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Phytochemical studies on the extract and essential oils of *Artemisia dracunculus* L. (Tarragon)

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***Artemisia dracunculus* L. (Tarragon) is a species of flowering plant within the family Asteraceae, commonly used as a dietary seasoning. During the present study, the plant was collected from Indian Institute of Integrative Medicines (IIIM Srinagar). Air dried shoots (room temperature 25-35°C) were used to extract essential oil using Clevenger type apparatus for 3 h and analyzed. Thirty-four (34) compounds were identified using gas chromatography- flame ionization detector (GC-FID) and Gas chromatography-mass spectrometry (GC-MS) analysis. Major constituents of the essential oil were trans-Anethole (28.06%), Z-β-ocimene (15.79%), α- Terpenolene (10.12%), Elemecin (10.08%), 1, 8 cineole (7.71%) and α-copaene (2.78%), etc. Comparing our results with those of other *Artemisia* species already published in the literature revealed considerable qualitative and quantitative similarity of the major constituents of the essential oils. As trans-Anethole is the major constituent, this chemo type may be useful for industrial exploitation as well as chemotaxonomic characterization.**

Key words: *Artemisia dracunculus*, Terpenolene, Z-β-ocimene, trans-Anethole.

INTRODUCTION

Artemisia is a genus of small herbs or shrubs widely distributed throughout the world but found mostly in Northern temperate regions. It belongs to the important family compositae (Asteraceae), which comprises about 1000 genera and over 20,000 species. Within this family, *Artemisia* is included into the tribe Anthemideae and comprises over 500 species. The 500 species of *Artemisia* are mainly found in Asia, Europe and North America. This genus is industrially important due to its insecticidal, antifungal, antibacterial, allelopathic and other properties. The genus is useful in Ayurveda, Homeopathy, Unani, Siddha and Western medicinal system (Ved and Goraya, 2008).

Chemical composition and biological activities of *Artemisia* spp. essential oils has been reported recently (Lopes-Lutz et al., 2008). *Artemisia dracunculus* L. (commonly known as Tarragon) finds an important place in the genus *Artemisia* and remains a subject of interest due to great variability in traditional medicinal use, plant morphology, reproductive behaviour, essential oil con-tent, composition, etc. Tarragon is a perennial, erect, herb or small shrub, widely distributed in India, China, Japan, North America, European countries, etc., between altitudes of 3000-4000 msl (Hooker, 1882). The species is under cultivation for long time in France, Germany, Holland, Russia, Georgia, Hungary, California, Cuba, etc. for its aromatic value in seasoning salads, edibles, medicinal and in the preparation of Tarragon vinegar.

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Tarragon is safe to use as dietary supplements or in functional foods (Poulev et al., 2004). Biological characteristics and useful properties of tarragon are reported in a review recently (Aglarova et al., 2008). The dried aerial parts of *A. dracunculus* are used orally to treat epilepsy in Iranian traditional medicine (Khorasani, 1992).The species is also useful as sleep aid to mild sedative properties (Chevallier, 1996). It is reported that monoterpenes present in essential oil of *A. dracunculus* are responsible for anticonvulsant and sedative effect (Sayyah et al., 2004). Antidiabetic property is also supported recently by ethanolic extract (Ribnicky et al., 2004). Reports are available on chemical composition of *A. dracunculus* from different parts of the world (Pino, 1996; Irena and Krystyna, 1996; Pappas and Sturtz, 2001; Sayyah et al., 2004). The aim of the present study was to determine the chemical profile of essential oil of *A. dracunculus* L. by using different spectroscopic procedures like GC and GC-MS.

MATERIALS AND METHODS

Plant material

The Himalaya is a well known source of variety of Medicinal and aromatic plants. The plant material of *A. dracunculus* was collected from various geographical regions like Sonmarg, Gulmarg, Gurez and was then transfered to IIIM germplasm and Field station Bonera, Pulwama. The plant material was then taken from IIIM germplasm for the extraction and isolation purposes.

Extraction of essential oil

The shade dried leaves and stem of the plant were finely chopped and then subjected to hydro distillation separately in a Clevenger like apparatus at 60°C for 3 h. The oil obtained was dried over anhydrous sodium sulphate and stored at 4°C in a sealed vial until analysis.

