# Fatty Acid Composition of Seeds of *Satureja thymbra* and *S. cuneifolia*

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The chemical composition of fatty acid methyl esters (FAMEs) from seeds of *S. thymbra* and *S. cuneifolia* were analyzed by GC/MS. 7 FAMEs were identified from the seeds of *S. thymbra* mainly as 9-octadecenoic acid methyl ester (43.9%), hexadecanoic acid methyl ester (11.4%), 9,12,15-octadecatrienoic acid methyl ester (*Z,Z,Z*) (30.2%), and octadecanoic acid methyl ester (14.1%), while from the seed of *S. cuneifolia* 10 FAMEs were obtained with the main components, similar to *S. thymbra.* These were identified as 9-octadecenoic acid methyl ester (10.1%), hexadecanoic acid methyl ester (methyl palmitate, 34.6%), 9,12,15-octadecatrienoic acid methyl ester (*Z,Z,Z*) (6.3%) and octadecanoic acid methyl ester (1.8%).

*Key words: Satureja thymbra, Satureja cuneifolia*, Fatty Acids

## Introduction

The genus *Satureja* (Lamiaceae) is represented by 15 species in Turkey and five of them are endemic (Davis, 1982; Tümen *et al.*, 2000). Antimicrobial, antifungal, antiinflammatory, situmalant, diuretic, mutagenic effects and other biological activities of *Satureja* species were reported in the literature. They are also used against common cold as herbal tea (Başer, 1995). The *Satureja thymbra* and *S. cuneifolia* are main commercial species of *Satureja* exported from Turkey. Also, those species are used in obtaining thyme oil and thyme juice, and sold to merchant. Dried herbal parts constitute an important commodity for export. Approximately 1000 tons of *Satureja* species are collected per year and sold under the name "**Sivri kekik**" (Satil *et al.*, 2002).

There are many studies about the essential oil of the leaves of *S. thymbra* and *S. cuneifolia* and other *Satureja* species which include mainly carvacrol and thymol along with *p*-cymene and γ-terpinene. (Başer *et al.*, 2001; Azaz *et al.*, 2002; Müller-Riebau *et al.*, 1995; 1997; Karpouthis *et al.*, 1998; Tümen *et al.*, 1998). There is no study about the fatty acid composition of seeds of *Satureja* species. In this study we report here the analysis of the total fatty acid methyl esters composition of *S. thymbra* and *S. cuneifolia* by GC/MS.

## Experimental

### *Plant material*

Plant material of *S. thymbra* L. was collected from Çeşme-İzmir in July 2002 and *S. cuneifolia* Ten. was collected from Kiraz-İzmir in September 2002. The plants were identified by Dr. Fatih Satıl from Balıkesir University, Turkey, voucher specimens were deposited in the Herbarium of Department of Biology, Faculty of Arts and Science, Balıkesir University (F. S. 1038 and 1042, respectively).

### *Extraction and preparation of fatty acids*

5.1 g of seed obtained from 250 g of *S. thymbra* leaves while 2.5 g of seed obtained from 200 g of *S. cuneifolia* leaves. 2.5 g of the seeds from the both species were refluxed in hexane for 6 h by a soxhlet extraction, the solvent was evaporated under the reducued pressure by a rotary evaporator at 30 °C and residue refluxed with 0.5 N sodium hydroxide solution in methanol (5 ml) for 10 min. The flask was fitted to a condenser. After 5 ml of 14% $BF_3$-MeOH solution was added by a pipette through condenser and boiled for 2 min. Then 5 ml of heptane was added through condenser and boiled one more minute. The solutions were cooled. 5 ml of saturated NaCl solution was added

  

and flask was rotated very gently and required methyl esters were extracted with heptane (2 × 5 ml), then the organic layer was separated using Pasteur pipettes for both samples and, dried over anhydrous $Na_2SO_4$ and filtered for the each oil. The fatty acid methyl esters were recovered after solvent evaporation in vacuum for the both seeds (AOAC, 1990).

*Gas chromatography mass analysis*

The fatty acid methyl esters were analyzed using Fisons Instrument GC8000 series gas chromatography and Fisons Instrument MD800 mass spectrometer. DB5 fused silica column (60 mm × 0.25 mm, ∅ with 0.5 mm film thicknes) was used with helium at a 1 ml/min (0.14 MPa) as a carrier gas, GC oven temperature was kept at 40 °C for 5 min and programmed to 280 °C at rate of 5 °C/min and kept constant at 280 °C for 20 min. The split ratio was adjusted to 1:20 and the injection volume was 0.1 μl. EI/MS was taken at 70 eV ionization energy. Mass range was from *m/z* 35–450 amu. Scan time was 0.5 sec with 0.1 interscan delay. The library search was carried out using NIST and Wiley GC-MS library and TÜBİTAK-MRC library institution of essential oil. The relative percentage amount of separated compounds were calculated from total ion chromatography by computerized integrator.

## Results and Discussion

The GC/MS analysis of the seeds of *S. thymbra* showed that the 7 FAMEs and the main compounds were identified as 9-octadecenoic acid methyl ester (oleic acid) (43.9%), hexadecanoic acid methyl ester (palmitic acid methyl ester) (11.4%), 9,12,15-octadecatrienoic acid methyl ester (*Z,Z,Z*) (linolenic acid methyl ester) (30.2%), octadecanoic acid methyl ester (stearic acid methyl ester) (14.1%) along with nonanoic acid methyl ester, tetradecanoic acid methyl ester (pelargonic acid methyl ester), 9-hexadecenoic acid methyl ester (palmitoleic acid methyl ester). The fatty acid composition of the main seeds of *S. cuneifolia* was similar to *S. thymbra* but percentages of main compounds were different. 10 FAMEs were obtained from the *S. cuneifolia* seeds and the main compounds were identified as 9-octadecenoic acid methyl ester (10.1%), hexadecanoic acid methyl ester, (34.60%), 9,12,15-octadecatrienoic acid methyl ester (*Z,Z,Z*) (6.3%), Octadecanoic acid methyl ester (1.8%).

