

# Gc-Ms Analysis and Antimicrobial Activity of Essential Oil of *Senecio chrysanthemoides*

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## ABSTRACT

The chemical composition of the essential oil obtained from the leaves of *Senecio chrysanthemoides* collected from the Garhwal region of Uttarakhand, was analyzed by GC-MS. The major constituent was found out to be (Z)- $\beta$ -Farnesene (18.80%). The antibacterial and antifungal activity of the oil was determined by disc diffusion method. Results showed that the oil exhibited mild antimicrobial activity.

**Keywords:** *Senecio chrysanthemoides*, Antibacterial, Antifungal, Asteraceae, Essential oil.

## INTRODUCTION

The genus *Senecio* (Asteraceae) is one of the richest in species among the Angiosperms, with more than 1500 species distributed worldwide in cold and tropical regions [1]. Many species of the genus *Senecio* have reportedly been used by Andean people in Chile as traditional remedies for mountain sickness. Several of these species are known by the vernacular name “*chachakoma*” but Villagran *et al.*, pointed out that given the same name to widely different species of the genus *Senecio* is basically wrong and misleading [2]. In traditional medicine, the use of *Senecio* species for treatment of asthma, coughs, bronchitis, eczema and wound healing have been reported [3-5]. Previous works on the chemical composition of the essential oils of some *Senecio* included *Senecio trapezuntinus* Boiss., *Senecio platyphyllus* DC. var. *platyphyllus*, *S. vernalis* Waldst. & Kit., *S. glaucus* subsp. *coronopifloius*, *S. leucostachys* Baker., *Senecio squalidus* L., *Senecio aegyptius* var. *discoideus* Boiss., *Senecio graveolens* Wedd., *Senecio farfarifolius* Boiss., *Senecio nutans* Sch.-Bip., and *Senecio longipenicillatus* Sch.-Bip.

## MATERIALS AND METHODS

**2.1 Plants Materials:** Whole plants of *Senecio chrysanthemoides* were collected from the Tungnath (Chopta), Rudraprayag, Uttarakhand India in October 2014. The plant was identified from Department of Botany, HNB Garhwal University Srinagar Uttarakhand. A Voucher Specimen (GUH-3354) was deposited in the Department of Botany.

**2.2 Methodology:** About 10 kg sample of dried leaves of *Senecio chrysanthemoides* were subjected to hydro distillation for 8 hours using a Clevenger-type apparatus. The oil was extracted over ether and dried over anhydrous

Na<sub>2</sub>SO<sub>4</sub>. The yield was 0.05% (v/w).

**2.3 GC and GC/MS:** GC/MS analysis were performed with a Perkin Elmer *Clarus 500* gas chromatograph equipped with a split/splitless injector (split ratio 50:1) data handling system. The column was Rtx-5 capillary columns (60 m x 0.32 mm, 0.25  $\mu$ m film thickness). Helium (He) was the carrier gas at a flow rate 1.0 mL/min. The GC was interfaced with (Perkin Elmer *Clarus 500*) mass detector operating in the EI+ mode. The mass spectra were generally recorded over 40-500 amu that revealed the total ion current (TIC) chromatograms. Temperature program was used as follows: initial temperature of 60°C (hold: 2 min) programmed at a rate of 30°C/min to a final temperature of 220°C (hold: 5 min). The temperatures of the injector, transfer line and ion source were maintained at 210°C, 210°C and 200°C, respectively.

**2.4 Identification of Compounds:** The components of the oils were identified by comparison of their mass spectra with those of computer library (*NIST/ Pfleger /Wiley*) or with authentic compounds and confirmed by comparison of their retention indices either with those of authentic compounds or with data published in literature [6-7]. Isolation of the compounds: The fractionation of the oil was carried over silica gel (230-400 mesh, Loba) by column chromatography using n-hexane (Qualigens) and varying percentages of diethylether (Qualigens) in n-hexane as mobile phase [8]. Monitoring was done on pre coated silica gel TLC plates using iodine as visualizing agent. Repeated column chromatography of the column fractions gave one compound coded as C.

**Microorganisms:** Three gram negative bacteria viz. *Pasteurella multocoda* (MTCC 1348), *Escherichia coli* (MTCC 443), and *Salmonella enterica* (MTCC 1223), and two gram positive bacteria viz. *Staphylococcus aureus* (MTCC 637) and *Bacillus subtilis* (MTCC 541) were used for the study of antibacterial activity. Fungi used were *Candida albicans* (MTCC 854) and *Aspergillus flavus* (MTCC 771). Standard pure cultures of these bacteria were procured from the Institute of Microbial Technology (IMTECH), Chandigarh, India as Microbial Type Culture Collection (MTCC) and maintained in the laboratory by regular sub culturing on to nutrient agar.

**Antimicrobial activity:** Antibacterial screening of the oil was done by Disc diffusion method as reported in literature, with slight modification [9]. Then minimum inhibitory concentration (MIC) of the essential oil is determined.

