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# COMPARATIVE CHEMICAL COMPOSITION OF THE STUDY OF THE ESSENTIAL OILS OF *TARAXACUM MITALII* COLLECTED FROM TWO DIFFERENT HABITAT TYPES OF KUMAUN, HIMALAYAS

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## ABSTRACT

Medicinal plants are of great importance to the health of individuals and communities in general. The major constituent found to be Citronellol present in the essential oil. *Taraxacum mitalii* was collected from two different locations of Uttarakhand, essential oil was extracted from the leaf sample using hydro-distillation method, Gas chromatography coupled with mass spectrometer was used for chemical analysis of the extracted essential oil. Total of 64 constituents were identified from two essential oil of *Taraxacum mitalii* representing 97.5%, 88% of the total oil collected from Nainital, Ranikhet region. Monoterpene were Citronellol (21.93%), Geraniol (18.62%), β- Linalool (9.09%) and Iso- Menthone (5.89%) as a major component. Second constituents were sesquiterpene (24.21%) with 32 compounds. The major components of sesquiterpene were γ.-Eudesmol (5.59), Citronellyl formate (4.40), Geranyl tiglate (3.80%), Viridiflorene (2.03%) and β-Bourbonene (1.88%).

**KEYWORDS:** Citronellol, Chemical Constituent, essential oil, GC-MS, *Taraxacum mitalii*.

## INTRODUCTION

Medicinal plants are of great importance to the health of individuals and communities in general. Medicinal plants are of great importance to the health of individuals and communities in general. Dandelion (Taraxacum spp) is used in many traditional and modern

herbal medical systems, as particularly has been documented in Asia, Europe and North America. The root is primarily considered a gastrointestinal remedy supporting digestion and liver function, while the leaf is used as a diuretic and bitter digestive stimulant (Eric Yarnell and Kathy Abascal, 2009).

Taraxacum is a large genus of flowering plants in the Asteraceae family. The species of this genus are widely distributed and cosmopolitan in nature, especially in Kumaun Garhwal hills. Herbs 8-15 cm tall, petiole usually purplish to pinkish, arachnoid at base, narrow to narrowly winged, leaf blade grayish green, sometimes brownish purple. Different species of Taraxacum have been screened for their chemical constituents and medicinal properties. Phytochemical constituents were isolated from the aerial parts of Taraxacum coreanum by repeated column chromatography and HPLC. Their structures were identified as β-sitosterol daucosterol, taraxasteryl acetate, chrysoeriol, diosmetin, luteolin, luteolin-7-O-glucoside, esculetin and 5-hydroxypyrrolidin-2-on (Sullim *et.*, 2011). Studies have been conducted on different species of this genus. The compounds mentioned in the scientific literature of Taraxacum officinale are sterols, triterpenes, hydroxycinnamic acid derivatives, flavonoids (aglycones and glycosides) and mucilages. The leaves and flowers also contain tannins and carotenoids (Bruneton, 1999; Codreanu *et al*., 2006; Wichtl and Anton, 2003).

## EXPERIMENTAL

### Material

The leaves of the plant were collected in the month of July 2016 from two different locations of Kumaun Himalayas, mainly Mukteshwar (Disst. Nainital, Ranikhet Disst. Almora, Uttarakhand) identified Department of Botany, Kumaun University, Nainital and also authenticated by Botanical Survey India, Dehradun. The voucher specimen was deposited in the Herbarium section at B.S.I., Dehradun (voucher no. 113268). All solvents and reagents were of analytical grade.

### Extraction and isolation of essential oil

The fresh leaves were completely immersed in water overnight, then water-distilled in a full glass Clevenger-type apparatus to giving greenish-yellow oil. The extraction was carried out for 6 h and the essential oil was dried over anhydrous sodium sulphate and stored at $4^0$C before being analyzed. The yield of oil was calculated based on dried weight of plant material.

