analysis was run on Nucon 5765 gas chromatograph (Rtx-5 column, 30 m 0.32 mm i.d., FID), split ratio 1: 48, N_2 flow of 4 kg/cm^2 and on Thermo Quest Trace GC 2000 interfaced with Finnigan MAT PolarisQ ion trap mass spectrometer fitted with a Rtx-5 (Restek Corp.) fused silica capillary column (30 mm 25 mm; 0.25 µm film coating). The column temperature was programmed from 60°C-210° at 3°C /min. using He as carrier gas at 1.0 mL/min. The injector temperature was 210°C, injection size 0.1µL prepared in *n*-hexane, split ratio 1:40. MS were taken at 70 eV with mass scan range of *m/z* 40-450 amu. The identification was done on the basis of Linear Retention Index (LRI, determined with reference to homologous series of *n*-alkanes (C_9-C_{24} Polyscience Corp., Niles IL) under identical experimental conditions, co-injection with standards (Sigma), MS Library search (NIST and WILEY), by comparing with the MS literature data[13].

Table 1: Comparison of Essential oil Composition of *T. longifolium* from two Different Altitudes.

S. No.	Compounds	LRI	%Composition (FID) [a]Milam glacier 3600mt	%Composition (FID) [b]Munsyari 2700mt	Mode of identification
1	tricyclene	926	0.3	-	-
2	α-pinene	941	1.4	2.4	a,b
3	sabinene	978	0.1	0.4	a,b
4	β-pinene	982	0.2	0.8	a,b
5	α-terpinene	1019	0.2	2.2	a,b
6	β-phellamdrone	1034	0.1	-	-
7	1,8-cineole	1038	3.2	1.2	a,b
8	(*E*)- β-ocimene	1054	0.2	0.8	a,b
9	*cis*-sabinene hydrate	1069	0.7	1.6	a,b
10	linalool	1101	0.8	1.9	a,b
11	*trans*-p-mentha-2-enol	1145	0.3	-	-

12	borneol	1167	0.3	0.9	a,b
13	terpinene-4-ol	1180	1.2	0.7	a,b
14	methyl chavicol	1198	0.2	1.3	a,b
15	geraniol	1155	1.5	1.9	a,b
16	bornyl acetate	1285	0.2	-	-
17	thymol	1290	0.3	-	-
18	α-terpinyl acetate	1352	0.2	0.8	a,b
19	isoboronyl proponiate	1381	9.4	3.6	a,b
20	α-gurjunene	1410	0.4	1.0	a,b
21	β-caryophyllene	1418	3.3	1.2	a,b
22	α-humulene	1457	0.4	2.9	a,b
23	(*E*)- β-farnesene	1459	6.8	2.7	a,b
24	γ-muurolene	1479	0.3	-	-
25	germacrene D	1481	1.3	2.9	a,b
26	β-selinene	1489	0.5	1.6	a,b
27	bicyclogermacrene	1497	0.2	-	-
28	δ-cadinene	1529	0.3	2.1	a,b
29	cadina-1,4-diene	1532	15.0	8.0	a,b
30	germacrene D-4-ol	1578	0.6	1.8	a,b
31	spathulenol	1579	0.1	-	-
32	(*E*)-sesquisabinene hydrate	1582	0.1	-	-
33	guaiol	1604	0.9	2.7	a,b
34	γ-eudesmol	1624	3.7	6.9	a,b
35	β- eudesmol	1652	24.8	10.8	a,b,c
36	selin-11-en-4 α-ol	1658	2.7	1.9	a,b
37	α-bisabolol	1685	7.4	10.4	a,b,c
38	aristolone	1758	0.5	2.9	a,b
39	(*E*)-spiroketalenol-ether polyyne	1877	t	-	-
40	(*Z*)- spiroketalenol-ether polyyne	1886	t	-	-
41	(*E*)-spiroketalenol-ether polyyne(M^+214)	1897	2.1	4.0	a,b
42	(*Z*)- spiroketalenol-ether polyyne (M^+ 214)	1934	1.3	7.7	a,b
Total			**93.5%**	**91.7%**	

a=Retention Index (RI) on Rtx-5 capillary column, b=MS (GC-MS), c= ^{1}H NMR ^{13}C NMR data Compounds >3.0% represented in bold face, t= trace (<0.1%) Altitudes a=Milam glacier 3600mt, b= Munsyari, 2700mt.

3. Results and Discussion

The GC and GC-MS analysis of leaf oil of *T. longifolium*, was shown in Table 1 in order of their elution in Rtx-5column. The major constituents in one sample were the α-bisabolol (7.4%) cadina-1, 4-diene (15%) β-eudesmol (24.8%) while the γ-eudesmol (6.9%) β-eudesmol (10.4%) α-bisabolol (10.8%) were the principle components of another sample. The previous study showed that variation in chemical composition also reported which were collected from Dayara and Tungnath showed that the major components were cis-lanceol (11.8%), b-pinene (10.7%), (*E*)-β-farnesene (7.4%), α-bisabolol (7.2%) and other notable constituents were β-eudesmol (5.2%) and terpinen-4-ol (5.1%). In sample, β-eudesmol (31.4%) and α-bisabolol (10.7%) were detected as main components followed by neryl acetate (5.8%) and (*E*)-β-farnesene (5.7%) [14]. We can see that the results of our work is totally different with previous one, this also showed that the oil composition vary with altitudes.

4. Conclusion

The present investigation reveals that the chemical composition of essential oil of *Tanacetum longifolium* vary with altitude

and as it is used as a traditional medicine in Uttrakhand tribe areas, it will become as a raw material to made scented products. Attempts will be made in future to isolate the huge amount of oil to use this purpose.

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