BJP

Bangladesh Journal of Pharmacology

Research Article

Chemical composition of leaf and seed essential oil of *Coriandrum sativum* L. from Bangladesh

A Journal of the Bangladesh Pharmacological Society (BDPS)
Journal homepage: www.banglajol.info
Abstracted/indexed in Academic Search Complete, Agroforestry Abstracts, Asia Journals Online, Bangladesh Journals Online, Biological Abstracts, BIOSIS Previews, CAB Abstracts, Current Abstracts, Directory of Open Access Journals, EMBASE/Excerpta Medica, Google Scholar, HINARI (WHO), International Pharmaceutical Abstracts, Open J-gate, Science Citation Index Expanded and Social Sciences Citation Index

Bangladesh J Pharmacol 2009; 4: 150-153

ISSN: 1991-0088

Chemical composition of leaf and seed essential oil of *Coriandrum sativum* L. from Bangladesh

Md. Nazrul Islam Bhuiyan[1], Jaripa Begum[1] and Mahbuba Sultana[2]

[1]BCSIR Laboratories, Chittagong 4220, Chittagong, Bangladesh; [2]Department of Botany, Jagannath University, Dhaka, Bangladesh.

Article Info

Received: 13 October 2009
Accepted: 10 December 2009
Available Online: 17 December 2009

DOI: 10.3329/bjp.v4i2.2800

Cite this article:
Bhuiyan MNI, Begum J, Sultana M. Chemical composition of leaf and seed essential oil of *Coriandrum sativum* L. from Bangladesh. Bangladesh J Pharmacol. 2009; 4: 150-53.

Abstract

The essential oils from leaves and fruits of *Coriandrum sativum* L. were analyzed by gas chromatography mass spectroscopy (GC-MS). The leaf oil contained 44 compounds mostly of aromatic acids containing 2-decenoic acid (30.8%), E-11-tetradecenoic acid (13.4%), capric acid (12.7%), undecyl alcohol (6.4%), tridecanoic acid (5.5%) and undecanoic acid (7.1%) as major constituents. The seed oil contains 53 compounds where the major compounds are linalool (37.7%), geranyl acetate (17.6%) and γ-terpinene (14.4%). The compositions of both oils varied qualitatively and quantitatively.

Introduction

Coriander (*Coriandrum sativum* L.), an annual herb of the parsley family (Apiaceae), is native to the Mediterranean region and is extensively grown in Bangladesh, India, Russia, central Europe and Morocco and has been cultivated since human antiquity (Small, 1997). The plant is grown widely all over the world for seed, as a spice, or for essential oil production. At one time, coriander was among the worlds leading essential oil plants (Lawrence, 1993). The green leaves of coriander are known as "asotu" in the Eastern Anatolian region or "cilantro" in the United States, and are consumed as fresh herb. The odor and flavor of mature seed and fresh herbage are completely different.

While aliphatic aldehydes (mainly C_{10}-C_{16} aldehydes) with fetid-like aroma are predominant in the fresh herb oil (Potter, 1996), major components in the oil isolated from coriander fruit include linalool and some other oxygenated monoterpenes and monoterpene hydrocarbons (Bandoni et al., 1998; Anitescu et al., 1997). The entire plant when young is used in preparing chutneys, sauces, in flavoring curries and soups. Coriander fruits are extensively used as condiments, in the preparation of curry powder, pickling spices, sausages and seasonings. They are used for flavoring pastry, cookies, buns and cakes. It is widely used as folk medicine as carminative, spasmolytic, digestive and galactagogue; seed extract antimicrobial; used in lotions and shampoos; with castor oil useful in rheumatism (Anonymous, 1950; Asolkar et al., 1992; Chopra et al., 1956; Ghani, 2003; Yusuf et al., 1994). The composition of the essential oil of coriander fruits in some of the world has been studied and found differ from each other. They reported linalool as major constituents (Coleman and Lawrence, 1992; Leung and Foster, 1996; Tashinen and Nykanen, 1975; Pino et al., 1996). It is reported that coriander seed oil contains linalool (60-70%) and 20% hydrocarbons and the composition of the herb oil completely differs from the seed oil (Guenther, 1950). Rastogi and Mehrotra reported (1993) detection of α-pinene, limonene, β-phellandrene, eucalyptol, linalool, borneol, β-caryophyllene, citronellol, geraniol, thymol, linalyl acetate, geranyl acetate, caryophyllene oxide, elemol and methyl heptenol in seed oil by TLC.