**GC and GC/MS analysis and identification**

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. 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 (99.999%) was used as carrier gas adjusted to 1.21 ml/min at 69.0 K Pa, splitless injection of 1 mL, of a hexane solution injector and interface temperature were $270^0$C, oven temperature programmed was 50–$280^0$C at $3^0$C/min. Mass spectra were recorded at 70 eV, ion source temperature was $230^0$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 (Adams, 1955, Adams, 2001 and Julain & Konig 1988). Retention indices (RI) were determined with reference to a homologous series of normal alkanes, by using the following formula (Kovats, 1958).

$$KI = 100\,[n + (N-n) \times \left[ \frac{\log t^1_R\,(\text{unknown}) - \log t^1_R\,(C_n)}{\log t^1_R\,(C_N) - \log t^1_R\,(C_n)} \right]]$$

$t^1_R$ – 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

**RESULT AND DISCUSSION**

The essential oil from the leaves of *Taraxacum mitalii* analyzed by GC-FID, GC-MS. A total of 64 constituents were identified from the essential oil collected from two different region of Kumaun, representing 97.50%, 88% of the total oil collected from Mukteshwar (Distt. Nainital, Ranikhet Distt. Almora) region. Citronellol (21.93%) was the major constituents present in the essential oil of *Taraxacum mitalii*. Citronellol is used in perfumes and insect repellents, and as a mite attractant. Citronellol is a good mosquito repellent at short distances, but protection greatly lessens when the subject is slightly further from the source. Citronellol

has antimicrobial, antifungal, antispasmodic and anticonvulsant activities. Since ancient times, essential oils are recognized for their medicinal value and they are very interesting and powerful natural plant products. They continue to be of paramount importance until the present day. Essential oils have been used as perfumes, flavors for foods and beverages, or to heal both body and mind for thousands of years (Baris et al., 2006; Margaris et al., 1982; Tisserand, 1997; Wei & Shibamoto 2010).

Hemiterpene constituent are found (0.09%) with 6-methyl- Hept-5-en-2-ol. Monoterpene constituent are found (73.20%) with 31 compounds. Monoterpene ware Citronellol (21.93%), Geraniol (18.62%), β- Linalool (9.09%) and Iso- Menthone (5.89%) as a major component and β-Pinene (0.05%), α- Phellandrene (0.09), 1,8-Cineol (0.10%) and Bois de Rose oxide (0.11%) minor components.

Second constituents was sesquiterpene (24.21%) with 32 compound. The major component of sesquiterpene were γ.-Eudesmol (5.59), Citronellyl formate (4.40), Geranyl tiglate (3.80%), Viridiflorene (2.03%) and β-Bourbonene (1.88%). The minor components of sesquiterpene are cis-Guaia-3,9-dien-11-ol (0.06%), trans-Cadina-1,4-diene (0.07%), β-Maaliene (0.09%), β-Eudesmol (0.09%) and β-Elemene (0.10%).

