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CHEMICAL COMPOSITION OF THE ESSENTIAL OIL OF *Teucrium hyrcanicum* AND *T. chamaedrys* L. SUBSP. *chamaedrys* FROM IRAN

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The genus *Teucrium* (Lamiaceae) is comprised of about 340 species widespread over the world. In the Flora Iranica, this genus is represented by 12 species [1]. Various species of the genus *Teucrium* are used as antiseptic, antipyretic, anti-inflammatory, antispasmodic, antinociceptive, anti-rheumatic, anthelmintic, diuretic, hypoglycemic, diaphoretic, and tonic in folk medicine [2].

Phytochemically, several diterpenoids, diterpenelactones, triterpenoids, flavonoids, and minor phenolic compounds have already been isolated from this plant and analyzed [3–7].

A literature survey on the essential oil composition of some *Teucrium* species revealed that in *T. melissoides*, *T. polium* subsp. *capitatum*, *T. haenseleri,* and *T. capitatum*, monoterpenes such as α-pinene, β-pinene, *p*-cymene, and limonene were the main constituents. Also in the oils of *T. oriental* L. var. *oriental*, *T. fruticans*, *T. abutiloides*, *T. salviastrum*, *T. turredanum,* and *T. betonicum*, sesquiterpenoids such as β-caryophyllene, germacrene D, and α-humulene were reported to be the major components [8–15].

In this paper the essential oil composition of *Teucrium hyrcanicum,* which is an endemic plant related to the Caspian sea area, is reported for the first time [16].

Thirty-six components were identified in the oil of *T. hyrcanicum* representing 93.1% of the oil, and also forty-two components were characterized in the oil of *T. chamaedrys* ssp. *chamaedrys* representing 94.1% of the oil.

The identified components with their percentages are given in Table 1. These components are listed in order of their elution from the DB-5 column.

As it is shown, the oil of *T. hyrcanicum* consists of oxygenated monoterpenes (16.3%), sesquiterpene hydrocarbons (32.3%), and oxygenated sequiterpenes (24.9%). Hexahydrofarnesyl acetone (12.7%), linalool (11.7%) and *E*-β-farnesene (10.7%), dihydroedulane (8.6%), and *ar*-curcumene (8.5%) were the main constituents in this oil. As a result, in the oil of *T. hyrcanicum*, sesquiterpenes (61.7%) predominated over monoterpenes (16.3%).

In contrast, the oil of *T. chamaedrys* ssp. *chamaedrys* is rich in sesquiterpenes (63.8%), with α-muurolene (15.3%), β-caryophyllene (15.0%), and *Z*-β-farnesene (7.6%) as the major components. Among the identified monoterpenes (26.5%) in this oil, α-pinene (7.9%), β-pinene (5.9%), and limonene (5.1%) are the most abundant.

The composition of the essential oil of *T. chamaedrys* (subspecies not referred to) has been reported in the literature. Some differences in the quantity and quality of the oil composition may be due to different subspecies, chemotype, and geographic and climatic factors. For example, in two of them, germacrene D and β-pinene were reported as the main constituents [17, 18].

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TABLE 1. Composition of the Essential Oils of *T. hyrcanicum* (A) and *T. chamaedrys* ssp. *chamaedrys* (B)

Compound	RI[a]	A, %	B, %	Compound	RI[a]	A, %	B, %
α-Thujene	929	-	0.1	β-Bourbonene	1392	-	2.3
α-Pinene*	939	-	7.9	*n*-Tetradecane	1399	0.8	-
α-Camphene	952	-	0.5	α-Cedrene	1402	0.9	-
1-Octen-3-ol	974	2.6	0.6	*cis*-α-Bergamotene	1416	0.5	-
Sabinene	976	-	0.2	β-Caryophyllene*	1426	2.1	15.0
β-Pinene*	980	-	5.9	*Z*-β-Farnesene	1443	-	7.6
Myrcene*	991	-	0.9	β-Sesquiphellandrene	1453	0.8	-
3-Octanol	993	0.3	-	*E*-β-Farnesene	1455	10.7	
1,8-Cineol*	1029	0.7	-	α-Humulene	1458	-	1.6
Limonene*	1032	-	5.1	*E*-α-Farnesene	1467	-	1.3
E-β-Ocimene*	1047	-	0.3	Germacrene D	1475	-	0.2
γ-Terpinene	1044	-	0.2	*ar*-Curcumene	1479	8.5	-
Linalool*	1096	11.7	2.6	*trans*-β-Ionone	1480	3.4	-
Undecane	1108	0.9	-	α-Muurolene	1490	-	15.3
1-Octen-3yl acetate	1110	-	0.3	*n*-Pentadecane	1499	2.9	-
Camphor*	1138	1.4	0.6	Germacrene A	1503	-	3.9
Verbenol	1142	-	0.1	β-Bisabolene	1505	2.3	1.4
E-Nonenal	1160	0.7	-	β-Himachalene	1513	4.2	-
Borneol*	1162	-	1.2	α-Cadinene	1523	-	3.8
4-Terpineol	1173	-	0.2	α-Calacorene	1538	-	0.1
Methyl salicylate	1175	-	0.2	Germacrene B	1546	0.4	-
α-Terpineol	1186	0.6	0.4	*cis*-3-Hexenyl benzoate	1560	-	0.7
n-Decanal	1185	0.5	0.1	Spathulenol	1576	-	2.1
n-Dodecane	1200	0.4	-	Caryophyllene oxide*	1584	2.1	2.3
β-Cyclocitral	1218	0.8	-	Viridiflorol	1594	-	0.6
p-Menth-4-en-3-one	1229	0.3	-	Gossonorol	1628	2.6	-
Dihydroedulan	1278	8.6	-	α-Cadinol	1648	-	2.2
Bornyl acetate	1280	-	0.3	Khusinol	1675	-	0.6
Carvacrol*	1288	0.8	-	*n*-Heptadecane	1699	0.2	-
n-Tridecane	1299	1.3	-	*n*-Octadecane*	1800	0.2	-
δ-Elemene	1341	-	0.2	6,10,14-Trimethyl	1831	-	1.2
α-Longipinene	1358	1.9	-	pentadecanone			
β-Damascenone	1376	-	0.3	Hexahydrofarnesyl acetone	1841	12.7	-
α-Copaene	1380	-	3.0	Hexadecanoic acid	1937	1.2	0.7
1,8-Dimethylnaphthalene	1391	2.20	-	Phytol	1949	0.9	-

[a]RI: retention indices on DB5 column.

*Co, co-injection with an authentic sample.

Identification method: RI, MS.

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