VOLATILE CONSTITUENTS AND ANTIMICROBIAL ACTIVITY OF IMMATURE GREEN SEEDS OF *CORIANDRUM SATIVUM* LINN.

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Summary

A steam distilled volatile oil obtained from the green seed of Coriander (in Hindi commonly known as Dhania), *Coriandrum sativum* Linn. (Family-Umbelliferae) was analysed by capillary GC and GC-MS. The volatile oil mainly comprises of twenty (20) components out of which seventeen (17) constituents comprising 98.7% of the oil were identified. The volatile oil mainly contains monoterpenes (71.7%) and (+) linalool (29.5%) was found to be predominant constituents followed by neral (17.2%), linalool-1,2-epoxide (7.5%), nerolic acid (7.2%), α-terpenyl acetate (3.9%), α-pinene (3.3%), isopulegol (2.9%) and camphene (0.2%). Nine (9) nonterpenic constituents (27%) and 2-methyl-3-(1'-methyl) cyclohexanol (10.2%) and linoleic acid (9.1%), dimethyl

cyclohexane (3.2%), non-3-ene (1.9%), caproic acid (0.9%), hexamide (0.7%), n-nonane (0.5%), cyclohexane (0.3%) and dec-4,6-diene-1-oic acid (0.2%). One component (0.9%) was partially identified. Two components (0.4%) were remaining unidentified. The maximum antibacterial activity was shown with 1% v/v of volatile oil on *Staphylococcus aureus* (10.6 mm) followed by *Escherichia coli* (10.2 mm), where as maximum antifungal activity was shown by 1% v/v of volatile oil on *Candida albicans* (11.1 mm) followed by *Aspergillus niger* (10.7%).

Keywords: *Coriandrum sativum* Linn., Umbelliferae, essential oil, antimicrobial activity.

Introduction

Coriandrum sativum Linn. (Umbelliferae) commonly known as Dhania, is an annual herb, widely grown in the Netherland, Central and Eastern Europe, China and India. Coriander is indigenous to Italy [1, 2]. The green seeds possess stimulant, antipyretic, anthelmintic and antimicrobial properties. It is used in chronic ulcer and also helps to prevent gripping. Chemical composition of volatile oil of seeds of Indian species has been reported as follows β-Sitosterol, D-mannitol, flavonoid glycoside, coriandirinonediol, kaempferol-3-glucoside, Δ-octadecinoic acid (seed); α-pinene, limonene, β- caryophyllene, citronellol, geraniol, thymol, linalyl acetate, geranyl acetate, caryophellene oxide, elemol methylheptenone (seed oil); umbelliferone, scopoletin (Fruit); volatile flavor compounds, oxalic acid, vitamin C, carotene, and calcium (leaves); chlorogenic and caffeic acids, rutin, triacontane, triacontanol, triacosanol, psoralen, angelicin, coriandrinol (β-sitosterol glucoside),coriandrones C to E (Isocoumarins), quercetin, aflatoxins B_1 and B_2 (Whole plant); butylphthalides- neoenidilides and Z-ligustilide (Netherlands plant) [3, 4, 5, 6, 7].

As a part of our investigation on aromatic and medicinal plant of India, we describe in this communication, the chemical composition of the oil isolated from immature seed by modern sophisticated technique.

Material and Methods

Plant Material: Fresh immature green seeds of *Coriandrum sativum* Linn. were obtained from the herbal garden, Teerthanker Mahaveer College of Pharmacy, TMU, Moradabad, UP, India. The plant material was identified by Dr. Anjula Pandey, taxonomist, NBPGR, PUSA Campus, New Delhi. A voucher specimen is preserved in the herbarium of T. M. College of Pharmacy, TMU, Moradabad, UP, India.

Isolation: The fresh immature green seeds (1.0 Kg) were hydrodistilled according to the method recommended in British Pharmacopoeia, 1993 [8]. The light pale yellow oil so obtained was dried over anhydrous sodium sulphate and stored at 4°C in the dark. The yield was 2% based on fresh weight of sample.

GC Analysis: Analytical GC was carried out on a Varian 3300 gas chromatograph fitted with a silicone DB-1 capillary column (30m x 0.25m), film thickness 0.25 μm, carrier gas nitrogen, flow rate 1.5 ml/min., split mode, temperature programmed 80-250°C at 4°C/min. Injector temperature and detector temperature were 250°C and 300°C respectively. Detector used was FID. Injection volume for all samples was 0.1 μl.

GC-MS Analysis: Analytical GC-MS was carried out on a QP 2000 instrument at 70 eV and 250°C GC column Ulbon HR-1 equivalent to OV-1 fused silica capillary 0.25 mm x 50 m with film thickness 0.25 μm. The initial temperature was 100°C for 6 min. and then

heated at the of 10°C per minute to 250°C. Carrier gas He, flow rate 2.0 ml/min. Detector used was FID.

Identification: The volatile components were identified by comparing their retention time of GC chromatograph with those of literature. Further identification was done by GC-MS. The fragmentation patterns of mass spectra were compared with those of spectrometer data base using the NBS 54 AL and Wiley L- built libraries and also with those reported in the literature [9, 10, 11, 12]. Many constituents were identified by comparing their retention indices with those of authentic standards available in author's laboratory.

Screening of Antimicrobial Activity

Preparation of Sample: The volatile oil (0.1 v/v %, 0.5 v/v %, 1 v/v %) and dried alcoholic extract (5.0 % w/w) were dissolved in dimethyl sulphoxide (DMSO) for antimicrobial activity.

