

Anti-inflammatory Activity of Essential Oils of *Echinophora* L. Two Species

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INTRODUCTION

Six species of the genus *Echinophora* (Apiaceae), including three endemics, are found in Turkey's flora. In Turkish, *E. tenuifolia* L. is called çörtük, çördük, tarhana otu or turşu otu while *E. tournefortii* L. is called dikenli çörtük. They have traditionally been utilized for wound healing, and their 5% infusions are used to treat stomach ulcers (Davis, 1972; Genç and Ecevit-Genç, 2014). In the present work, the essential oils (EOs) of *E. tenuifolia* and *E. tournefortii* aerial parts were obtained by hydrodistillation using a Clevenger type apparatus for 3h. Essential oils were analysed both by GC-FID and GC-MS, simultaneously. Also, *in vitro* anti-inflammatory activity was tested by 5-lipoxygenase (5-LOX) inhibitory effect of the essential oils.

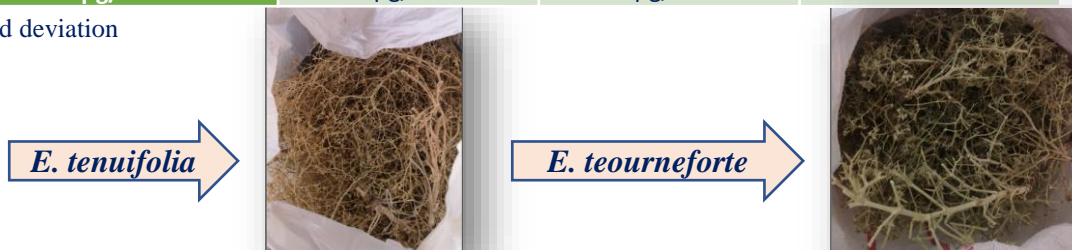
RESULTS and DISCUSSION

In this study, the essential oils (EOs) of *Echinophora tenuifolia* and *E. tournefortii* aerial parts were obtained by hydrodistillation using a Clevenger type apparatus for 3h. The yield of *E. tournefortii* and *E. tenuifolia* aerial parts were 0.12% and 0.1%. Essential oils were analysed both by GC-FID and GC-MS, simultaneously. (Z)- β -Ocimene (21.2%), α -pinene (20%) and β -pinene (16.2%) were found as the main constituent of the EO of *E. tournefortii*. The essential oil of *E. tenuifolia* was characterized with δ -3-Carene (48.6%) and methyl eugenol (34.6%).

Table 2. Enzyme inhibition activity of essential oils of *E. tournefortii* and *E. tenuifolia*

	EO of <i>E. tournefortii</i>	EO of <i>E. tenuifolia</i>	NDGA
Inhibitory activity against 5-LOX (percentage \pm S.D.) 130 μ g/mL	68.43 \pm 1.32	74.27 \pm 3.80	
	IC ₅₀ : 18.40 \pm 1.71 μ g/mL	IC ₅₀ : 40.07 \pm 4.55 μ g/mL	IC ₅₀ : 3.634 \pm 0.29 μ g/mL

*S.D.: standard deviation



According to the previous studies, methyleugenol (28.6%), α -phellandrene (43.8%), and δ -3-carene (36.6%) were the most abundant compounds in essential oils of *E. tenuifolia* (Akgül & Chialva, 1989; Baser et al., 1994). The other study, the main components of essential oil were found to be δ -3-carene (17.93%), p-cymene (8.99%), methyleugenol (16.41%), and α -phellandrene (9.33%) (Gökbulut et al., 2013). The previous research, In the oil of *E. tournefortii* subsp. *subtorpiana* were identified caryophyllene oxide (12.8%), α -pinene (9.6%) and β -pinene (5.3%) as major compounds (Baser et al., 1998). The other study, the essential oil of *E. tournefortii* main components were myrcene (29%) and -pinene (28%) (Demirci et al., 2010).

