Food Chemistry 45(1992) 117–118

Composition of the essential oil of marjoram (*Origanum majorana* L.)

M. E. Komaitis

Department of Agricultural Industries, Agricultural University of Athens, Iera Odos 75, Athens 118 55, Greece

N. Ifanti-Papatragianni & E. Melissari-Panagiotou

Department of Food Chemistry, University of Athens, Athens, Greece

(Received 9 October 1991; accepted 28 November 1992)

The quantitative composition of the essential oil of *Origanum majorana* L. grown in Greece is reported. A total of 45 compounds were identified by means of gas liquid chromatography and GC–MS analysis. The most prominent component was 4-terpineol (37%) and three substances were identified for the first time in marjoram oils.

INTRODUCTION

Origanum species have been used in medicine and as spices since antiquity.

Ietswaart (1980) revised the genus *Origanum* that was divided into 10 sections; 38 species and 17 hybrids were recognised.

Origanum Majorana L. is a herbaceous, perennial plant native to the Mediterranean region (Furia & Bellanca, 1971). It is frequently used in the food industry in various liqueur formulations.

There exists some confusion in regard to the so-called marjoram oils and origanum oils. The term 'marjoram' comprises a number of aromatic species. The most important representative is *Origanum majorana* L. However, essential oils called 'marjoram oils' have also been derived from other species, e.g. *Thymus mastichina* L. (Guenther, 1949).

Sarer *et al.* (1982) investigated the composition of the essential oil of *Origanum majorana* L. by means of LSC and GLC. They reported that the most prominent components of the essential oil were carvacrol (65%) and thymol (4%). Nykanen (1986*a*) analysed the essential oil of wild marjoram (*Origanum vulgare* L.) grown in Finland. A total of 82 compounds were identified. Germacrene D was the main component in the hydrocarbon type and carvacrol in the phenol type. In another paper, the same author (1986*b*) reported the flavour composition of marjoram (*Origanum majorana* L.). A total of 56 compounds were identified. The most prominent components were *cis*-sabinene hydrate and 4-terpineol and, together with *trans*-sabinene hydrate, α-terpineol and linalool, they comprised 71–84% of the essential oil.

Food Chemistry 0308-8146/92/$05.00

MATERIALS AND METHODS

The plants were grown in the Halkis area (Greece). All plants were collected at flowering in the middle of July 1989. The plant material was air-dried and stored at −5°C. The essential oil was isolated from the dried sample by steam distillation and extraction with distilled *n*-pentane. The steam distillation extraction was carried out for 5 h. The pentane extracts were dried over anhydrous sodium sulphate and stored at −18°C until used.

The essential oil was examined by gas chromatography using a Varian 3400 instrument (FID) and a 25 m × 0·25 mm i.d. Carbowax 20M fused silica capillary column. The carrier gas was helium at a flow rate of 5 ml min^{-1}. The oven temperature was 35°C for 5 min, then rose by 2°C per minute to a final temperature of 230°C for 20 min.

The GC–MS analysis was performed with a VG 20.250 GC-Data System operating at an ionisation potential of 70 eV. The fused silica capillary column used was Carbowax 20M (25 m × 0·3 mm i.d.). The oven temperature was 35°C, rising at 2°C min^{-1} to 230°C.

Table 1. Constituents of the essential oil of *Origanum majorana* L.

