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ESSENTIAL OIL COMPOSITION OF TURKISH PICKLING HERB (*ECHINOPHORA TENUIFOLIA* L. SUBSP. *SIBTHORPIANA* (GUSS.) TUTIN)

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Constituents of essential oils from pickling herb (*Echinophora tenuifolia* L. subsp. *sibthorpiana* (Guss.) Tutin) gathered on April, May and June periods in Konya province were identified by GC/MS. The oil yields on a dry weight basis were 0.9%, 1.3% and 1.1%, respectively. The main ones of identified components representing 87.25%, 96.91% and 97.38% of the oils were δ-3-carene (36.98%, 38.8% and 30.01%), methyl eugenol (21.10%, 25.04% and 25.96%), α-phellandrene (14.5%, 21.71% and 29.26%); together with *p*-cymene (5.08%, 2.01% and 1.96%) and β-phellandrene (3.11%, 3.47% and 4.7%), respectively. Minor qualitative and major quantitative variations of some compounds were determined with respect to collection time.

Key words: α-phellandrene, Apiaceae, composition, δ-3-carene, *Echinophora tenuifolia* subsp. *sibthorpiana*, essential oil, harvest time, methyl eugenol, pickling herb

INTRODUCTION

Echinophora tenuifolia L. subsp. *sibthorpiana* (Guss.) Tutin is a perennial and endemic herbaceous plant which grows wild in several areas of Turkey (Davis 1982). The plant is called as "çörtük, çördük, tarhana otu or turşu otü" in Turkish. The young leaves and stalks of the plant are edible. Some uses of this plant are known for culinary purposes. Its fresh or dried leaves are used as a spice and condiment. They are added into pickles, tarhana soup, dairy products and meatballs (Akgül and Chialva 1989, Başer *et al*. 1998, Kıvanç 1988, Akgül 1993, Baytop 1994, Özcan *et al*. 2001). The plant has also healthful properties and its infusions are used for carminative and digestive activities (Baytop 1984, Başer *et al*. 1998).

Some studies on the esential oil composition of *Echinophora* species have been caried out (Tanker *et al*. 1976, Akgül and Chialva 1989, Başer *et al*. 1994, 1996, 1998, Ahmadi *et al*. 2001). The essential oil of pickling herb is a liquid with slightly yellowish colour and characteristic smell. The yield of essential

oil of plants varies from 0.9% to 2.2%, and is also dependent on seasonal factors (Akgül and Chialva 1989, Başer *et al*. 1994, Özcan *et al*. 2001).

α-Phellandrene, methyl eugenol, δ-3-carene, β-phellandrene and *p*-cymene were previously reported as a major constituents of the essential oil in Turkish pickling herb (Akgul and Chialva 1989). Başer *et al*. (1994, 1998) established the presence of methyl eugenol, α-phellandrene and *p*-cymene as important components in the essential oils from different localities of Turkey. The main components in the oil from plant collected from Konya in Turkey were methyl eugenol, δ-3-carene and *p*-cymene (Özcan *et al*. 2001).

The aim of the present study was to determine the effect of collection time on essential oil composition of pickling herb gathered in three different periods.

MATERIALS AND METHODS

Plant material: The young stems and leaves of pickling herb (*Echinophora tenuifolia* L. subsp. *sibthorpiana*) were collected from plants growing wild in Konya in April, May and June 2001. Temperature in these months are approximately 19–25 °C, 25–30 °C and 30–34 °C, respectively. Voucher specimens were deposited in the Department of Biology, Selçuk University, Konya, Turkey.

Recovery of the essential oils: Air-dried aerial parts of plants were hydrodistilled in a Clevenger-type apparatus for 3 h. The essential oils obtained were dried over anhydrous sodium sulphate and stored at 15 °C until used. The oil yields calculated on a dry weight basis, were 0.9%, 1.3% and 1.1%, respectively.

GC-MS analysis: The oil (5 µl) was diluted with CH_2Cl_2 (495 µl) prior to analysis. GC-MS analyses were performed by a HP 6890 coupled with a HP 5972 MSD and fitted with a 30 m × 0.32 mm capillary column coated with RTX–5MS (0.25 µm film thickness). The analytical conditions were: carrier gas He, injector temperature 250 °C, split ratio 50:1, temperature program 60–240 °C with 3 °C /min. Components were identified by comparing their retention indices and mass spectra with data in the literature (Adams 1989, McLafferty 1989).

RESULTS AND DISCUSSION

The percentage of the volatile oil constituents of pickling herb collected on different periods are listed in Table 1 in order of their retention times and indices.

