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

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**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.
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 transferred 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 x 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 μm) 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%), Sesquiterpene 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. abietica, 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 monoterpenic 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-ynidicycloethers. 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 monoterpane, whilst p-cymene (27.06%) was the major component in mature leaf oil. The other major
monoterpene constituents in young leaf oil included caryophyllene oxide (a sesquiterpene; 7.66%) and monoterpene such as p-cymene (16.47%), (+)-limonene (8.03%) and oxygenated compounds such as capilline (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%), 4,7-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 isoborneol (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%), Elemaecin (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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### REFERENCES

Adams RP (2007). Identification of essential oil components by Gas Chromatography/Mass Spectrometry. Allured Publishing Corp., Carol Stream, Illinois, USA.

Aglarova AM, Zilfikarov IN, Severtseva OV (2008). Biological characteristics and useful properties of tarragon (*Artemisia dracunculus* L.). Pharm. Chem. J. 42(2):81-86.

Chauhan RS, Kitchlu S, Ram G, Kaul MK, Tava A (2010). Chemical composition of capillene chemotype of *Artemisia dracunculus* L. from North-West Himalaya. J. India Industrial Crops Prod. 31:546-549.

Chevallier A (1996). The Encyclopedia of Medicinal Plants. Dorling Kindersely Ltd., London, p. 336.

Hooker JD (1882). The Flora of British India, vol. III, pp. 321-330.

Irena O, Krystyna S (1996). Evaluation of three cultivated forms of

### 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-phellandrene    | 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-terpenol        | 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-terpinylacecte | 1331.7 | 0.0236 |
| Noryl acetate     | 1340.9 | 0.236 |
| Germyl 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 | 10.837 |
| 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 |
|--------------------|--------------------|
| Monoterpe hydrocarbons | 35.22 |
| Oxygenated sesquiterpenes | 2.09 |
| Sesquiterpe hydrocarbons | 13.01 |
| Other Constituents     | 30.02 |
| Total                | 80.34 |
tarragon (*Artemisia dracunculus* L.). Folia Hortic. 8:29-37.

Jennings W, Shibamoto T (1980). Qualitative analysis of flavor and fragrance volatile by glass capillary gas chromatography, Academic press, Inc., New York.

Khorasani MH (1982). Makhzan al adviah. Safa Publication, Tehran, pp. 583-584.

Kordali S, Cakir A, Mavi A, Klic M, Yildrin A (2005). Screening of chemical composition and antifungal and antioxidant activities of the essential oils from three Turkish Artemesia species. J. Agric Food Chem. 53(5):1408-1416.

Lopes-Lutz D, Alviano DS, Alviano CS, Kolodziejeczyk PP (2008). Screening of chemical composition, antimicrobial and antioxidant activities of *Artemisia* essential oils. Phytochem.69(8):1732-1738.

Lutz D, Alviano SD, Alviano SC, Kolodziejeczyk DD (2008). Screening of chemical composition, antimicrobial and antioxidant activities of *Artemisia* essential oils. J. Phytochem. 69(8):1732-1738.

Pappas RS, Sturtz G (2001). Unusual alkynes found in the essential oil of *Artemisia dracunculus* L. var. *dracunculus* from the pacific Northwest. J. Essent. Oil Res. 13:187-188.

Perez-Alonso MJ, Velasco-Negueruela A, Paula-paul J, Sanz J (2003). Variations in the essential oil composition of *Artemisia pedemontana* gathered in Spain: Chemotype camphor 1,8-cineole and Chemotype davanone. Biochem. Syst. Ecol. 31:77-84.

Pino JA (1996). Chemical composition of the essential oils of *Artemisia dracunculus* L. from Cuba. J. Essent. Oil Res. 8:563-564.

Poulev A, Joseph O, Gary W, Malek D, Jager R, Ilya R (2004). Toxicological evaluation of the ethanolic extract of *Artemisia dracunculus* L. for use as a dietary supplement and in functional foods. J. Food Chem. Toxicol. 42:585-598.