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COMPOSITION OF ESSENTIAL OILS OF LEAVES, STEMS, AND ROOTS OF *Thymus kotschyanus* VAR. *pseuderiophorus* GROWING WILD IN IRAN

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Essential oils are complex mixtures of volatile substances generally present at low concentration that are widely used in the perfume industries, in the pharmaceutical sector, and in the food and human nutrition field. Before such substances can be analyzed, they have to be extracted from the matrix. One of these methods is conventional hydrodistillation. In this study we distilled essential oils from leaves, stems, and roots of *Thymus kotschyanus* var. *pseuderiophorus* Rech. f. p. p from wild populations in the north of Iran and then analyzed it by GC-MS.

The genus *Thymus* includes about 350 species worldwide and is distributed mainly in temperate Eurasia. In Iran 14 species are present, four being endemic [1, 2]. The chemical composition of the essential oils of various *Thymus* species have been extensively studied [3–16]. Water-distilled oil obtained from the aerial parts of *T. kotschyanus* growing wild in the north of Iran has been reported. The major compounds were thymol (31.8%), carvacrol (24.3%), *p*-cymene (12.3%), and 1,8-cineole (5.8%) [15]. However, to the best of our knowledge no report on the oils from the leaves, stems, and roots of this plant exists, leading us to the present work.

The percentage composition of the oils is given in Table 1 in order of their elution from a DB-5 column.

In *T. kotschyanus* Boiss. & Hohen var. *pseuderiophorus* Rech. f. p. p we identified 14 components representing 98.4%, 20 constituents representing 99.3%, and 24 compound representing 98.3% of the leaf, stem, and root oils, respectively.

As can be seen from the above information, the oils from leaves, stems, and roots of *T. kotschyanus* var. *pseuderiophorus* Rech. f.p.p are rich in oxygenated monoterpenes (79.2%, 84.6%, 80.7%) and contain small amount of monoterpene hydrocarbons and very few sesquiterpenoids.

Comparison of these results with previous investigations on oils of the genus *Thymus* showed that they were also dominated by monoterpenes.

The dominant compound in the oil of *T. serrulatus* [3], *T. carnosus* [4], *T. transcaspicus* [5], *T. vulgaris* [6], *T. daenensis* [7], *T. fallax* [8], and *T. eriocalyx* [9] was thymol (49.0%, 36.1%, 56.4%, 39.1%, 73.9%, 65.9%, and 43.1%, respectively).

The oil of *T. serpyllum* consisted mainly of γ-terpinene (21.9% and 22.7%), *p*-cymene (21.1% and 20.7%), and thymol (18.7% and 18.7%) before flowering and at the full flowering stage, respectively [10]. In the essential oil of *T. citriodorus* cultivated in Iran, geraniol (54.4%), geranial (13.9%), and neral (10.1%) were the main constituents [11].

The major compounds in *T. persicus* oil were found to be carvacrol (39.0% and 27.1%), geraniol (15.7% and 9.4%), *p*-cymene (7.5% and 10.2%), and thymol (6.5% and 11.9%) before flowering and at the full flowering stage, respectively [12].

In another study, pulegone (18.7%), isomenthone (17.8%), and thymol (14.9%) were the main constituents in *T. kotschyanus* oil, and the main compounds in the *T. pubescens* oil were found to be carvacrol (32.1%), thymol (19.1%), and α-terpineol (14.6%) [13].

Seventy-eight components were identified comprising 88.0% and 91.3% of the total components in the oils, respectively. 1,8-Cineole (21.5%) was the dominant compound in *T. haussknechtii* oil and thymol (47.5%) was the main component in the oil of *T. kotschyanus* var. *kotschyanus* [16].

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TABLE 1. Percentage Composition of Leaf, Stem, and Root Oils of *Thymus kotschyanus* var. *pseuderiophorus* Rech. f. p. p

Compound	RI	Leaf	Stem	Root	Compound	RI	Leaf	Stem	Root
α-Thujene	930	2.2	1.3	0.1	Borneol	1169	8.9	11.8	4.8
α-Pinene	939	–	–	5.3	4-Terpineol	1178	–	–	0.4
Camphene	954	1.6	1.4	3.3	*endo*-Fenchyl acetate	1220	–	–	1.6
Sabinene	975	–	0.2	0.2	Bornyl acetate	1289	–	–	0.4
β-Pinene	979	0.3	–	–	Thymol	1290	–	–	2.0
Myrcene	991	1.4	0.8	1.1	Carvacrol	1299	69.5	71.6	71.3
α-Phellandrene	1003	0.3	0.2	0.3	Daucene	1382	–	–	0.5
α-Terpinene	1017	–	0.8	0.3	β-Caryophyllene	1419	–	0.4	0.8
p-Cymene	1025	7.3	4.2	2.2	(*E*)-Cadina-1(6),4-diene	1477	–	0.1	–
Limonene	1029	–	–	0.7	β-Bisabolene	1506	–	0.8	0.2
1,8-Cineole	1031	–	–	0.1	α-Bisabolene	1507	0.9	1.0	0.4
γ-Terpinene	1060	4.1	2.2	1.2	Caryophyllene oxide	1583	0.1	0.3	–
cis-Sabinene hydrate	1070	0.8	0.6	–	Carotol	1595	–	–	0.4
α-Terpinolene	1089	0.4	0.2	–	τ-Cadinol	1640	0.6	0.8	0.4
Linalool	1097	–	0.2	–	Total		98.4	99.3	98.3
Camphor	1146	–	0.4	0.3	Oxygenated monoterpenes		79.2	84.6	80.7