Essential oil analysis

GC/FID was carried out on Perkin Elmer auto system XL Gas Chromatograph 8500 series equipped with flame ionization detector (FID) and head space analyzer using a fused silica capillary RTX-1 Column (30 m x 0.25 mm, film thickness 0.25 mm) coated with dimethyl polysiloxane (RT × 1). Oven temperature was programmed from 60 to 290°C with injector temperature of 230°C and detector temperature of 250°C. Injection volume was 1 µl, and nitrogen was used as a carrier gas (1.0 ml/min). GC- MS analysis was carried on a varian gas chromatograph series 3800 fitted with a VF 5 ms fused silica capillary column (30 m x 0.25 mm, film thickness 0.25 mm) coupled with a 4000 series mass detector under the following conditions: injection volume of 0.5 ml with split ratio 1:60, helium as carrier gas at 1.0 ml/min constant flow mode, injector temperature of 230°C, oven temperature of 60 to 280°C at 3°C /min. Mass spectra was electron impact (EI+) mode,70 eV and ion source temperature was 250°C. Mass spectra were recorded over 50-500 a.m.u range. Identification of the essential oil constituents was done on the basis of Retention Index [RI, determined with respect to homologous series of n-alkanes (C9-C24), Polyscience Corp., Niles IL] under the same experimental conditions), and co-injection with standards (Sigma Aldrich and standard isolates), MS Library search (NIST 98 and WILEY), by comparing with the MS literature data (Jennings and Shibamoto, 1980; Adams, 2007).

RESULTS AND DISCUSSION

The essential oil obtained using Clevenger-type apparatus of the dried aerial part was analyzed and oil percentage was found to be 0.05%. The total oil percentage present in aerial parts was found to be 88.46%. GC and GC-MS analyses of essential oil resulted in the identification of 34 components. The essential oil was found to be rich in trans-Anethole (28.06%), Z-β-ocimene (15.79%), α- Terpenolene (10.12%), Elemecin (10.08%), 1,8 cineole (7.71%) and α-copaene (2.78%) (Table 1). The essential oil was found to be dominated by Monoterpene hydrocarbons (35.22%), Sesquterpene hydrocarbons (13.01%) and Oxygenated sesquiterpenes (2.09%) (Table 2). Besides this, other components belonging to different classes were found to be 30.02%. In the present study, the concentration of trans-Anethole was highest (29%) which was found to be almost in higher concentration as in case of *A. dracunculus* from Italy (up to 53%). In Russian Tarragon, the concentration of β- ocimene (12%) was found to be almost in higher concentration (15%). The essential oils of most *Artemisia* species are characterized by high content of oxygenated monoterpenes with 1,8-cineole and camphor being the most represented. In some other species, such as *A. annua, A. vulgaris, A. diffusa, A. santonicum, A. spicigera, A. afra, A. abiatica, A. austriaca* and *A. pedemontana*, bornane derivatives (camphor, borneol and bornyl acetate) and 1,8-cineole are the major characteristic components (Perez-Alonso et al., 2003; Kordali et al., 2005). Existing literature reveals that *Artemisia absinthium* oil was characterized by high amounts of myrcene (10.8%), trans-thujone (10.1%) and trans-sabinyl acetate (26.4%).

Approximately 71.0% of *A. absinthium* oil composition was identified. The remaining unidentified components were monoterpene esters and sesquiterpenes. Phenyl propanoid compounds comprised 52.2% of *A. dracunculus* oil, with methyl chavicol and methyl eugenol being the most representative constituents. *A. biennis* yielded an oil rich in (Z)-beta-ocimene (34.7%), (E)-beta-farnesene (40.0%) and the acetylenes (11.0%) (Z)- and (E)-en-yndicycloethers. Previous research showed that bornane derivatives (camphor, borneol and bornyl acetate) and 1,8-cineole are major characteristic components of many species of *Artemisia* genus, such as: *A. Annua, A. vulgares, A. diffusa, A. santonicum, A. spicigera, A. afra, A. asiatica, A. austriaca* and *A. pedemontana* (Perez-Alonso et al., 2003; Kordali et al., 2005). In the young leaf of *Artemisia Scoparia* oil, b-myrcene (24.13%) was the major constituent monoterpene, whilst p-cymene (27.06%) was the major component in mature leaf oil. The other major

Table 1. Essential oil composition of aerial parts of *Artemisia dracunculus* L.

