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CONSTITUENTS OF ESSENTIAL OILS FROM LEAVES AND SEEDS OF *FOENICULUM VULGARE* MILL. CULTIVATED IN BANGLADESH

JASIM UDDIN CHOWDHURY, MD. HOSNAY MOBAROK, MD. NAZRUL ISLAM BHUIYAN* AND NEMAI CHANDRA NANDI

BCSIR Laboratories, Chittagong, P.O. Chittagong Cantonment, Chittagong-4220, Bangladesh

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Abstract

Analysis of essential oils obtained from the seeds and leaves of *Foeniculum vulgare* Mill. cultivated in Bangladesh revealed that anethole was the major constituent (58.5% in seed oil and 51.1% in leaf oil), followed by limonene (19.6% in seed oil and 22.9% in leaf oil). Other components present in leaf oil included anisaldehyde, fenchyl acetate and fenchone, while seed oil contained fenchone, α-pinene, fenchyl acetate, γ-terpinene and anisaldehyde. Besides, minor constituents like camphene, camphor, myrcene, pahllandrene, ocimene, β-bisabolene and apiol were obtained from seeds and leaves.

The plant was identified by matching with voucher specimen (J-1695) preserved in the herbarium of BCSIR Laboratories, Chittagong. The essential oils were obtained by hydrodistillation method from leaves and seeds collected from the plants grown in BCSIR campus, Chittagong, during July 2006. The isolated oils were dried over anhydrous sodium sulphate.

Fennel (*Foeniculum vulgare* Mill., Family Umbelliferae), is a perennial or annual herb and a typical aromatic plant that grows and grown all over the world for its fruits used as culinary spice. The oils from leaves and seeds of *F. vulgare* were analyzed by electron impact ionization method on GC-17A Gas Chromatograph (Shimadzu) coupled to a QP 5050A Mass Spectrophotometer (Shimadzu). A fused capillary column (column 30 m x 0.25 mm, 1 µm film thickness) coated with DB-5 ms (J&W) was used. Direct injection of 1 µl sample with He as a carrier gas (at a pressure of 100 Kpa) and oven temperature held isothermal at 50° C for 4 min and then programmed to increase at 10° C/min to 150° C with keep time of 5 min which was further programmed to increase at 10° C/min to 250° C with a keep time of 5 min. Acquisition parameters: full scan; scan range 40-300° C, ionization voltage 70 ev. The essential oil composition was identified by comparing the mass spectra from NIST Library (NIST 147 & NIST 27).

In oils, anethole (51.08% and 58.54 % in leaves and seeds, respectively) and limonene (22.9% and 19.6 %, in leaves and seeds, respectively) were found to be the major constituents. β-thujaplicin, which has recently been reported to have antifungal (Morita *et al.* 2004) and antibacterial (Arima *et al.* 2003) activity, was found in leaf oil at about 4.8%. In all 30 components were identified in the seed oil and 31 in leaf oil (Table 1). The components present in the essential oil obtained from seeds and leaves of fennel cultivated in Bangladesh are similar to those reported for sweet and bitter fennel but the relative percentage of compounds such as anethole and limonene differed (Arslan *et al*. 1989, Embong *et al.* 1977). Limonene, was found in higher concentration (23% in leaf oil and 20% in seed oil) than the previously reported essential oils of Fennel. The percentage variation of chemical composition of *F. vulgare* especially on anethole and limonene seems to be due to the different geographical location and climate of Bangladesh.

*Corresponding author: nazrul119@yahoo.com

The oil obtained from air-dried fruits of *F. vulgare* of Turkish origin contained methyl chavicol (47.09%), limonene (29.07%), fenchone (13.43%), fenchyl acetate (1.95%), *cis*-β-ocimene (1.41%), α-pinene (1.22%), and myrcene (1.08%) as the main constituents (Özcan and Akgül 2001). The major components from these were found to be methyl chavicol, *trans*-anethole, limonene, fenchone, β-terpinene and piperitonene oxide (Marotti 1994). Özcan *et al*. (2006) found estragole (61.08%), fenchone (23.46%), limonene+ β-phellandrene + 1, 8-cineole (8.68%) and α-pinene (1.15%) as the important components of ripe fruit oil.

