



eISSN: 2581-3285

Findings in Agricultural Research and Management (FARM) Journal

Volume-2, Issue-2, April-June, 2018

Available online at www.farmjournal.infoPublished on 30th June, 2018 © 2018 farmjournal.info
Creative Commons-BY-NC

Fatty Oil and Its Constituents in Fennel (*Foeniculum vulgare* Mill)

D. Agarwal*, L. K. Sharma¹ and S. N. Saxena²

SRF, ICAR- National Research Center on Seed Spices, Ajmer, India

¹SRF, Agricultural Research station, Agricultural University, Mandor, India²Principal Scientist, ICAR-National Research Center on Seed Spices, Ajmer, India*Email of corresponding author: agarwal1dl@gmail.com

A study was conducted with five fennel varieties originated from different parts of India and were evaluated for seed essential and total oil content and its composition. Seventeen fatty acids were found in fennel seed oil including petroselinic acid (62.08-66.71%), 10-Nonadecanone (4.70-22.80%) and linoleic acid (1.32-7.59%). Oleic acid, stearic acid, eicosanoic acid, lenolenic acid and intermediate compounds cyclotetracosan, cyclohexadecan, 10-Nonadecanol were detected in one or other genotypes.

Introduction

Fennel (*Foeniculum vulgare* Mill) is an annual herbaceous plant belongs to the family *Apiaceae*. It is widely cultivated throughout the temperate and tropical regions of the world. It is a traditional and popular herb with a long history of use as a medicinal and economic plant in Asian countries. A series of studies showed that *F. vulgare* effectively controls numerous infectious disorders of bacterial, fungal, viral, mycobacterium, and protozoal origin (Kaur, 2009) It is also used in the treatment of kidney stones, menopausal problems, nausea and obesity. Fennel seeds essential oil is used as flavouring agents in food products such as liqueurs, bread, cheese, pickles and pastries and an ingredient of cosmetics and pharmaceutical products. In India, fennel is cultivated in semi arid regions of Gujarat and Rajasthan states with an area of 46760 hectare and production of 78570 tonnes during 2015-16. Fennel essential oil composition has been reported by various researchers including reports on essential oil variation in fennel plants collected from different parts of various countries. A few reports were focused on changes in essential oil during plant developmental stages. In present communication we selected five released and notified fennel varieties originated from different part of India which have covered considerable area under cultivation. These varieties have been evaluated for seed essential and fatty oil content as well as their composition.

Materials and Methods

Thirty gram seed powder was utilized for oil extraction with hexane using Accelerated Solvent Extraction System (Dionex India Pvt. Ltd.). Fatty oil constituents were analyzed by derivatization of fatty oil in to Fatty Acid Methyl Esters (FAME) as per AOCS Method CE 1-62 21 for further analysis by GC-MS. Diluted FAME were separated on an Agilent Series GC-MS (Agilent, USA; GC-7820 A, MS-5975) equipped with an HP5-MS (Universal column) (30 m x 0.32 mm x 0.25 µm); Agilent J&W GC column with an auto sampler. A sample of 1 µL was used in split mode

(20:1) with an auto sampler. Helium was used as the carrier gas at a flow rate of 1.0 ml/ min. The column temperature was programmed from 50°C to 280°C with equilibrium time of 3 minutes, held for 30 min. Injector temperature was set at 250°C. The fatty acids were identified by a comparison of their retention indices and their identification was confirmed by computer matching of their mass spectral fragmentation patterns of compounds in the NIST-MS library and published mass spectra with the help of Chemstation software (Agilent Technologies, USA)

Results and Discussion

Seventeen fatty acids and their isomers were identified in fennel seed oil and shown in Table 1 & 2. Some compounds were detected in either one or two genotypes while very less quantity of other compounds were detected in all studied genotypes. Petroselinic acid was the major fatty acids found in the range of 62.08% in genotype Hisar Swarup to 66.71% in genotype AF-1. Significant quantity of 10-Nonadecanone was detected in all genotypes ranged from 4.70 % in AF-1 to 22.80 % in Hisar Swarup. Other fatty acids such as linoleic acid (9, 12 octadecadienoic acid) was detected only in Rajendra Sourabha and AF- 1. Considerable amount of estragole was also detected in all the genotypes ranged from 3.18 % in AF-1 to 9.72 % in RF-101. Oleic acid, stearic acid, eicosanoic acid, lenolenic acid and intermediate compounds cyclotetracosan, cyclohexadecan, 10-Nonadecanol were detected in one or other genotypes. Fennel seeds contain up to 20% fatty acids and petroselinic acid is a characteristic fatty acid of fennel oil. Petroselinic acid is a positional isomer of oleic acid, a monounsaturated omega-12 fatty acid occurs naturally in several animal and vegetable fats and oils. The level of petroselinic acid in fennel seed oil could be as high as 70 to 80% (Reiter, 1998). The chemical analysis of the acetone extract of fennel showed that linoleic acid (54.9 %), palmitic acid (5.4 %) and oleic acid (5.4 %) were major components in acetone extract (Singh, 2006). In present study significant genetic variation in fatty acid composition was observed as some of the fatty acids or their derivatives only detected in specific genotype/s. Genotype GF-2 showed 4.24% 10-Nonadecanol which was not detected in other genotypes. Similarly, 5.49% cyclohexadecane was detected in Hisar Swarup only. These are long-chain fatty compounds belongs to alkene, alcohols and the ketones. These compounds constitute leaf cuticular waxes that may differ widely among species. Fatty acid derivatives can act as signaling molecules, modulating normal and disease-related phenotypes in animals and display antimicrobial and anticarcinogenic activity (Dembitsky, 2006). Occurrence of these fatty acids derivatives in fennel seed oil in significant quantities may be attributed to various pharmacological activities including antimicrobial and anti-carcinogenic activities (Badgujar, 2014).