Telci et al. reported (2006) that in the ripe fruits, the content of essential oil is comparably low (typically, less than 1%); the oil consists mainly of linalool (50 to 60%)

and about 20% terpenes (pinenes, γ-terpinene, myrcene, camphene, phellandrenes, α-terpinene, limonene, cymene). Asolkar et al. (1992) reported a type from Mysore contained high geranyl acetate. Oil of coriander is a valuable ingredient in perfumes. Its soft, pleasant, slightly spicy note blends into scents of oriental character. Ghani reported (2003), the presence of linalool, pinene, cymene, phellandrene, geraniol and borneol.

There are no previous references in literature about these Bangladeshi oils. In this work we have determined the chemical composition of leaf and seed oils of *C. sativum*. These features allow it to be identified for medicinal use and classified among the other oils available in the international market.

Materials and Methods

Plant materials

The plant materials of *C. sativum* were collected from the plants grown in the campus of BCSIR Laboratory, Chittagong during October, 2008. The specimen was identified by Dr. Mohammad Yusuf, Ex-Director-in-charge, BCSIR Labs. Ctittagong. One-voucher specimen (Y-635) was deposited in the herbarium of BCSIR Laboratory, Chittagong.

Extraction of essential oil

Samples of leaf was harvested from healthy, well-grown, two-year-old plants. Freshly harvested leaves (400 g) and seeds (300 g) were grounded in a blender separately. The grounded leaves and seeds were subjected to hydrodistillation using a modified Clevenger-type glass apparatus for 4 hours for isolation of oils separately. The oil samples were stored at 0°C in air-tight containers after drying them over anhydrous sodium sulfate and filtered before going to GC-MS analyses.

GC-MS analysis

The essential oils from leaves and fruits of *C. sativum* were analyzed by GC-MS electron impact ionization method on GC-17A gas chromatograph (shimadzu) coupled to a GC-MS QP 5050A mass spectrometer (shimadzu); fused silica capillary column (30 m x 0.25 mm; 0.25 mm film thickness), coated with DB-5 (J & W); column temperature 100°C (2 min) to 250°C at the rate of 3°C/min; carrier gas, helium at constant pressure of 90 Kpa. Acquisition parameters full scan; scan range 40 -350 amu.

Identification of the compounds

Compound identification was done by comparing the NIST library data of the peaks with those reported in literature, mass spectra of the peaks with literature data. Percentage composition was computed from GC-MS peak areas on DB-5 column without applying correction factors.

Results and Discussions

The essential oils from leaves and seeds of *C. sativum* were studied for physicochemical properties and component studies analyzed by GC-MS (Table I). The leaf oil contains 44 compounds mostly of aromatic acids of which the major are 2-decenoic acid (30.8%), E-11-tetradecenoic acid (13.4%), capric acid (12.7%), undecyl alcohol (6.4%) and tridecanoic acid (5.5%; Table II). Other major constituents in the leaf oil are undecanoic acid (2.1%), 2-dodecanal (1.3%), 2-undecenal (3.9%), cyclododecane (2.5%), decamethylene glycol (1.2%), decanal (1.4%) and dodecanoic acid (2.6%). The seed oil contains 53 compounds (Table III) of which the major compounds are linalool (37.7%), geranyl acetate (17.6%) and γ-terpinene (14.4%). Other major compounds in the fruit oil are β-pinene (1.8%), m-cymene (1.3%), citronellal (2.0%), citronellol (1.3%), citral (1.4%), geraniol (1.9%), citronellyl acetate (1.4%), α-cedrene (3.9%), and α-farnesene (1.2%) and β-sesquiphellandrene (1.6%). The present study revealed that the oil isolated from Bangladeshi seeds are similar to the others in respect of the presence of linalool and geranyl acetate (Coleman and Lawrence, 1992; Leung and Foster, 1996; Tashinen and Nykanen, 1975; Pino et al., 1996; Rastogi and Mehrotra, 1993; Telci et al., 2006). In addition it contains γ-terpinene as one of the major compounds. This confirms that the variations in the cultivar reported is not due to geographic divergence and ecological conditions but that is due to different chemotype than ours. On the basis of above fact it may be concluded that *C. sativum*, growing widely in Bangladesh, may be utilized as a source for the isolation of natural linalool and 2-decenoic acid respectively. As a result of this study, the essential oil of *C. sativum* has been extracted and its components identified. The high concentration of linalool and 2-decenoic acid in leaf and seed oil make it respectively potentially useful in the medicines and perfumery purposes. In addition to its use as a scent in domestic products such as soap, detergent, shampoo, and lotion, linalool is also used as a chemical intermediate. One common downstream product of linalool is vitamin E. Linalool is also used by pest professionals as a flea, and cockroach insecticide (Lewinshon et al., 2001).

