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Composition variation in essential oils of *Artemisia nilagirica* and *Artemisia capillaris*, growing in India

Ruchi Badoni, Deepak Kumar Semwal* and Usha Rawat

Department of Chemistry, H.N.B. Garhwal University, Srinagar-246174 (Uttarakhand), INDIA

* Corresponding author. E-mail: dr_dks.1983@yahoo.co.in

Abstract : The present study was aimed to find out the chemical constituents of essential oils of *Artemisia nilagirica* (Clarke) Pamp. and *Artemisia capillaris* Thunb. of Asteraceae family, growing in Garhwal region of India. The essential oils were obtained by hydro-distillation and subjected to detailed GC-MS analysis in order to determine the variation in their volatile constituents. While comparing the common constituents in both of the species, the remarkable variation was observed and it was 6.03, 3.251, 2.093, 33.73, 7.573, 15.041 and 8.00% for trans-caryophyllene, DL-limonene, á-pinene, á-thujone, â-myrcene, â-ocimene and â-thujone, respectively.

Keywords: *Artemisia nilagirica*, *Artemisia capillaris*, Asteraceae, Essential oils, â-Ocimene, DL-Limonene

INTRODUCTION

The essential oils are concentrated, hydrophobic liquid containing volatile aroma compounds from plants, which are called aromatic herbs or aromatic plants. They are also known as volatile or ethereal oils, or simply as the oil of the plant from which they are derived, such as camphor oil, peppermint oil, lemon-grass oil, etc. Essential oils have played an important role in human life, so much so that they have become indispensable in the production of perfumes, cosmetics, medicines, food preparation and as a starting material for the synthesis of various other compounds.

About 8000 flowering plant species grow in Western Himalaya be rich in genetic diversity of medicinal and aromatic plants (Rao, 1994). Among these, most of the plants possess very refined and pleasant smell which can be utilized in flavor and perfumery. Majority of these plants are used for various ailments as traditional medicines. Various perfumeries, flavor and fragrance industries produce their required products from these plant species for commercial purposes.

Artemisia nilagirica (Asteraceae) vern. Kunja is a much branched herb or undershrub. The leaf juice of plant is used against the intestinal worms whereas *Artemisia capillaris* (Asteraceae) vern. Jhirun is an annual glabrous or sparsely and hairy herb; decoction of the leaves has been taken as a bitter tonic for worms and colic (Gaur, 1999). *A. capillaris* has long been used in China and Japan to treat jaundice (Okuno et al., 1981). The plants of *Artemisia* are widely distributed and well known for their essential oil bearing properties. Numerous reports have been published on essential oils composition of different *Artemisia* species, especially on those used in flavor industries and in medication commercially (Gilemeister and Hoffman, 1961; Juteau *et al*., 2002; Saleh *et al.*, 2006; Cetin *et al.*, 2009; Jaime A. Teixeira da Silva, 2004 and Ramezani *et al.*, 2005). Since these plants have their medicinal values, the present study was aimed to find out the compositional variation of *A. capillaris* and *A. nilagirica*, frequently used in traditional medicines in India.

MATERIALS AND METHODS

Plant materials: The aerial parts of *A. nilagirica* were supplied by Indian Glycol Limited, Ghimtoli, Dist. Rudraprayag, Uttarakhand, whereas *A. capillaris* was collected from Garhwal University campus, Chauras, Dist. Tehri Garhwal, during the month of June. The plants were identified from Taxonomy Laboratory, Department of Botany, University of Garhwal, Srinagar and the voucher specimens (GUH-2209 and GUH-6391, respectively) of the plants were deposited in departmental herbarium for future records.

Oil isolation procedure: The essential oil from fresh parts of plants species were isolated by hydro-distillation method, using a Clevenger apparatus. The distilled oils were dried over anhydrous sodium sulfate and stored in tightly closed dark vials at 4 °C until the analysis and tests has been carried out. The constituents present in the essential oils were further analyzed by GC-MS.

GC-MS analysis: The identification of chemical constituents was carried out by the GC/MS. The analysis was performed with GC Perkin-Elmer-Clarus-500 plus MS Perkin-Elmer-Clarus-500; Column: Perkin-Elmer HP 5-MS (oven: initial temp. 50 °C for 5 min, ramp 3 °C/min to 220 °C per min; inj=270 °C; volume=1ìl; split ratio =1:100;

Table 1. Chemical composition of essential oils of *A. nilagirica* and *A. capillaris.*

S. No.	Constituents	*A. nilagirica* (%)	*A. capillarys* (%)
1	1,1-Biphenyl	-	42.055
2	1,8-Cineole	1.266	0.523
3	1-Borneol	4.760	-
4	1-Cyclohexene-1 -carboxaldehyde	1.107	-
5	1-Phenyl-penta-2, 4-dyne	-	1.073
6	4-Terpineol	7.059	-
7	DL-Limonene	2.694	5.365
8	Germacrene D	1.087	-
9	Lavandulyl acetate	2.850	-
10	p-Menth-1-en-8-ol	1.571	-
11	Sabinene	3.081	-
12	Trans-caryophyllene	1.505	7.535
13	Trans-ocimene	0.166	1.585
14	Umbellulone	1.991	-
15	α-Pinene	0.233	2.326
16	α-Terpinene	1.555	-
17	α-Terpinolene	-	1.188
18	α-Thujone	36.944	3.214
19	β-Eudesmol	1.887	-
20	β-Myrcene	1.664	9.237
21	β-Ocimene	0.762	15.803
22	β-Pinene	0.114	0.643
23	β-Sesquiphellendrene	1.585	-
24	β-Thujone	8.213	0.213
25	γ-Curcumene	1.302	-
26	γ-Elemene	-	0.728
27	γ-Terpinene	2.717	5.307

carrier gas=He; solvent delay=5min; transfer temp=250 °C; source temp=180 °C; column=60m×250ìm. The constituents were identified by compared the MS with standard compounds of Nist and Willey libraries. The area percentage of chemical constituents from both species is given in Table 1.

