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Research Article

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Chemical Constituents of Essential Oil from *Anethum Sowa* Kurz. Seed

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ABSTRACT

The oil obtained by the hydro-distillation method from the fresh leaves and stems of Anethum sowa L. (Dill) herb was analyzed by GC-MS. Nine compounds were isolated and identified. The major constituents were limonene (83 %), grandisol (7.4 %), bis-1,2-benzenedicarboxylic acid (5.7 %), carvone (1.5 %), thujyl alcohol (0.7 %), β-phellandrene (0.6 %), cyclohexane (0.5 %), β-myrcene (0.3 %) and α-thujene (0.1%).

Keywords: *Anethum sowa* L., Essential oil, GC-MS, Limonene.

INTRODUCTION

Anethum belongs to family Apiaceae/Umbelliferae. It is a genus of annual or biennial herbs comprising of four species. Two species of the genus *Anethum* yield dill oil, which is presently under use in various pharmaceutical preparations. *Anethum sowa*, the Indian species is sometimes regarded as a variety of *Anethum graveolens. Anethum graveolens* Linn. (Syn. *Peucedanum graveolens* Linn.) which is indigenous to South Europe and is cultivated in England, Germany, Rumania and the Mediterranean region[1-3]. *Anethum sowa* L. (Internationally Dill,Hindi Sowa) has a verylong history of herbal use.Ebbers papyrus (C. 1500 BC) reports that ancient Egyptians used dill for its soothing properties and as an ingredients in a pain-killing mixture. The Romans knew dill as *Anethum*, which later became ‘anise’. Dill was used as a remedy by the ancient Greeks to encourage good night’s sleep. The dill seed was much esteemed by Indians, who used it as a condiment and medicine. The earliest reference to use of dill seed in medicine goes back to ‘Charak Samhita’ (700 BC) an infusion of it was given as a cordial drink to women after confinement, the leaves moistened with oil were used as a poultice for suppurative skin conditions4.It grows in the tropical and sub-tropical parts of India and tropical Asia [1,5]. It is cultivated throughout India chiefly in Punjab, Uttar-Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Assam and West Bengal [4,6.] It is sometimes found growing as a weed of fruits cultivation and even as an escape in irrigated fields.Three distinct varieties of India dill fruits, ‘Ghoda’ (mericarp), ‘Vizag’ (Cremocarp and mericarp) and Variyali sowa (Cremocarp) are reported [7]. Dill is an important herb of everyday use. The fruits are well known for their medicinal properties, due to the essential oil present in them. The oil of dill fruits and its emulsion in water (dill water) are considered to be an aromatic, carminative (useful in flatulence, especially for infants), colic pains, vomiting and hiccups. Its young leafy shoots bearing pleasant smell are used to flavour bread, potatoes, rice and vegetables. The seeds are often added to pastries and sauces. Dill oil is used as a soap perfume and in food industry for flavouring and seasoning. The chief constituents of dill oil is carvone, a cyclic terpene ketone which is pharmaceutically very important [4,8-13].

In the food industry, the herb and seed have been largely replaced by dill oil obtained by steam distillation from freshly cut, entire herbs including stalks, leaves and fruits or from separated nature seeds14. The two oils differ in

composition: seed oil is characterized by a high content of carvone and limonene [15,16], while the herb oil contains, in addition, significant amounts of β-phellandrene and 3,9-epoxy-1-*p*-methene17, both considered among the most important odorants of dill herb[14,18]. The content of these main components have been found to vary according to geographical origin, harvesting time, growth conditions, and isolation procedure[16,19].The yield of essential oil from Indian dill seeds varies from 1.5 to 4.5 per cent [20,21] while herb yield is 0.06 per cent oil [22]. The essential oils of dill seeds and dill weed have been subjected to numerous chemical investigations during the last five decades [19].

Essential oils of Dill herb and seed have been reported by many researchers [21,23-25]. The purpose of this study was to determine the chemical constituents of *Anethum Sowa* seeds essential oil. The literature search shows that, there is no previous report on the chemical composition of the essential oil of Dill seeds grown in Haryana.

EXPERIMENTAL SECTION

The dried seeds of *Anethum sowa* Kurz. were purchased from the local market of Hisar in the month of May 2003 and identified by Dr. M. P. Sharma, Taxonomist, Department of Botany, Faculty of Science, Jamia Hamdard, New Delhi. A voucher specimen (SAs/1) of the sample has been retained in the Pharmacognosy laboratory for future reference.

Extraction and Isolation of Volatile Oils

Hydrodistillation of the samples was carried out using all glass apparatus (Clevenger apparatus) [26]. The distillation was continued for two hours to yield 3.2% oil, based on dried weight of sample. Heavier fractions collected in the final stages were kept separately and it is reported to contain dillapiole only [27]. The first fraction of the distillate (devoid of dillapiole) was analysed by GC and GC-MS spectroscopy. The oil was dried over anhydrous sodium sulphate and stored at 4°C in the dark.

Physical Characteristics

Colour: Pale yellow; Odour: Pleasantly aromatic; Weight per millitre at 25°C: 09082 gm/ml; Optical rotation at 25°C: + 40°; Specific gravity at 25°C: 0.9701; Solubility: Soluble in 0.5 volume of 70% ethanol [28].

GC Analysis

The GC analysis of the oil was performed on a Varian 3300 gas chromatogram, using a fused capillary column (30 m × 0.25 mm i.d., film thickness 0.25 µm), coated with dimethylsiloxane (BP-1). The oven temperature was programmed at 80-225°C at 4°C/min, and then held isothermal at 250°C, detector used FID, detector temperature 300°C, injection volume 0.1 µl and carrier gas nitrogen was used.