Table I

Physicochemical properties of leaf and seed essential oil of *C. sativum*

Parameters	Leaf oil	Seeds oil
Essential oil % (FWB)	0.1	0.4
Specific gravity	0.8	0.9
Optical rotation at 32°C	-5°	+9°
Refractive index at 32°C	1.4	1.5

Table II

Chemical composition of leaf essential oil of *C. sativum*

SN.	Name of chemical compounds	Percentage
1	g-Thionodecalactone	0.2
2	1,2-Decanediol	0.5
3	*n*-Cetyl alcohol	0.4
4	2.4-Dimethylheptane	0.2
5	2-Decenoic acid	30.8
6	2-Dodecanal	1.3
7	2-Tridecenal, (E)	1.0
8	2-Undecenal	3.9
9	4-Allylphenyl acetate	0.2
10	5-Nonanol ,5-methyl	0.3
11	Anisle, P-allyl.	0.3
12	Benzene	0.1
13	β-Cinene	0.1
14	Z-Nonene	0.1
15	Cyclododecane	2.5
16	Cyclooctanol	0.6
17	Decahydroazulene	0.4
18	Decamethylene glycol	1.2
19	Decanal	1.4
20	d-Limonene	0.2
21	Dodecanal	1.3
22	Dodecanoic acid	2.6
23	E-11-tetradecenoic acid	13.4
24	Ethylidenecyclooctane	0.3
25	Eucalyptol	0.3
26	1-Pentadecene	0.1
27	α-Caryophyllene	0.3
28	α-Pinene	0.5
29	m-Mminoaniline	0.3
30	Capric acid	12.7
31	Nonanoic acid.	1.2
32	Nonanol	0.4
33	Octanoic acid	0.6
34	o-Cymene	0.1
35	Oleic acid	0.6
36	Oxirane tetradecyl	0.1
37	Oxirane, octyl	0.3
38	E-2-Ethyl-3-methyl thiophane	0.2
39	E-Undecanoic acid	5.0
40	Tridecanoic acid	5.5
41	Undecanal	0.3
42	Undecanoic acid	2.1
43	Undecyl alcohol	6.4
44	Undecylenic acid	0.3

Table III

Composition of seed essential oil of *C. sativum*

SN.	Name of chemical compounds	Percentage
1	γ-Terpinene	14.4
2	Camphene	0.1
3	E-Verbenol	0.3
4	Sabinene	0.2
5	β-Pinene	1.8
6	2-Oxabicyclo[2.2.2]0ctan-6-ol,1,2,3-trimethyl	0.0
7	β-Myrcene	0.6
8	Cyclooctanol	0.0
9	α-Thujene	0.0
10	m-Cymene	1.3
11	Limonene	0.4
12	E-Ocimene	0.1
13	Z-Ocimene	0.0
14	Lilac alcohol	0.1
15	α-Terpinene	0.0
16	Z-Verbenol	0.1
17	Linalool	37.7
18	Isothujol	0.0
19	α-Campholenal	0.2
20	Citronellal	2.0
21	Umbellulone	0.1
22	Borneol	0.3
23	4-Terpineol	0.1
24	Terpinyl acetate	0.3
25	Decanal	0.1
26	Z-verbenone	0.1
27	Citronellol	1.3
28	Citral	1.4
29	Geraniol	1.9
30	Eugenol	0.9
31	Carveol	0.2
32	Undecanal	0.6
33	Methyl geranate	0.2
34	Myrtenyl acetate	0.4
35	Citronellyl acetate	1.4
36	Geranyl acetate	17.6
37	Z-myrtenyl acetate	0.1
38	β-Elemene	0.1
39	Dodecenal	0.2
40	Caryophyllene	0.3
41	β-Farnesene	0.1
42	2-Dodecenal	0.2
43	Curcumene	1.0