**Table 1: Essential oil composition of of Taraxacum mitalii.**

| S.N. | Compound | Area % Sample-1 | Mol. formula | Mol. Wt. | RI | Area % Sample-2 | RI |
|---|---|---|---|---|---|---|---|
| 1. | α-PINENE | 0.60 | $C_{10}H_{16}$ | 136 | 936 | 0.45 | 136 |
| 2. | Bois de Rose oxide | 0.11 | $C_{10}H_{18}O$ | 154 | 968 | 0.9 | 154 |
| 3. | β-Pinene | 0.05 | $C_{10}H_{16}$ | 136 | 978 | 0.7 | 136 |
| 4. | Myrcene | 0.17 | $C_{10}H_{16}$ | 136 | 987 | 0.11 | 136 |
| 5. | 6-methyl- Hept-5-en-2-ol | 0.09 | $C_8H_{16}O$ | 128 | 995 | 0.02 | 128 |
| 6. | α- Phellandrene | 0.09 | $C_{10}H_{16}$ | 136 | 1002 | 0.03 | 136 |
| 7. | p-Cymene | 0.12 | $C_{10}H_{14}$ | 134 | 1015 | 0.19 | 134 |
| 8. | α- Limonene | 0.26 | $C_{10}H_{16}$ | 136 | 1025 | 0.11 | 136 |
| 9. | 1,8-Cineol | 0.10 | $C_{10}H_{18}O$ | 154 | 1030 | 0.13 | 154 |
| 10. | Cis-Ocimene | 0.16 | $C_{10}H_{16}$ | 136 | 1038 | 0.11 | 136 |
| 11. | (E)-β-Ocimene | 0.16 | $C_{10}H_{16}$ | 136 | 1041 | 0.13 | 136 |
| 12. | Terpinolene | 0.13 | $C_{10}H_{16}$ | 136 | 1080 | 0.09 | 136 |
| 13. | β- Linalool | 9.09 | $C_{10}H_{18}O$ | 154 | 1082 | 8.23 | 154 |
| 14. | trans-Rose oxide | 0.76 | $C_{10}H_{18}O_1$ | 154 | 1116 | 0.66 | 154 |
| 15. | Iso- Menthone | 5.89 | $C_{10}H_{18}O$ | 154 | 1140 | 4.32 | 154 |
| 16. | trance- Chrysanthemol | 0.14 | $C_{10}H_{18}O$ | 154 | 1154 | 0.09 | 154 |
| 17. | Neoisomenthol | 0.39 | $C_{10}H_{20}O$ | 156 | 1164 | 0.22 | 156 |
| 18. | α- Terpineol | 1.43 | $C_{10}H_{18}O_1$ | 154 | 1176 | 1.00 | 154 |
| 19. | Citronellol | 21.93 | $C_{10}H_{20}O_1$ | 156 | 1213 | 20.00 | 156 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20. | 6,7-Dihydro-7-hydroxylinalool | 0.20 | $C_{10}H_{20}O_2$ | 172 | 1184 | 0.11 | 172 |
| 21. | Geraniol | 18.62 | $C_{10}H_{18}O$ | 154 | 1228 | 15.23 | 154 |
| 22. | Citronellyl formate | 4.40 | $C_{11}H_{20}O_2$ | 184 | 1254 | 3.30 | 184 |
| 23. | Geranyl formate | 3.18 | $C_{11}H_{18}O_2$ | 182 | 1280 | 2.22 | 182 |
| 24. | Methyl-Nerate | 0.19 | $C_{11}H_{18}O_2$ | 182 | 1276 | 0.19 | 182 |
| 25. | (R)-(+)-Citronellic acid | 0.41 | $C_{10}H_{18}O_2$ | 170 | 1293 | 0.36 | 170 |
| 26. | α-Cubebene | 0.12 | $C_{15}H_{24}$ | 204 | 1330 | 0.06 | 204 |
| 27. | Citronellyl acetate | 0.28 | $C_{12}H_{22}O_2$ | 198 | 1337 | 0.04 | 198 |
| 28. | Hydroxycitronellol | 0.29 | $C_{10}H_{22}O_2$ | 174 | 1355 | 0.12 | 174 |
| 29. | α-Copaene | 0.82 | $C_{15}H_{24}$ | 204 | 1370 | 0.34 | 204 |
| 30. | β-Bourbonene | 1.88 | $C_{15}H_{24}$ | 204 | 1380 | 0.88 | 204 |
| 31. | β-Elemene | 0.10 | $C_{15}H_{24}$ | 204 | 1389 | 0.10 | 204 |
| 32. | Phenethyl isobutyrate | 0.09 | $C_{12}H_{16}O_2$ | 192 | 1395 | 0.05 | 192 |
| 33. | β-Maaliene | 0.09 | $C_{15}H_{24}$ | 204 | 1412 | 0.05 | 204 |
| 34. | (E)-Caryophyllene | 1.02 | $C_{15}H_{24}$ | 204 | 1420 | 1.00 | 204 |
| 35. | β-Copaene | 0.28 | $C_{15}H_{24}$ | 204 | 1421 | 0.34 | 204 |