The *in vitro* anti-inflammatory activity was evaluated by 5-lipoxygenase (5-LOX) inhibitory effect of the essential oils spectrophotometrically. The anti-inflammatory activity of the essential oils of *E. tenuifolia* and *E. tournefortii* were determined as 74.72 \pm 3.83%, and 68.43 \pm 1.32% in 130 μ g/mL, respectively. The anti-inflammatory activity of essential oil of *E. tournefortii* is lower than the EO of *E. tenuifolia*. To the best of our knowledge, this is the first report on the enzyme inhibitory activity of EOs of *E. tenuifolia* and *E. tournefortii* aerial parts.

MATERIAL AND METHODS

- The aerial parts of *Echinophora* species were collected in August 2020 in Turkey. The plant material was diagnosed by Dr. Osman Tugay and Deniz Ulukuş. *E. tournefortii* and *E. tenuifolia* are kept at the Herbarium of Selçuk University in Konya, Turkey (Herbarium codes: O. Tugay 17792 and O. Tugay 17791, respectively).
- Essential oils (EOs) from aerial parts of *E. tournefortii* and *E. tenuifolia* were obtained by hydrodistillation using a Clevenger apparatus. The essential oils were analyzed by both GC-FID and GC-MS (Demirci, 2013). The results are given Table 1.
- The EOs were searched LOX-5 enzyme inhibition (Demirci et al., 2018).

Table 1. The Composition of the essential oils of *E. tournefortii* and *E. tenuifolia*

Compound	<i>E. tournefortii</i> %	<i>E. tenuifolia</i> %
α -Pinene	20.0	0.3
α -Thujene	-	0.1
Camphene	2.3	tr
Hexanal	-	tr
β -Pinene	16.2	tr
Sabinene	1.0	0.1
δ -3-Carene	-	48.6
Myrcene	12.4	2.5
α -Phellandrene	-	3.6
<i>o</i> -Cymene	-	0.2
α -Terpinene	-	0.1
Limonene	2.6	1.2
Sylvestrene	-	0.1
β -Phellandrene	1.5	0.4
2-Pentyl furane	-	tr
(Z)- β -Ocimene	21.2	tr
γ -Terpinene	-	0.4
(E)- β -Ocimene	8.0	tr
<i>p</i> -Cymene	tr	2.3
Isoterpinolene	-	0.4
Terpinolene	-	1.3
Perillene	tr	tr
5-Methyl styrene	-	tr
α - <i>p</i> -Dimethyl styrene	-	0.1
(E)- β -Ocimene epoxide	0.3	-
3-Nonanol	1.4	-
Linalool	0.3	-
1-Nonal-3-ol	0.2	-
Pinocarvone	0.2	-
Bornyl acetate	0.3	-
Myrtenol	0.2	-
trans-Pinocarveol	0.4	-
trans-Verbenol	0.6	-
<i>p</i> -Mentha-1,8-dien-4-ol	-	0.2
α -Terpineol	0.4	-
Verbenone	-	tr
Piperitenone	-	0.1
δ -Cadinene	1.1	tr
Myrtenol	tr	-
<i>p</i> -Mentha-1(7)5-dien-2-ol	-	tr
2-Methyl-6-methylene-3,7-octadiene-2-ol *	-	tr
<i>m</i> -Cymen-8-ol	-	0.2
<i>p</i> -Cymen-8-ol	-	0.3
cis-Pinocarveol	-	0.1
α -Calacorene	tr	-
Muurolo-4,10(14)diene-1-ol	0.9	-
3,4-Dimethyl-5-pentilidene-2(5H)-furanone	0.5	-
Methyleugenol	-	34.6
Isothymol	-	tr
Eugenol	-	tr
Isocarvacrol	-	tr
T-Muurolo	tr	tr
Carvacrol	-	0.1
Elemicine	-	tr
α -Cadinol	0.8	tr
Myristicine	-	0.1
Tetracosane	-	tr
Pentacosane	0.2	0.1
Phytol	0.2	tr
Hexacosane	1.0	-
Tetradecanoic acid	-	0.1
Heptacosane	-	tr
Nonacosane	0.4	tr
Hexadecanoic acid	1.1	0.1
Total	95.7	97.7

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RRI: Relative retention indices calculated against *n*-alkanes; % calculated from FID data