GC-MS Analysis

The GC-MS data were obtained on a Shimadzu QP 2000 instrument at 70 eV and 250°C. GC column: Ulbon HR-1, fused silica capillary column 0.25 mm × 50 m i.d., film thickness 0.25 µm. The initial temperature 100ºC for 6 minutes and then heated at 10°C/min to 250°C. Carrier gas helium at a flow rate of 2 ml/min was used.

Identification of Compounds

The compounds were identified by comparing the retention indices (RI) of the peaks on Pearson Ulbon HR-1, fused silica capillary column with literature values, matching against the standard library spectra, built up using pure substances and components of known essential oils and finally confirmed and comparison of mass spectral fragmentation patterns with published data. Relative amounts of identical components are based on peak areas obtained without FID responses factor correction [22,29-32].

RESULTS AND DISCUSSION

The composition of the oil, their retention indices and percentage are summarized in Table 1. The components are arranged in order of GC elution on Ulbon HR-1 column. Eight peak indexes of volatile constituents along with their structures are given in Table 2. The oil on appropriate dilution possessed strong characteristic odour of lemon, orange and dill. Analysis of the oil resulted in the identification of nine components comprising 99.8% of the total volatiles. The oil was characterized by large amount of monoterpenes (93.6%). The predominant monoterpene was

limonene (83%) followed by grandisol (7.4%) and carvone (1.5%) of the nine monoterpenes four of them hydrocarbon (84%), two alcohols (8.1%) and one ketone (1.5%) only one aliphatic constituent, cyclohexane was detected in the volatile oil. *bis*-1,2-benzenedicarboxylic acid (5.7%). The only aromatic constituent characterized in the volatile oil. It may a rich source for isolation of limonene.

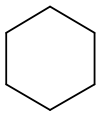
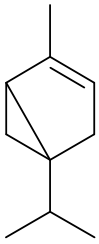
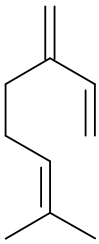
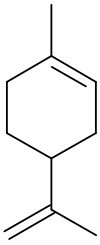
Table 1: Chemical composition of volatile oil of *Anethum sowa*

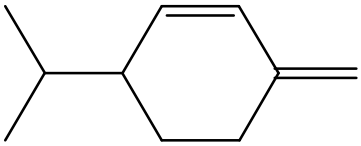
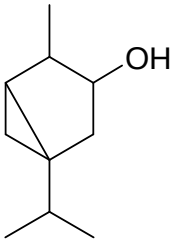
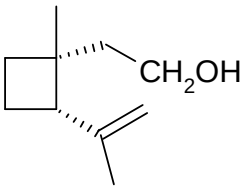
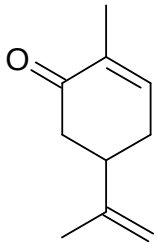
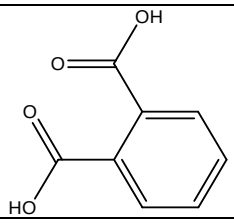
Sr. No.	Components	R.I.	%
1	Cyclohexane	-	0.5
2	α-Thujene	923	0.1
3	β-Myrcene	971	0.3
4	Limonene	1011	83.0
5	β-Phellandrene	1028	0.6
6	Thujyl alcohol	1100	0.7
7	Grandisol	1200	7.4
8	Carvone	1206	1.5
9	*bis*-1,2-Benzenedicarboxylic acid	-	5.7
	Total 9		**99.8**

R.I. *= Retention indices*

Total monoterpenes (7) = 93.6%; Monoterpene hydrocarbon (4) = 84.1%; Monoterpene alcohol (2)= 8.1%; Monoterpene ketone (1) = 1.5%; Aliphatic constituents (1) = 0.5%; Other constituents (1) = 5.7%.

Table 2: Eight mass peak index of volatile oil components of *Anthum sowa*

S.No.	Component	Structural formula	Mass fragmentation
1	Cyclohexane C6H12 84		83, 85 (64.1), 47 (47.8), 48 (19.5), 49 (16.3), 87 (10.8), 86 (7.6), 50 (7.6)
2	Thujene C10H16 136		93, 40 (60.8), 77 (47.8), 91 (44.5), 92 (39.1), 79 (36.9), 41 (33.6), 43 (21.7)
3	β-Myrcene C10H16 136		41, 93 (42.3), 69 (40.2), 40 (22.8), 91 (11.9), 53 (10.8), 77 (9.7), 79 (9.7)
4	Limonene C10H16 136		68, 67 (86.9), 93 (53.2), 41 (46.7), 53 (36.9), 79 (33.6), 77 (20.6), 94 (20.6)

5	β-Phellandrene C10H16 136		40, 93 (78.2), 91 (51), 41 (50), 43 (46.7), 79 (44.5), 127 (45.6), 77 (43.4), 136 (42.3)
6	Thujyl alcohol C10H18O 154		43, 41 (45.6), 40 (43.4), 67 (39.1), 55 (20.6), 79 (18.4), 44 (17.3), 81 (16.3)
7	Grandisol C10H18O 154		67, 41 (89.1), 95 (65.2), 68 (51), 55 (42.3), 69 (36.9), 81 (31.5), 53 (26)
8	Carvone C10H14O 150		82, 54 (70.6), 41 (46.7), 53 (28.2), 93 (28.2), 108 (26), 40 (19.5), 79 (17.3)
9	*bis*-1, 2- Benzenedicarboxylic acid C8H6O4 166		149, 57 (45.6), 43 (35.8), 167 (31.5), 41 (29.3), 71 (26), 70 (21.7), 55 (16.3)

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