Preparation of Standard Drugs Solution: Chloramphenicol and ketoconazole were used as standard solutions for comparison of antibacterial and antifungal studies. Both the standard drugs were taken in DMSO. The concentration of both standard drug solutions was 0.1 mg/ml.

Antimicrobial Activity: The antibacterial and antifungal activities of volatile oil and alcoholic extract of immature green seed were performed by the department of Microbiology, TMU, Moradabad. The identification of microbial strains was based on morphological, cultural and biochemical tests. The invitro antimicrobial activity of volatile oil and alcoholic extract of immature green seeds of *Coriandrum sativum* was studied by cup plate method [13, 14, 15, 16] against various microorganisms mentioned in the **Table 2.**

Chloramphenicol and Ketaconazole were used as standard and the activity of volatile oil was compared with corresponding concentration of standard drugs. The plates were incubated at 37+2°C, after 48 hrs of incubation. The petri dishes were taken out from the incubator and the antimicrobial activity was compared by measuring the diameter of zone of inhibition (Table **2**).

Results and Discussion

The volatile components of immature green seeds of *Coriandrum sativum* are listed in **Table 1.** Components are arranged in order to GC elution on QP 2000 column. Twenty (20) components detected in the oil. Seventeen (17) of them comprising (98.7%) of sample were positively identified. The oil was characterized by large amount of (8) monoterpenic constituents (71.7%) with (+) linalool (29.5%) was found to be predominant constituent followed by neral (17.2%), linalool-1,2-epoxide (7.5%), nerolic acid (7.2%), α-terpenyl acetate (3.9%), α-pinene (3.3%), isopulegol (2.9%) and camphene (0.2%). There were nine (9) monoterpenes including two hydrocarbons (3.5%), one epoxide (7.5%), one acetate (3.9%), two alcohols (32.4%), one acid (7.2%) and one aldehyde (17.2%). Eight (8) non terpenic constituents comprising (17.9%) of the sample were detected. The major aliphatic constituents being linoleic acid, non-3-ene hexamide, cyclohexane, 2-methyl-3-(1-methyl) cyclohexanol, dimethyl cyclohexane and dec-4, 6-diene-1-oic acid. One component (0.9%) was partially identified. Two components present in 0.4% remaining unidentified.

Antimicrobial activities of dried alcoholic extract and different concentrations of volatile oil of immature green seeds of *Coriandrum sativum* Linn. is summarized in **Table 2**. The maximum antibacterial activity was shown with 1 % v/v of volatile oil on *Staphylococcus aureus* (10.6 mm) followed by *Escherichia coli* (10.2 mm), where as maximum antifungal activity was shown by 1 % v/v of volatile oil on *Candida albicans* (11.1 mm) followed by *Aspergillus niger* (10.7 mm).

Table-1: Chemical Composition of Volatile Oil Obtained from Green Immature Seeds of *Coriandrum sativum* Linn.

S. No.	Components	Percentage (%)
1.	2-methyl-3(1'-methyl) cyclohexanol	10.2
2.	$C_{10}H_{16}O$	0.9
3.	Camphene	0.2
4.	Caproic acid	0.9
5.	Cyclohexane	0.3
6.	Dec-4,6-diene-1-oic acid	0.2
7.	Dimethyl cyclohexane	3.2
8.	Hexamide	0.7
9.	Isopulegol	2.9
10.	Linalool	29.5
11.	Linalool-1,2-epoxide	7.5
12.	Linoleic acid	9.1
13.	Neral	17.2
14.	Nerolic acid	7.2
15.	n-nonane	0.5
16.	Non-3-ene	1.9
17.	Unknown	0.1
18.	Unknown	0.3
19.	α-pinene	3.3
20.	α-terpenyl acetate	3.9

Total Monoterpenes	=	71.7 %
Total Other Components	=	27.0%
Total Partially Identified	=	0.9%
Total Unknown	=	0.4%

Table-2: Antimicrobial Activity of Immature Green Seeds of *Coriandrum sativum* Linn.

S. No.	Test Organism	Zone of Inhibition in mm[a]			Dried alcoholic extract 5.0 % w/v	Standard chloramphenicol (0.1 mg/ml)	Standard ketoconazole (0.1 mg/ml)
		Conc. of volatile oil					
		0.1 % v/v	0.5 % v/v	1.0 % v/v			
1.	*Staphylococcus aureus*	6.2	9.1	10.6	8.2	17.2	-
2.	*Escherichia coli*	5.5	8.2	10.2	7.9	16.1	-
3.	*Candida albicans*	6.3	9.7	11.1	8.6	16.0	17.2
4.	*Aspergillus niger*	6.0	9.2	10.7	8.2	15.8	16.7

[a]an Average of Triplicate

Chloramphenicol- Against all micro-organism [gram+ve, Gram-ve bacteria and fungal strains]

Ketoconazole- against fungal strains only

Conclusion

From the above result, it can be deduced that the volatile oil comprises of twenty components out of which seventeen constituents comprising 98.7 % were positively identified and linalool (29.5 %) was found to be predominant constituent. The maximum antibacterial activity was shown against *Staphylococcus aureus* (10.6 mm) at 1 % v/v concentration of volatile oil, whereas maximum antifungal activity was shown against *Candida albicans* (11.1 mm) at the same concentration.

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