Table III

Composition of seed essential oil of *C. sativum* (Continued)

SN.	Name of chemical compounds	Percentage
44	α-Cubebene	0.1
45	α-Cedrene	3.9
46	α-Farnesene	1.2
47	β-Bisabolene	0.8
48	β-Sesquiphellandrene	1.6
49	E-Nerolidol	0.1
50	Artumerone	0.0
51	8-Hexadecenal, 14-methyl-, (Z)	0.2
52	α-Bisabolol	0.2
53	*n*-Hexadecanoic acid	0.1

References

Anitescu G, Doneanu C, Radulescu V. Isolation of coriander oil: Comparison between steam distillation and supercritical CO_2 extraction. Flav Fragr J. 1997; 12: 173-76.

Anonymous. The wealth of India: Raw materials. Vol. II, CSIR, New Delhi, India, 1950, pp 347-50.

Asolkar LV, Kakkar KK, Chakre OJ. Glossary of Indian medicinal plants with active principles. Part I. New Delhi, India, P & I Directorate, CSIR, 1992, pp 232-33.

Bandoni Al, Mizrahi I, Juarez MA. Composition and quality of essential oil of coriander (*Coriandrum sativum* L.) from Argentina. J Essent Oil Res. 1998, 10: 581-84.

Chopra RN, Nayar SL, Chopra IC. Glossary of Indian medicinal plants. New Delhi, India, CSIR, 1956, pp 77-78.

Coleman WM, Lawrence BM. Comparative automated static and dynamic quantitative headspace analysis of coriander oil. J Chromatogr Sci. 1992, 30: 396-98.

Ghani A. Medicinal plants of Bangladesh: Chemical constituents and uses. 2nd ed. Dhaka, Asiatic Society of Bangladesh, 2003, p 183.

Guenther E. The essential oil. Vol. IV. Florida, USA, REK Publishing Company, 1950, pp 602-15.

Lawrence BM. A planning scheme to evaluate new aromatic plants for the flavor and fragrance industries. In: New crops. Janick J, Simon JE (eds). New York, Wiley, 1993, pp 620-27.

Leung AY, Foster S. Encyclopedia of common natural ingredients used in food, drugs and cosmetics. 2nd ed, New York, John Wiley and Sons, 1996, pp 193-95.

Lewinshon E, Schalechet F, Wilkinson J, Matsui K, Tadmor Y, Nam K, Amar O, Lastochkin E, Larkov O, Ravid U, Hiatt W, Gepstein S, Pichersky E. Enhanced levels of the aroma and flavor compound S-linalool by metabolic engineering of the terpenoid pathway in tomato fruits. Plant Physiol. 2001; 127: 1256–65.

Pino JA, Rosado A, Fuentes V. Chemical composition of the seed oil of *Coriandrum sativum* L. from Cuba. J Essentl Oil Res. 1996; 8: 97-98.

Potter TL. Essential oil composition of cilantro. J Agric Food Chem. 1996; 44: 1824-26.

Rastogi RP, Mehrotra BN. Compendium of Indian medicinal Plants. Vol. II. Lucknow, CDRI, 1993, p 212.

Small E. Culinary herbs. Ottawa, NRC Research Press, 1997, pp 219-25.

Tashinen J, Nykanen L. Volatile constituents obtained by the extraction with alcohol-water mixture and by steam distillation of coriander fruit. Acta Chem Scand. 1975; 20: 425-29.

Telci I, Gul TO, Sahbaz N. Yield, essential oil content and composition of *Coriandrum sativum* varieties (var. *vulgare* Alef and var. *microcarpum* DC.) grown in two different locations. J Essentl Oil Res. 2006; 18: 189-93.

Yusuf M, Chowdhuty JU, Wahab MA, Begum J. Medicinal plants of Bangladesh. Bangladesh, Bangladesh Council of Scientific and Industrial Research, 1994, p 66.

Author Info
Md. Nazrul Islam Bhuiyan (Principal contact)
e-mail: Nazrul119@yahoo.com