Plant Material. Leaves, stems, and roots of *T. kotschyanus* var. *pseuderiophorus* Rech. f. p. p were collected in May 2008 from Firoozkooh, Province of Tehran. Voucher specimens have been deposited at the Herbarium of the Research Institute of Forest and Rangelands (TARI), Tehran, Iran.

Oil Isolation. Dry leaves (100 g), stems (120 g), and roots (150 g) of *T. kotschyanus* var. *pseuderiophorus* were subjected to separate hydrodistillation for 3 h using a Clevenger-type apparatus. After decanting and drying over anhydrous sodium sulfate, the corresponding yellowish colored oils were recovered from the leaves, stems, and roots in a yield of 0.82%, 0.41% and 0.27% (w/w), respectively.

Analysis. GC analysis of the oils was performed on a Shimadzu 15A gas chromatograph equipped with a split/splitless injector (250°C) and FID detector (250°C).

Nitrogen was used as carrier gas (1 mL/min) and a DB-5 capillary column was used (30 m × 0.25 mm, film thickness 0.32 μm). The column temperature was kept at 60°C for 3 min and then heated to 220°C with a 5°C/min rate and kept constant at 220°C for 5 min.

The relative percentage amount were calculated from the peak area using the Shimadzu C-R4A chromatopac processor without the use of correction factors.

GC/MS analysis was performed using a Hewlett-Packard 6890/5973 GC/MS instrument with a HP-5MS column (30 m × 0.25 mm, film thickness 0.32 μm). The column temperature was kept at 60°C for 3 min and then heated to 220°C with a 5°C/min rate and kept constant at 220°C for 5 min. The flow rate of He as carrier gas was (1 mL/min). Mass spectra were taken at 70 eV. Identification of the constituents of each oil was made by comparison of their mass spectra and retention indices (RI) with those given in the literature and those of authentic samples [17].

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REFERENCES

1. K. H. Rechinger, Thymus, in: *Flora Iranica Labiatae*, No. 150. Edits, K. H. Rechinger and I. C. Hedge, Akademische Druck and Verlagsanstalt, Graz, Austria, 1982, pp. 535–552.
2. V. Mozaffarian, *A Dictionary of Plant Names,* Farhang Moaser Publishers, Tehran, 1996.

3. N. Asfaw, H. J. Storesund, L. Skattebol, F. Tonnesen, and A. J. Aasen, *Flav. Fragr. J*., **15**, 123 (2000).
4. F. Sefidkon, F. Askari, and S. A. Mirmostafa, *J. Essent.Oil Res*., **13** (3), 192 (2001).
5. R. Miri, M. Ramezani, K. Javidani, and L. Ahmadi, *Flav. Frag. J.*, **17** (4), 245 (2002).
6. M. Mirza and Z. F. Baher, *J. Essent. Oil Res*., **15** (6), 404 (2003).
7. S. E. Sajjadi and M. Khatamsaz, *J. Essent. Oil Res*., **15** (1), 34 (2003).
8. M. M. Barazandeh, *J. Essent. Oil Res*., **16** (2), 101 (2004).
9. R. Kalvandi, F. Sefidkon, M. Atri, and M. Mirza, *Flav. Frag. J.*, **19** (4), 341 (2004).
10. F. Sefidkon, M. Dabiri, and S. A. Mirmostafa, *J. Essent. Oil Res*., **16** (3), 184 (2004).
11. R. Omidbaigi, F. Sefidkon, and M. Hejazi*, Flav. Frag.J.*, **20** (2), 237 (2005).
12. F. Sefidkon, M. Dabiri, and S. A. Mirmostafat, *J. Essent. Oil Res*., **14** (5), 351 (2002).
13. K. Morteza-semnani, B. Rostami, and M. Akbarzadeh, *J. Essent. Oil Res*., **18** (3), 272 (2006).
14. A. Rustaiyan, S. Masoudi, A. Monfared, M. Kamalinejad, T. Lajevardi, S. Sedaghat, and M. Yari, *Planta Med*., **66**, 197 (2000).
15. M. Abousaber, A. HadjAkhoondi, and A. Shafiee, *J. Essent.Oil Res*., **14** (3), 154 (2002).
16. E. Bagci and K. H. C. Baser, *Flavour Fragr. J.*, **20** (2), 199 (2005).
17. R. P. Adams, *Identification of Essential Oil Component by Gas Chromatography/Mass Spectroscopy*, Allured Publ. Corp., Carol stream, IL, 1995.