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ESSENTIAL OIL COMPOSITION OF THE SPICE PLANT *Echinophora tenuifolia* L. SUBSP. *sibthorpiana* TUTIN FROM TURKEY

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The genus *Echinophora* belongs to Umbelliferae and is represented in the Flora of Turkey by six species, three of which are endemic. *Echinophora* species grow naturally in low rainfall areas of Anatolia. *E. tenuifolia* L. subsp. *sibthorpiana* (Guss.) plants are biennial and 20–45 cm high and have brush growing habitus [1].

Fresh or dried herb is used in folk medicine for wound healing and gastric ulcers [2]. It is also used as flavoring agent for soup, meat, and dairy products [3].

The yield of essential oils obtained by hydrodistillation from aerial parts of two *Echinophora tenuifolia* L. subsp. *sibthorpiana* were found to be 0.2 and 0.23% in plants collected during rosette phenological period and dried room temperature conditions in the research. Essential oil yield was 0.4% in plants collected at pre-flowering period. Plant ontogeny is one of the most important factors affecting essential oil accumulation in essential oil plants [4]. Because the leaf content of plants decreases after pre-flowering periods and they have no economic value as spice and herbal tea after the periods, the plants were collected from rosette phenological periods to pre-flowering periods. Therefore, we examined the essential oil composition of the two phenological periods. From previous research, the essential oil content of *Echinophora tenuifolia* L. subsp. *sibthorpiana* in Turkey was between 1.01 and 1.73% [2].

The composition and relative percentages of the essential oil of *Echinophora tenuifolia* L. subsp. *sibthorpiana* were elucidated by the aid of GC-MS analysis (Table 1). Components were grouped according to similarity of their chemical structure. The essential oil components identified in the research were 15 monoterpenes; three of them are oxygenated monoterpenes, six aldehydes, five aromatic components, three sesquiterpenes, and 15 other components. It was determined that methyl eugenol, an aromatic compound, was the most abundant component in both samples, making up 52.4 and 62.9% of the total area in sample I and II, respectively. Another important component was 1-phellandrene with 30.4% in sample I, while *p*-cymene (7.8–9.1%) and δ-3-carene (3.3–5.7) were other dominant components following methyl eugenol in sample II.

Literature review showed variation among the essential oil compositions of different *Echinophora* spp. species oil [2]. The essential oil compositions of *Echinophora tenuifolia* subsp. *sibthorpiana* growing in Manisa, Aegean region of Turkey, were characterized by a high percentage of α-phellandrene (51.0%), methyl eugenol (24.7%), δ-3-carene (5.7%), β-phellandrene (5.0%), and *p*-cymene (4.3%) [3]. However, Baser et al. [2] identified the essential oil composition of the same species growing in Van (East Turkey), having methyl eugenol (58.7%) as the main component with other components such as α-phellandrene (15.5%) and *p*-cymene (11.0%). Although our results were similar to Baser et al. [2] since the main component was methyl eugenol, the essential oil composition of *Echinophora tenuifolia* subsp. *sibthorpiana* shows chemical variability within the same subspecies, and it seems to depend on the genetic structure of the plants and on climatic conditions [5].

Identification of oil components was accomplished based on their mass spectral fragmentation patterns (WILEY and NIST database/ChemStation data system). The quantification of the components was made on the basis of their peak areas in total ion chromatograms.

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TABLE 1. Essential Oil Composition of Two *Echinophora tenuifolia* L. subsp. *sibthorpiana*

Component	Rt	Sample I	Sample II	
		vegetative I	vegetative II	pre-flowering II
Monoterpenes				
α-Thujene	4.12	0.2	-	-
α-Pinene	4.28	0.3		
Sabinene	5.15	0.3	-	-
β-Cymene	5.16	-	0.5	0.5
Myrcene	5.52	0.6	0.2	0.2
1-Phellandrene	**6.07**	**30.4**	-	-
δ-3-Carene	**6.08**		**5.7**	**3.3**
***p*-Cymene**	**6.69**		**7.8**	**9.1**
trans-β-Ocimene	7.17	0.1	-	-
δ-Terpinene	7.54	1.1	-	-
α-Terpinolene	8.47	1.6	0.2	-
4,4-Epoxy-1-isopropyl-4-methyl-1	12.16	-	0.2	-
Oxygenated monoterpenes				
Linalool L	9.30	-	-	2.5
para-Cymen-8-ol	13.03	-	0.5	1.0
Pulegone	14.40	-	-	0.7
Aldehydes				
Decanal	12.87	0.6	-	-
2-Decenal	15.28	0.9	-	
Tetradecanal	17.04	0.1	-	-
2-Undecanal	19.53	0.2	-	-
Veratraldehyde	25.08	-	1.1	1.0
9-Octadecenal	31.70	0.1	-	-
Aromatic components				
Phenol,2-(1,1-dimethylethyl)-	17.48	-	1.3	-
Thymol	18.99	0.6	-	-
Eugenol	19.96		0.5	0.2
iso-Eugenol	20.01		0.3	0.1
Methyl eugenol	**22.16**	**52.4**	**62.9**	**41.8**
Sesquiterpenes				
Germacrene D	24.15	0.1	-	
β-Selinene	24.47	-	0.6	-
β-Ionone	24.36	0.2	-	-
Others				
1-Isopropyl methylbenzene	8.54	-	-	0.1
1-Methyl-4-(1-methylethen)benzene	8.77	-	0.2	0.4
p-Mentha-1,5,8-triene	9.45	0.1	-	-
Cyclopentane,1,2-dimethyl-3-methyl	11.68		-	0.6
α-Phellandrene epoxide	**13.47**	0.6	0.7	1.1
Anisyl acetone	25.58	-	0.1	-
Undecanoic acid	25.64	0.1	-	-
Benzene,1,2,3-trimethoxy-5-(2-propenyl)	27.51	-	-	0.2

TABLE 1. (continued)

Component	Rt	Sample I	Sample II	
		vegetative I	vegetative II	pre-flowering II
Others				
Dodecanoic acid	29.34	0.2	-	-
β-Maaliene	29.93	-	-	0.1
4,5-Dimethoxy-(2-propenyl)phenol	30.32	-	0.3	0.2
1-*H*-Benzocyclohepten-7-ol,2,3,4,4a	31.54	-	-	0.3
2-Propenal,3-(3,4-dimethoxyphenyl)	36.61	-		0.8
Neophytadiene	37.33	0.1	-	-
Phytol	46.56	0.1		
Oil content, mL/100 g		0.20	0.23	0.40

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