

## CHEMICAL COMPOSITION OF *Thymus punctulosus* ESSENTIAL OIL

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The genus *Thymus* (thyme, Lamiaceae) is popular in traditional medicine of many countries and nationalities as a valuable medicinal raw material [1, 2]. Extracts and essential oils of *Thymus* representatives exhibit antimicrobial [3, 4], antioxidant [5], and spasmolytic [6, 7] activity. Long-term investigations of the chemical composition of thymes were reported in the review [1]. Thymes with limited distributions, in particular, endemic ones, are of great interest.

*Thymus punctulosus* Klok. is a petrophyte, mountain-steppe, and mountain-forest-steppe plant endemic to the South Urals and southern part of the Central Urals (Russia). It is a woody dwarf semishrub with one or frequently several multi-year trunks and branching descending axial runners.

Samples of plant raw material were collected from natural populations of *T. punctulosus* during the first decade of July 2008 [population I located in Troitsk Region, Chelyabinsk Oblast (Southern Urals) on limestone outcroppings along the Ui River; population II, in Kizil Region, Chelyabinsk Oblast (Southern Urals) on limestone outcroppings along the Ural River]. Herbarium specimens of *T. punctulosus* are preserved in the herbarium of the Institute of Plant and Animal Ecology, Ural Branch, Russian Academy of Sciences (SVER), Ekaterinburg. Essential oil was obtained by steam distillation from air-dried raw material. A weighed portion of raw material (50.0 g) was loaded into a 1-L flask, treated with water (0.5 L), and refluxed for 3 h. The yield of essential oil was 1.2%. Essential oil was analyzed on a Trace DSQ (Thermo) GC–MS using electron-impact ionization (70 eV) in mass range 50–650 amu. The analytical conditions were column thermostat temperature programmed from 40°C (4 min) at 4°C/min to 200°C; quartz capillary column 30 m × 0.32 mm × 0.25 μm (TR-5MS, Thermo); He carrier gas (99.9% pure) at flow rate 0.6 mL/min; flow division 1:50; vaporizer temperature 280°C; detector, 200°C.

Table 1 lists the GC–MS results for *T. punctulosus* essential oil. The chemical composition of *T. punctulosus* has not been previously studied. The principal constituents of its essential oil for population I were *trans*-nerolidol (24.83%) and caryophyllene oxide (19.04%); for population II, *trans*-nerolidol (61.39%). Sesquiterpenes made up 71.88 and 82.97% of *T. punctulosus* essential oils from population I and II, respectively. Bicyclic (38.57%) and acyclic (23.96%) sesquiterpenes had the greatest contents in population I; acyclic sesquiterpenes (59.51%), in population II. The differences in the chemical composition of essential oils of *T. punctulosus* from different populations might have been caused by genetic or ecological factors, as was noted earlier for *T. spinulosus* [8].

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TABLE 1. Composition of *T. punctulosus* Essential Oil

Compound	R <sub>1</sub>	Constituent content of total essential oil, %		Compound	R <sub>1</sub>	Constituent content of total essential oil, %	
		I	II			I	II
Camphene	901	0.45	0.15	Geranylacetate	1379	2.78	0.74
$\beta$ -Myrcene	972	0.31	0.15	$\beta$ -Burbonene	1384	1.62	0.94
<i>o</i> -Cymene	1024	0.45	–	1,3,5-Trimethylenecycloheptane	1397	0.26	–
1,8-Cineol	1032	3.08	1.86	Caryophyllene	1422	3.48	0.93
<i>cis</i> - $\beta$ -Ocimene	1045	0.21	0.31	Aromadendrene	1463	0.26	0.15
Linalool	1098	3.37	3.91	Germacrene D	1485	1.76	1.29
Camphor	1154	2.93	2.37	Ionol	1500	4.10	1.17
Borneol	1179	1.30	0.95	$\delta$ -Cadinene	1518	3.34	1.15
Terpinen-4-ol	1186	3.93	1.60	<i>cis</i> - $\alpha$ -Bisabolene	1539	1.33	0.38
$\alpha$ -Terpineol	1199	1.36	0.79	<i>trans</i> -Nerolidol	1560	23.71	59.20
<i>cis</i> -Geraniol	1227	0.28	0.31	Caryophyllene oxide	1591	18.18	1.86
Neral	1245	0.89	0.39	Spatulenol	1640	–	10.00
Linalylacetate	1246	0.45	–	Cubenol	1645	1.85	0.87
<i>trans</i> -Geraniol	1255	0.76	0.48	$\tau$ -Cadinol	1649	5.78	2.95
Citral	1275	2.01	1.13	$\alpha$ -Cadinol	1664	2.24	0.60
Bornylacetate	1285	1.40	0.30	Eudesm-7(11)-en-4-ol	1677	3.70	1.17
$\gamma$ -Elemene	1329	0.28	0.28	Farnesol	1703	0.25	0.31
Nerylacetate	1358	1.23	0.58				

R<sub>1</sub>: retention index on TR-5MS column.

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