Bacterial suspension of 0.1 ml (10 times diluted) was added to the previously prepared nutrient agar plate and bacterial strain was thoroughly spread on the surface of agar media, using a bent rod. The sterilized Whatmann filter paper No.1 disc (5mm in diameter) was thoroughly soaked with essential oil (15 $\mu$ L) and placed in the inoculated plates. Gentamycin and Nystatin were used as a reference drugs. Fine pointed forceps were used to place the disc on the previously inoculated plates with the maximum possible aseptic precautions. The discs were firmly pressed against the nutrient agar medium so that they come in complete contact with the agar surface. The discs were placed at equal distances from each other on the seeded plates and the plates were incubated at 37 $^{\circ}$ C overnight, to observe the zone of inhibition around the disc. They were then compared with the zone of inhibition using standard antibiotic after overnight incubation on the nutrient agar plates.

## RESULTS AND DISCUSSION

### 3.1 Essential Oil Composition

The essential oil (yield 0.1%; v/w) obtained from aerial parts of *Senecio chrysanthemoides* was analyzed by using GC-FID and GC-MS. A total of 24 constituents, representing 74.47% of the total oil, have been identified. The composition of the essential oil obtained from aerial parts of *Senecio chrysanthemoides* with the retention

indices, retention time, percentage composition and identification methods. Compounds are listed in order of their elution from an HP-5 column. Essential oil showed the dominant presence of sesquiterpene hydrocarbons (56.86%) followed by oxygenated sesquiterpenes (15.58%) and oxygenated monoterpenes (13.08%). The major constituents of sesquiterpene hydrocarbons were (*Z*)- $\beta$ -Farnesene (18.80%), Germacrene D (10.84%) and  $\beta$ -Caryophyllene (3.39%). Oxygenated monoterpenes comprised dihydro citronellol (15.08%) as the representative constituent while  $\alpha$ -Cadinol (2.35%), Trans-Arteannuic alcohol (3.05%), Zerumbone (2.00%) and Humulene epoxide II (2.85%) were found as major Oxygenated sesquiterpenes. Aldehyde and hydrocarbon were found in relatively smaller amounts consisting of *n*-Nonanal (2.79%) and Longicyclene (2.02%) respectively. To the best of our knowledge, this is the first report on the presence of dihydro citronellol (15.08%) in the genus *Senecio*. Earlier, the leaf oil of *Senecio chrysanthemoides* showed the presence of Germacrene D (10.84%) as main constituent. while in present study, oil was rich in (*Z*)- $\beta$ -Farnesene (18.80%) with absence of  $\beta$ -thujone. Chemical variation of essential oils has been attributed to difference in environmental and genetic factors. Furthermore, ecological factors, particularly, light and temperature have also been reported to influences the production of essential oils as well as other active agents in plants.

**Table-1:** Essential oil composition of *Senecio chrysanthemoides*.

Compounds	RT	aLRI	Peak Area (%)	Identification
$\alpha$ -Zingiberene	31.418	1495	1.68	a.b
$\alpha$ -Muurolene	31.648	1499	1.25	a.b
$\gamma$ -Cadinene	32.116	1513	0.37	a.b
Germacrene D-4-ol	32.279	1574	1.63	a.b
Spathulenol	32.410	1576	1.21	a.b
$\beta$ -Caryophyllene	28.999	1418	3.39	a.b
( <i>Z</i> )- $\beta$ -Farnesene	30.189	1443	18.80	a.b
$\gamma$ -Muurolene	30.876	1477	0.69	a.b
Germacrene D	31.091	1480	10.84	a.b
<i>n</i> -Nonanal	8.492	1098	2.79	a.b
Dihydro citronellol	16.876	1196	15.08	a.b
Longicyclene	26.426	1373	2.02	a.b
$\alpha$ -Copaene	27.417	1376	1.40	a.b
$\beta$ -Maalene	27.686	1380	0.24	a.b
Iso-longifolene	27.919	1387	2.81	a.b
Longifolene	28.005	1402	1.65	a.b
$\beta$ -Isocomene	28.693	1403	1.74	a.b
Caryophyllene oxide	34.339	1581	1.98	a.b
Humulene epoxide II	35.208	1606	2.85	a.b
Trans-Arteannuic alcohol	36.112	1607	2.05	a.b
epi- $\alpha$ -Muurolol	36.466	1641	1.49	a.b
$\alpha$ -Cadinol	36.799	1653	2.35	a.b
Zerumbone	37.130			

## CONCLUSION

The essential oil of aerial parts of *Senecio chrysanthemoides*, containing (Z)- $\beta$ -farnesene (18.80%), dihydro citronellol (15.08%) and germacrene D (10.84%) as major constituents showed interesting antibacterial and antioxidant activities which make this essential oil a potential industrial resource of new products. Therefore, isolation, characterization and biological activities of major constituents of essential oil will be the further research programme.

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