Compounds	%	Certainty of identification
Hydrocarbons		
α-Pinene	0.90	***
β-Pinene	0.22	***
Sabinene	1.45	***
δ-3-Carene	0.40	***
Myrcene	1.12	***
a-Phellandrene	0.57	***
a-Terpinene	2.24	***
Limonene	1.15	***
β-Phellandrene	0.70	***
cis-β-Ocimene	1.35	**
γ-Terpinene	1.42	***
trans-β-Ocimene	0.87	**
p-Cymene	12.05	***
Terpinolene	1.63	***
β-Caryophyllene	1.15	***
1,2,3,4,4a,7Hexahydro-1,6-dimethyl-4-isopropyl-naphthalene	tr	***
Alcohols and ethers		
1-Octen-3-ol	2.05	***
trans-Sabinene hydrate	2.14	***
cis-Sabinene hydrate	1.43	***
Linalool	1.96	***
3-Octanol	tr	***
1,8-Cineol	0.25	**
4-Terpineol	37.10	***
trans-trans-(+)-5-Caranol[a]	0.90	**
a-Terpineol	7.15	***
cis-Piperitol	0.10	***
trans-Piperitol	0.15	***
Geraniol	0.50	***
Santalol[a]	0.25	**
Aldehydes–Ketones		
Benzaldehyde	tr	***
1-(1,4-Dimethyl-3-cyclohexen-1-yl)-ethanone	0.12	***
Verbenone[a]	0.35	***
Carvone	0.25	***
Phenols		
Estragol	0.10	**
Thymol	0.70	***
Carvacrol	3.60	***
Acids and Esters		
Ethyl myristate	tr	***
Palmitic acid	tr	***
Ethyl palmitate	tr	***
Ethyl linoleate	tr	***
4-Terpenyl acetate	1.25	***
Linalyl acetate	1.15	***
Bornyl acetate	0.15	***
Geranyl acetate	tr	***

[a] Not reported previously as constituent of any marjoram species
tr, Trace 0·5%.
*** Positive identification from mass spectrum and retention time which agree with authentic compound.
** Tentative identification from mass spectra data.

The percentage of the oil components was calculated from peak areas using an internal standard. Identification of the essential oil constituents was effected by GLC and GC–MC. Mass spectra and retention times were compared with data from standards or from the literature.

RESULTS AND DISCUSSION

The essential oil yield was 0·20 ml per 100 g. Gas chromatographic analysis revealed 65 compounds. A total of 45 compounds, consisting of terpene or sesquiterpene hydrocarbons, 13 alcohols and ethers, four carbonyl compounds, eight esters and three phenolic compounds could be identified in the essential oil (Table 1).

Santalol, verbenone and caranol have not been previously reported as constituents of the essential oil of marjoram and car-3-ene is reported only by Sarer *et al.* (1982).

4-Terpineol was the main component (37%) and, together with α-terpineol and *cis*- and *trans*-sabinene hydrate, constituted 50% of the essential oil.

Of the two main chemotypes of marjoram, one consists mostly of monoterpene alcohols and the other of phenols. Oils with a high percentage of 4-terpineol have been reported by many workers. A high percentage of phenolic compounds (carvacrol) was reported by Sarer *et al.* (1982).

The results of the present study show that Greek marjoram belongs to the first chemotype.

REFERENCES

Furia, T. E. & Bellanca, N. (1971). *Fenaroli's Handbook of Flavor Ingredients*. The Chemical Rubber Co., Cleveland, OH, p. 162.

Guenther, E. (1949). *The Essential Oils*. D. Van Nostrand Company Inc., Toronto.

Ietswaart, J. H. (1980). A taxonomic revision of the genus *Origanum* (Labiatae). Leiden University Press, The Hague, pp. 106–18.

Nykanen, I. (1986*a*). High resolution gas chromatographic–mass spectrometric determination of the flavour composition of wild marjoram (*Origanum vulgare* L.) cultivated in Finland. *Z. Lebensm. Unters. Forsch.*, **183**, 267–72.

Nykanen, I. (1986*b*). High resolution gas chromatographic–mass spectrometric determination of the flavour composition of marjoram (*Origanum majorana* L.) cultivated in Finland. *Z. Lebensm. Unters. Forsch.*, **183**, 172–6.

Sarer, E., Scheffer, J. J. C. & Svedsen, A. B. (1982). Monoterpenes in the essential oil of *Origanum majorana*. *J. Med. Plant Res. Planta Medica*, **46**, 236–9.