Table 1. Essential oil Composition of *Foeniculum vulgare* Mill. cultivated in Bangladesh.

Seed oil		Leaf oil	
Compounds	Percent	Compounds	Percent
γ-terpinene	1.10	γ-terpinene	0.06
3-methoxycinamaldehyde	0.27	2-methoxybenzeneethanol	0.10
4-terpinolene	0.28	3-methoxycinamaldehyde	0.14
Anethole	58.54	4-hexen-1-ol,acetate	0.22
Anisaldehyde	0.72	Allyl-3-methoxybenzoate	0.06
Apiol	0.27	Anethole	51.08
Camphene	0.08	Anisaldehyde	7.55
Camphor	0.63	Apiol	0.63
Caryophyllene	0.10	Camphene	0.07
cis-sabinenehydrate	0.09	Camphor	0.04
Ethenyl)-2-cyclohexeneone	1.19	cis-verbenol	0.18
Eugenol	0.08	Fenchone	1.65
Fenchyl acetate	1.20	Fenchyl Acetate	5.34
Germacrene	0.47	Limonene	22.90
Isopinocampheol	0.11	Limonene-1,2-epoxide	0.11
l-fenchone	7.72	Methyleugenol	0.07
Limonene	19.63	Methylisoeugenol	0.12
Ocimene	0.09	Myristicin	0.08
Sabinene	0.69	n-amyl isovalerate	0.01
Terpinolene	0.12	Octahydro-1-benzothipene	0.07
trans-limonene oxide	0.83	p-anisic anhydride	0.20
Trans-p-mentha-2,8-dienol	0.29	Plinol D	0.11
(S)-2-methyl-5-(1-methyl		trans-carvyl acetate	0.25
trans-verbenol	0.15	trans-carvyl propionate	0.41
α-phallandrene	0.30	trans-p-2,8-menthadien-1-ol	0.15
α-pinene oxide	0.18	α-curcumene	0.05
β-bisabolene	0.08	β-bisabolene	0.03
β-camphor	0.16	β-myrcene	0.63
β-pinene	1.80	β-ocemene	0.27
β-pinene	0.22	β-phallandrene	0.04
β-thujaplicine	0.04	β-pinene	0.14
		β-thuzaplicin	4.82

References

Arima Y., Y. Nakai, R. Hayakawa and T. Nishino. 2003. Antibacterial effect of beta-thujaplicin on staphylococci isolated from atopic dermatitis: relationship between changes in the number of viable bacterial cells and clinical improvement in an eczematous lesion of atopic dermatitis. J Antimicro. Chemotherapy **51**(1): 113-122.

Arslan N., A. Bayrak and A. Akgul. 1989. The yield and components of essential oil in fennels of different origin (*Foeniculum vulgare* Mill.) grown in Ankara conditions. Herba Hungarica **28**(3): 27-31.

Embong M.B., D. Hadziyer and S. Molnar. 1977. Essential oils from species grown in Alberta. Fennel oil (*Foeniculum vulgare* var. *dulce*). Can. J. Plant Med. **17**: 281-293.

Marotti M., R. Piccaglia, E. Giovanelli, S.G. Deans and E. Eaglesham. 1994. Effects of variety and ontogenic stages on the essential oil composition and biological activity of fennel (*Foeniculum vulgare* Mill.). J Essent. Oil Res. **6**: 57-62.

Morita Y., E. Matsumura, T. Okabe, T. Fukui, T. Ohe, N. Ishida and Y. Inamori. 2004. Biological activity of beta-dolbrin, gamma-thujaplicin, and 4-acetyltropolone, hinokitiol-related compounds. Biol. Pharm Bull. **27**(10): 1666-1669.

Özcan M. and A. Akgül. 2001. Chemical composition of the essential oil of bitter fennel (*Foeniculum vulgare* subsp. *piperitum*). J. Spices Arom. Crops **10**: 49-50.

Özcan M.M, J.C. Chalchat, D. Arslan, A. Ates and A. Ünver. 2006. Comparative essential oil composition and antifungal effect of bitter fennel (*Foeniculum vulgare* subsp. *piperitum*) fruit oils obtained during different vegetation. J. Med. Food **9**(4): 552-561.

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