RESULTS AND DISCUSSION

The essential oils of the selected plant species were subjected to detailed GC-MS analysis in order to determine the variations in their volatile constituents. The results based on the comparison on essential oil constituents of *A. nilagirica* and *A. capillaris* are summarized in Table 1. The major constituents of *A. nilagirica* were á-thujone (36.944%), â-thujone (8.213%), 4-terpeneol (7.059%) and 1-boroneol (4.764%) whereas, the major constituents of *A. capillaris* were 1, 1-biphenyl (42.055%), â-ocimene (15.803%), â-myrecene (9.237%), trans-caryophyllene (7.535%), limonene (5.365%). These major constituents of both the species are either absent or negligible in other (Table 1). The constituent 1,8-cineole, DL-limonene, trans-caryophyllene, trans-ocimene, á-pinene, á-thujone, â-myrcene, â-ocimene, â-pinene, â-thujone, ã-terpinene has been found common in both the plants species but the major variations were observed in trans-caryophyllene, DL-limonene, á-pinene, á-thujone, â-myrcene, â-ocimene, â-thujone by 6.03, 3.251, 2.093, 33.73, 7.573, 15.041, and 8.00 % respectively. The earlier reported essential oil from *A. nilagirica* syn. *A. vulgaris* contains camphor, â-caryophyllene, D-germacrene, á-humulene, 1,8-cineole, â-eudesmol, borneol, artemisia alcohol, camphene, á-gurjunene, p-cymene, terpinene-4-ol, á-pinene, á-phellandrene, ä-carene, trans-isoelemicin, lyratol, ã-elemene, (-)-linalool, thujone, azulene, thujyl alcohol, fernenol, stigmasterol, sitosterol, amyrin and its acetate (Haider *et al.*, 2007; Uniyal *et al.*, 1985 and Aboutabl *et al.*, 1997) of which some are either absent or found as minor constituents. Some antifungal constituents have also been reported from the plant (Shafi *et al.*, 2004). The essential oil of *A. nilagirica* was found to possess complete anti-dermatophytic activity by the poisoned food technique (Kishore *et al.*, 2001).

Various parts of *A. capillaris* lead to isolation of p-cymene, 5-phenyl-1,3-diyne, dehydrofalcarinone, dehydrofacarinol, aromatic C-11-C-13 acetylenes, aesculetin dimethylether, capillene, aliphatic C-17 acetylene (Harada and Iwasaki, 1982) 62 -O-caffeoyl-*p*-hydroxyacetophenone-4-*O*-*â*-D-glucopyranoside and 6-amino-9-[1-(3,4-dihydroxyphenyl)ethyl]-9*H*-purine (Ma *et al.*, 2008), 6,7-dimethyl esculetin (Aburada *et al.*, 1976), capillarisin (Komiya *et al.*, 1975), artemisidin A, artemicapins A-D (Shung *et al.*, 2001). The growing buds contain ã-terpinene, caryophyllene, capillin, capillacin, methyleugenol, curcumene and bornyl acetate as the minor components which showed antifeeding activity to the larvae of cabbage butterfly (Yano, 1987). From the stalk and leaves, the major constituents were capillen, å-cadinene, á-thujone, á-humulene and borneol whereas azulene identified as rare constituent (Miyazawa and Kameoka, 1977). The methanolic extract of aerial part from *A. capillaris* showed antimutagenic activity (Park *et al.*, 1996). *A. capillaris* has also been reported for cytoprotective and antioxidant activity (Hong *et al.*, 2007; Seo *et al.*, 2003). Infusions of the buds, stems and leaves of *A. capillaris* have been used in Chinese traditional medicine since antiquity as a cholagogic, antipyretic, antiinflammatory and diuretic purposes and in the treatment of jaundice (Tang and Eisenbrand, 1992; Han *et al.*, 2006; Han *et al.*, 2005; Jang *et al.*, 2005; Hong *et al.*, 2004 and Hu *et al.*, 2000). A group of coumarins and flavonol glycosides have also been reported from the inflorescence of *A. capillaris* (Yamahara *et al.*, 1989 and Fakeya *et al.*, 1976).

Essential oils are generally complex mixtures of compounds, and potential synergistic and antagonistic effects should be taken into account when evaluating the biological activities of essential oils (Brenda *et al.*, 2007). The findings showed a considerable quantitative and qualitative difference between essential oil compositions of *A. nilagirica* and *A. capillaris.* These findings showed promising and noticeable variations in the concentrations of their constituents. The constituents of these oils have been found to interfere with respiration and electron transport in a variety of bacteria. Therefore, these oils can be used for food preservation and cosmetic preparations. Since both the plants were collected from different region there must be the effect of soil texture in the concentration on the constituents of these species.

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