Table 1
Chemical composition of the essential oils from pickling herb (*Echinophora tenuifolia* L. subsp. *sibthorpiana*) collected in different periods

Compound	April			May			June		
	%	Rt	RI	%	Rt	RI	%	Rt	RI
α-thujene	0.18	11.21	900	0.18	11.20	900	0.18	11.19	899
α-pinene	0.17	11.47	908	0.20	11.45	907	0.28	11.46	907
sabinene	0.26	13.54	964	0.24	13.54	964	0.26	13.52	964
myrcene	1.56	14.61	990	1.72	14.60	990	1.57	14.59	990
α-phellandrene	14.5	15.13	1002	21.71	15.13	1002	29.26	15.15	1002
δ–3-carene	36.98	15.46	1009	38.8	15.47	1010	30.01	15.44	1009
α-terpinene	0.06	15.78	1016	0.17	15.78	1016	0.18	15.78	1016
p-cymene	5.80	16.18	1025	2.01	16.19	1025	1.96	16.18	1025
β-phellandrene	3.11	16.37	1029	3.47	16.37	1029	4.70	16.37	1029
1,8-cineole	–	–	–	–	–	–	0.23	16.46	1031
Z-β-ocimene	0.57	17.05	1043	0.89	17.04	1042	0.59	17.03	1042
E-β-ocimene	0.54	17.55	1053	0.84	17.56	1053	0.53	17.55	1053
γ-terpinene	0.19	17.97	1061	0.31	17.98	1061	0.45	17.96	1060
terpinolene	0.44	19.36	1086	0.54	19.37	1086	0.65	19.36	1086
linalool	0.18	20.16	1100	0.12	20.15	1099	0.13	20.15	1099
1,3,8-*p*-menthatriene	0.14	20.60	1110	0.31	20.61	1110	0.44	20.60	1110
Z-*p*-menth–2-en–1-ol	0.06	21.08	1120	–	–	–	–	–	–
p-mentha–1,5-dien–8-ol	0.43	23.01	1160	0.13	23.01	1160	–	–	
p-cymene–8-ol	0.40	24.11	1182	–	–	–	–	–	–
carvacrol	0.11	29.74	1303	–	–	–	–	–	–
Z-jasmone	0.06	33.86	1396	–	–	–	–	–	–
methyl eugenol	22.10	34.28	1406	25.04	34.27	1406	25.96	34.27	1406
germacrene D	0.13	37.21	1477	0.23	37.21	1478	–	–	–

Rt = retention time, RI = retention index

The most prominent components were δ-3-carene, methyl eugenol, α-phellandrene, *p*-cymene and β-phellandrene. They constituted about 80% of total essential oil, except for April sample.

The major components of April sample were δ-3-carene (36.98%), methyl eugenol (22.10%), α-phellandrene (14.5%), *p*-cymene (5.08%) and β-phellandrene (3.11%). δ-3-Carene (38.8%), methyl eugenol (25.04%), α-phellandrene (21.71%), β-phellandrene (3.47%) and *p*-cymene (2.01%) were found as major components of May sample. The characteristic compounds of June sample were δ-3-carene (30.01%), α-phellandrene (29.26%), methyl eugenol (25.96%) and β-phellandrene (4.7%), together with *P*-cymene (1.96%) and myrcene (1.57%).

δ-3-Carene was identified as the highest main constituent for all of the samples. α-Phellandrene, β-phellandrene and methyl eugenol contents increased by the time, but *p*-cymene content was decreased.

While *Z*-*p*-menth-2-en–1-ol, *p*-cymen-8-ol, carvacrol and *Z*-jasmone amounts of oils could not establish in May and June, only 1,8-cineole could not find in April. Germacrene D was not present in June sample. *Z*-*p*-menth-2-en–1-ol was found as fairly low in oil isolated from plant material gathered in April. All the oils consisted of monoterpenic hydrocarbons and oxygenated monoterpenes, with very little amounts of sesquiterpenes. Decreasing of terpene hydrocarbons by the time is probably due to increase of oxygenated compounds during plant growth period.

As reported previously (Tanker *et al*. 1976), methyl eugenol (50%), camphene (27%), δ-3-carene (30%) and α-phellandrene (22 %) were identified as the major components of pickling herb oil. Akgül and Chialva (1989) found that an oil of *E. tenuifolia* subsp. *sibthorpiana* contained α-phellandrene (51%), methyl eugenol (25%), δ-3-carene (5.7%), β-phellandrene (5%) and *p*-cymene (4.3%). Başer *et al*. (1998) reported 58.7% methyl eugenol, 15.5% α-phellandrene and 11% *p*-cymene. Also, Özcan *et al*. (2001) determined methyl eugenol (36.61%), δ-3-carene (36.56%) and α-phellandrene (6.1%) as major constituents in essential oil distilled from plants growing wild in Konya province. Başer *et al*. (1994) detected α-phellandrene (15.5%), methyl eugenol (17.5%) and *p*-cymene (14.7%) as main components, while methyl eugenol content of samples was lower than those of results of Tanker *et al*. (1976), Başer *et al*. (1998) and Özcan *et al*. (2001). Methyl eugenol content was similar to reports of Akgül and Chialva (1989). In addition, α-phellandrene contents were higher than those of Tanker *et al*. (1976), Başer *et al*. (1994, 1998) and Özcan *et al*. (2001). Some variations may be due to the different climatical factors.

The essential aroma composition varies qualitatively and/or quantitatively with the time of harvest. Results confirm the effect of collection time on oil content and composition.

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