Pentadecanoic acid methyl ester (0.1%) and heptadecanoic acid methyl ester (0.3%) were not observed from the *S. thymbra* seeds. Ocatadecanoic acid methyl esters, 9-octadecenoic acid methyl ester, 9,12,15-octadecatrienoic acid methyl ester (*Z,Z,Z*), octadecanoic acid methyl ester, are 88.2% of the total compositon in the *S. thymbra* while this percentage is only 18.2% in the *S. cuneifolia.* Also, palmitic acid compositions are very different from the both plant seeds as 11.4% (*S. thymbra*) and 34.6% (*S. cuneifolia*) (see Table I). The 100% of the composition of the seeds oil of *S. thymbra* is fatty acid methyl esters while this percentage was only 57.6% in the *S. cuneifolia*.

This is the first study about fatty acid composition of the seed of *S. thymbra* and *S. cuneifolia* in the world.

Table. I. Fatty acid methyl esters composition of *S. thymbra* and *S. cuneifolia*[*,a].

| RT | Fatty acid methyl esters | *S. thymbra* | *S. cuneifolia* |
|---|---|---|---|
| 33.07 | nonanoic acid methyl ester (pelargonic acid) | 0.2 | 0.2 |
| 47.28 | tetradecanoic acid methyl ester (myristic acid) | 0.1 | 3.5 |
| 49.64 | pentadecanoic acid methyl ester | – | 0.1 |
| 51.53 | 9-hexadecenoic acid methyl ester (palmitoleic acid) | 0.1 | 0.7 |
| 51.90 | hexadecanoic acid methyl ester (palmitic acid) | 11.4 | 34.6 |
| 54.19 | heptadecanoic acid methyl ester (margaric acid) | – | 0.3 |
| 56.28 | 9-octadecenoic acid methyl ester (oleic acid) | 43.9 | 10.1 |
| 56.45 | 9,12,15-octadecatrienoic acid methyl ester (*Z,Z,Z*) (linolenic acid) | 30.2 | 6.3 |
| 56.74 | octadecanoic acid methyl ester (stearic acid) | 14.1 | 1.8 |
| | Σsaturated fatty acid | 25.8 | 40.5 |
| | Σunsaturated fatty acid | 74.2 | 17.2 |
| | Σfatty acid | 100 | 57.6 |

RT: Retention time
* Relative percentages obtained from the peak area in chromatogram.
[a] GC/MS analyses of the fatty acid methyl esters were replicated three times. (Mean RSD% value is 0.1).

AOAC (Association of Official Analytical Chemists) Official Method of Analysis (1990), Vol. 2, pp. 963–964.

Azaz D., Demirci F., Satıl F., Kürkçüoğlu M., and Başer K. H. C. (2002), Antimicrobial activity of some *Satureja* essential oils. Z. Naturforsch. **57c**, 817–821.

Başer K. H. C. (1995), Essential Oils from aromatic plants which are used as herbal tea in Turkey. In: Flavours, Fragrance and Essential Oils. Proceedings of the 13th International Congress of Flavours, Fragrances and Essential Oils (Başer K. H. C., ed.). AREP Publications, Istanbul, Turkey, pp. 67–79.

Başer K. H. C., Tümen G., Tabanca N., and Demirci F. (2001), Composition and antibacterial activity of the essential oils from *Satureja wiedemanniana* (Lallem.) Velen. Z. Naturforsch. **56c**, 731–738.

Davis P. H. (1982), Flora of Turkey and the East Aegean Islands. Vol. **7**, University Press, Edinburgh, p. 319.

Karpouhtis I., Pardali E., Feggou E., Kokkini S., Scouras Z. G., and Mavragani-Tsipidou P. (1998), Insecticidal and genotoxic activities of oregano essential oils. J. Agric. Food Chem. **46**, 1111–1115.

Müller-Riebau F., Berger B., and Yegen O. (1995), Chemical composition and fungitoxic properties to phytopathogenic fungi of essential oils of selected aromatic plants growing in Turkey. J. Agric. Food Chem. **43**, 2262–2266.

Müller-Riebau F., Berger B., Yegen O., and Cakir C. (1997), Seasonal variations in the chemical compositions of essential oils of selected aromatic plants growing wild in Turkey. J. Agric. Food Chem. **45**, 4821–5825.

Satil F., Dirmenci T., and Tümen G. ( 2002), Natural Situation of Commercial *Satureja* Species' in Turkey, 16th National Congress of Biology, September, 1–7, Malatya, Turkey.

Tümen G., Kirimer N., and Başer K. H. C. (1997), The essential oils of *Satureja* L. occurring in Turkey. In: Proceeding of the 27th International Symposium on Essential Oils (Franz C. H., Mathe A., and Buchbauer G., eds.). Allured Publ. Corp., Vienna, Austria, pp. 250–254.

Tümen G., Kirimer N., Ermin N., and Başer K. H. C. (1998), The essential oil of *Satureja cuneifolia*. Planta Med. **64**, 81–83.

Tümen G., Satıl F., Duman H., and Başer K. H. C. (2000), Two new records for the flora of Turkey: *Satureja icarica* P. H. Davis, *S. pilosa* Velen. Turkish. J. of Botany **24**, 211–214.