Table 1: Volatile oil and oleoresin percentage in fennel genotypes

S. No.	Variety	Oleoresin (%)
1	Hisar Swarop	16.68
2	Rajendra Saurabha	14.80
3	RF-101	13.54
4	GF-2	7.95
5	AF-1	6.87

Table 2. Composition of fennel seed oil

S. N.	Compound/Genotype	RT	RI	Identification	AF-1	GF-2	Hisar Swarup	Raj. Sourabha	RF-101
1	Estragol	3.953	1172	C ₀ GC	3.18±0.1	3.31±0.1	4.70±0.1	4.17±0.2	9.72±0.1
2	Linolenic acid	4.385	2191	RI,MS	0.01±0.0	0.03±0.0	0.03±0.0	0.02±0.0	0.01±0.0
3	Myristic acid	6.393	1769	RI,MS	0.25±0.0	-	-	-	0.01±0.0
4	7-Hexadecenoic acid	7.795	1976	RI,MS	1.00±0.0	-	-	-	0.28±0.0
5	Palmitic acid	7.960	1968	C ₀ GC	7.76±0.2	0.29±0.0	0.12±0.0	1.01±0.0	4.48±0.2
6	7,10-octadecadienoic acid	9.398	2093	RI,MS	0.07±0.0	0.69±0.1	0.52±0.0	-	-
7	Linoleic acid	9.551	2183	C ₀ GC	7.60±0.0	-	-	1.32±0.1	6.97±0.5
8	Petroselinic acid	9.576	2175	C ₀ GC	66.71±0.6	69.2±0.3	62.04±0.5	65.63±0.3	65.50±0.4
9	Oleic acid	9.614	2085	C ₀ GC	-	6.34±0.2	0.06±0.0	0.04±0.0	-
10	Margaric acid	9.780	2067	C ₀ GC	-	-	-	0.15±0.1	-
11	Stearic acid	9.805	2167	RI,MS	2.53±0.2	-	-	-	1.04±0.0
12	Gandoic acid	11.446	2374	RI,MS	0.12±0.0	-	-	-	-
13	Eicosanoic acid	11.701	2276	RI,MS	0.59±0.0	-	-	-	0.11±0.0
14	Cyclohexadecane	17.120	1918	RI,MS	-	-	5.49±0.2	-	-
15	Cyclotetracosane	17.121	2664	RI,MS	1.11±0.1	-	-	2.59±0.3	1.22±0.1
16	10-Nonadecanone	19.741	2046	RI,MS	4.70±0.2	8.67±0.1	22.81±0.5	10.49±0.1	6.90±0.3
17	10-Nonadecanol	19.970	2072	RI,MS	-	4.24±0.1	-	-	-
	Total				96.76	98	95.77	92.64	98.39

Conclusion

Fennel genotypes Hisar Swarup, AF-1, Rajendra Sourabha and RF-101 were found promising. The findings can be used for selecting better genotypes of fennel for its seed essential and fatty oil content as well as their composition.

References

- AOCS (2005). Fatty acid composition by gas chromatography AOCS method. AOCS official methods. American Oil Chemists Society. 1-62.
- Badgujar B Shamkant, Patel VV and Bandivdekar AH (2014). *Foeniculum vulgare* Mill: A Review of Its Botany, Phytochemistry, Pharmacology, Contemporary Application, and Toxicology BioMed Research International. <http://dx.doi.org/10.1155/2014/842674>.
- Dembitsky (2006). Anticancer activity of natural and synthetic acetylenic lipids. *Lipids*: 41(10): 883-924.
- Kaur GJ, Arora DS (2009). Antibacterial and Phytochemical screening of *Anethum graveolens*, *Foeniculum vulgare* and *Trachyspermum ammi*. *BMC Complementary and Alternative Medicine*. 9: 30.
- Reiter B, Lechner M and Lorbeer E. (1998). The fatty acid profiles-including petroselinic and cisvaccenic acid-of different umbelliferae seed oils. *Fett. Lipid*. 100: 498-502.
- Singh G, Maurya S, De LMP and Catalan C (2006). Chemical constituents, antifungal and antioxidative potential of *F. vulgare* volatile oil and its acetone extract. *Food Control*. 17: 745-52.