Compound Name	RI	Area %
α-thujene	923.7	0.0731
α-pinene	932.4	1.0572
Camphene	947	0.8372
Sabinene	970.2	0.1095
β-pinene	973.9	0.3629
Myrecene	984.8	1.9397
Hexanoic acid	994.2	0.1323
α-phellendrene	999.4	0.5691
Delta-3 carene	1007.7	0.1359
P-cymene	1015.7	0.1198
1,8-cineole	1022.8	7.7162
(Z)-β-ocimene	1030.5	15.7927
(E)-β-ocimene	1041.1	3.7592
Gama terpene	1050.7	0.3335
α- Terpenolene	1080.6	10.123
Linalool	1088.2	0.0741
α-thujone	1092.2	0.033
Hexyl isobutanoate	1132.4	0.726
P-cymene-8-ol	1168.7	0.984
α-terpeneol	1187.2	0.829
Cis-piperitol	1184.8	0.1162
Nerol	1217.5	0.0111
Carrone	1221.1	0.0307
trans-Anethole	1258	28.064
Bornyl acetate	1271.9	0.7026
α-terpinylacetate	1331.7	0.0236
Noryl acetate	1340.9	0.236
Gernyl acetate	1361.9	0.1626
Hoxyl hexonate	1365.4	0.0475
α-copaene	1377.1	2.7876
β-caryophyllene	1419.7	0.747
Alpha humiene	1452.5	0.0204
Elemicin	1473.8	10.0837
Carophyllene oxide	1569.6	0.4038
Total	88.46%	

Table 2. Composition of the essential oil of *A. dracunculus* L residues by class.

Chemical class	% in essential oil
Monoterpene hydrocarbons	35.22
Oxygenated sesquiterpenes	2.09
Sesquterpene hydrocarbons	13.01
Other Constituents	30.02
Total	80.34

monoterpene constituents in young leaf oil included caryophyllene oxide (a sesquiterpene; 7.86%) and monoterpenes such as p-cymene (16.47%), (+)-limonene (8.03%) and oxygenated compounds such as capillin (a polyacetylene ketone; 7.13%) (Singh et al., 2010). Lutz et al. (2008) and Chauhan et al. (2010) also studied 24 compounds using GC-FID and GC-MS analysis. Major constituent of the essential oil was capillene (58.38%), whereas other constituents were Z-β- ocimene (8.63%), β-phellandrene (7.03%), terpenolene (5.87%), camphene (4.16%), spathulenol (2.02%), β-pinene (1.02%), etc. Chemical composition of essential oil was described and compared with earlier studies. The population was categorized as chemotype of *A. dracunculus*. As capillene is the major constituents, this chemotype may be useful for industrial exploitation as well as chemotaxonomic characterization. The composition of the volatile oils obtained from the aerial parts of *Artemisia deserti* and *Artemisia oliveriana* was analyzed by GC and GC/MS. While the oil of *A. deserti* contained camphor (45.5%), 1,8-cineole (16.7%), piperitone (8.6%), b-pinene (5.7%) and isoborneole (3.2%), the oil of *A. oliveriana* contained a-thujone (65.4%), camphor (11.5%), 1,8-cineole (9.2%) and pinocarvone (8.8%) (Rustaiyan et al., 2000). Comparing our results with those of other *Artemisia* species already published in the literature revealed considerable qualitative and quantitative similarity of the major constituents of the essential oils.

Conclusion

The essential oil found to be rich in trans-Anethole (28.06%), Z-β-ocemene (15.79%), α- Terpenolene (10.12%), Elemecin (10.08%), 1,8 cineole (7.71%) and α-copaene (2.78%) is due to its chemotypic variability which makes it an alternate source of industrial exploitation as well as chemotaxonomic characterization.

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