| 36. | (+)-Aromadendrene | 0.82 | $C_{15}H_{24}$ | 204 | 1440 | 0.45 | 204 |
| 37. | α-Guaiene | 0.44 | $C_{15}H_{24}$ | 204 | 1440 | 0.33 | 204 |
| 38. | α-Humulene | 0.40 | $C15H_{24}$ | 204 | 1450 | 0.11 | 204 |
| 39. | 9-epi-(E)- Caryophyllene | 0.67 | $C_{15}H_{24}$ | 204 | 1464 | 0.11 | 204 |
| 40. | Germacrene D | 1.76 | $C_{15}H_{24}$ | 204 | 1479 | 1.35 | 204 |
| 41. | Geranyl propanoate | 1.01 | $C_{13}H_{22}O_2$ | 210 | 1471 | 1.00 | 210 |
| 42. | β-Selinene | 0.14 | $C_{15}H_{24}$ | 204 | 1490 | 0.11 | 204 |
| 43. | Viridiflorene | 2.03 | $C_{15}H_{24}$ | 204 | 1493 | 2.24 | 204 |
| 44. | γ-Amorphene | 0.31 | $C_{15}H_{24}$ | 204 | 1496 | 0.32 | 204 |
| 45. | (E,E)-α-Farnesene | 0.16 | $C_{15}H_{24}$ | 204 | 1504 | 1.00 | 204 |
| 46. | Geranyl isobutyrate | 0.77 | $C_{14}H_{24}O_2$ | 224 | 1507 | 0.20 | 224 |
| 47. | δ-CADINENE | 0.91 | $C_{15}H_{24}$ | 204 | 1520 | 0.56 | 204 |
| 48. | trans-Cadina-1,4-diene | 0.07 | $C_{15}H_{24}$ | 204 | 1532 | 0.45 | 204 |
| 49. | Guaia-6,9-dien | 0.14 | $C_{15}H_{24}$ | 204 | 1542 | 0.67 | 204 |
| 50. | α-Agarofuran | 0.70 | $C_{15}H_{24}O$ | 220 | 1550 | 1.45 | 220 |
| 51. | Geranyl butyrate | 0.53 | $C_{14}H_{24}O_2$ | 224 | 1559 | 1.35 | 224 |
| 52. | phenylethyl-Tiglate | 1.65 | $C_{13}H_{16}O_2$ | 204 | 1584 | 1.00 | 204 |
| 53. | Viridiflorol | 0.10 | $C_{15}H_{26}O$ | 222 | 1594 | 0.12 | 222 |
| 54. | 2-methylbutyrate-Geranyl | 0.37 | $C_{15}H_{26}O_2$ | 238 | 1596 | 0.23 | 238 |
| 55. | Geranyl isovalerate | 0.11 | $C_{15}H_{26}O_2$ | 238 | 1604 | 0.67 | 238 |
| 56. | γ.-eudesmol | 5.59 | $C_{15}H_{26}O$ | 222 | 1626 | 6.00 | 222 |
| 57. | Epicubenol | 0.15 | $C_{15}H_{26}O$ | 222 | 1630 | 0.23 | 222 |
| 58. | cis-Guaia-3,9-dien-11-ol | 0.06 | $C_{15}H_{24}O$ | 220 | 1647 | 1.00 | 220 |
| 59. | β-Eudesmol | 0.09 | $C_{15}H_{26}O$ | 222 | 1656 | 0.36 | 222 |
| 60. | Valerianol | 0.18 | $C_{15}H_{26}O$ | 222 | 1657 | 0.45 | 222 |
| 61. | (E)-Citronellyl tiglate | 0.42 | $C_{15}H_{26}O_2$ | 238 | 1664 | 0.12 | 238 |
| 62. | Geranyl tiglate | 3.80 | $C_{15}H_{24}O_2$ | 236 | 1696 | 3.35 | 236 |
| 63. | Geraniol hexanoate | 0.33 | $C_{16}H_{28}O_2$ | 252 | 1748 | 0.42 | 252 |
| 64. | Geranyl octanoate | 0.15 | $C_{18}H_{32}O_2$ | 280 | 1943 | 0.56 | 280 |
| | | 97.50 | | | | 88 | |

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

## CONCLUSION

The current study indicates that chemical composition of *Taraxacum mitalii* oil is of high quality with citronellol and geraniol as dominant compounds. In the present work, 64 constituents of the essential oil from *Taraxacum mitalii* were successfully identified and determined. Concluding, the essential oil mainly comprises mono- and sesquiterpene hydrocarbons (73.20% and 24.21%, respectively); oxygenated derivatives are only minor constituents of this essential oil. Sample 1 has total percentage 97.5% whereas Sample 2 has total percentage nearly 88%.

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