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Note

NOTE

Chemical composition of *Thymus vulgaris* L. (thyme) essential oil from the Rio de Janeiro State (Brazil)

ALEXANDRE PORTE^{1*} and RONOEL L. O. GODOY²

¹Instituto de Tecnologia – Universidade Federal Rural do Rio de Janeiro, BR 465, km 47, Seropédica, Cep 23890-000, Rio de Janeiro and ²Embrapa Agroindústria de Alimentos, Avenida das Américas, 29501, Guaratiba, Cep 23020-470, Rio de Janeiro, Brazil

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Abstract: The essential oil from fresh leaves of *Thymus vulgaris* L. from Rio de Janeiro State, Brazil, was isolated by hydrodistillation and analyzed through a combination of GC and GC/MS. Compounds representing 95.1 % of the oil were identified. Thirty-nine constituents were detected, of which twenty-eight were identified according to their chromatographic retention indices and mass spectra. The major constituents of the oil were thymol (44.7 %), *p*-cymene (18.6 %) and γ -terpinene (16.5 %).

Keywords: *Thymus vulgaris*; thyme; essential oil; thymol; *p*-cymene.

INTRODUCTION

Thymus vulgaris L., as *Rosmarinus officinalis* L. (rosemary) and other species of the Lamiaceae family, is native of Mediterranean countries, growing abundantly over wide areas in France, Spain, Portugal, Italy, Algeria and Morocco.¹ Moreover, it is also cultivated in other parts of Europe and North America, North Asia and Oceania.²

Thyme is employed to season and suppress offensive odors, such as trimethylamine odor, in foods.^{2,3} The essential oil is well recognized for its medicinal properties in the treatment of bronchitis, whooping cough and tooth-ache. The herb or its infusion is also given for several disorders. It is possible that the flavonoids present may be important, such as in the spasmolytic activity of the smooth muscles of the guinea pig ileum and trachea.^{2,3} It was found that the main components of the essential oil were thymol and carvacrol and that it had antimicrobial activity against fungi (some aflatoxins producers), viruses, helminths, Gram-positive bacteria (included *C. botulinum*) and Gram-negative bacteria.^{3–8}

The aim of this study was to examine the composition of the essential oil of thyme from Rio de Janeiro, Brazil.

* Corresponding author. E-mail: alexandre_porte@yahoo.com.br

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EXPERIMENTAL

Plant material

The botanical material was collected in Petrópolis, Rio de Janeiro, Brazil. A voucher specimen of this plant has been deposited in the herbarium of the Departamento de Botânica do Instituto de Biologia da Universidade Federal Rural do Rio de Janeiro (RBR 4239).

Isolation of the essential oil

Fresh leaves were subjected to hydrodistillation in a Clevenger-type apparatus for 93 min, which gave the essential oil.

Gas chromatography

Chemical analysis was performed on a Hewlett–Packard 5890 series II gas chromatograph fitted with a HP-5 capillary column (25 m×0.20 mm, film thickness 0.33 µm). The carrier gas was hydrogen at a flow of 1.0 ml min⁻¹ and a split ratio 1:100. The column temperature was programmed from 60–250 °C at 2.0 °C min⁻¹; the injector temperature was 250 °C and the detector (FID) temperature was 280 °C.

Gas chromatography/mass spectroscopy

The analysis was performed on a Hewlett–Packard 5890 series II gas chromatograph coupled to a HP 5970 mass selective detector using a fused silica capillary column HP-5 (25 m×0.20 mm, film thickness 0.33 µm). The column temperature was programmed from 60–250 °C at 2.0 °C min⁻¹ using helium as the carrier gas at a flow rate of 1.0 ml min⁻¹. The ion source temperature was 300 °C and the electron energy 70 eV. Identification of components was based on comparison of their mass spectra with those found in the literature,⁹ on retention indices,⁹ the mass spectrometry data bank (NIST) and a computer search of the Wiley library.

RESULTS AND DISCUSSION

The yield of thyme essential oil from the Rio de Janeiro plant material was 1.1 % based on the dry mass. Other Brazilian work, but from South Brazil, found a yield of 0.25 %.¹⁰ The compounds identified in the oil sample are presented in Table I.

GC and GC/MS analyses of the oil resulted in the identification of 28 constituents, accounting for 95.1 % of the oil. The chemical composition of the oil is characterized by high amounts of thymol, *p*-cymene and γ -terpinene. This composition is different to those found in some oils from Italy, Spain, France, Poland and New Zealand but is in accordance with the Food Chemical Codex requirement (*i.e.*, not less than 40 %, by volume of phenols).^{11–18} Therefore, the thyme essential oil analyzed in this study was a thymol chemotype, while the essential oil from the above-mentioned countries could have been carvacrol chemotypes or other chemotypes, assuming that the essential oils investigated in these countries were obtained from *Thymus vulgaris*, and not other species (*e.g.* *T. zygis* – very spread in Spain and Portugal, *T. panonicus* – common in Poland or *T. satureoides*).^{11,12}

The high concentration of thymol suggests that the thyme essential oil from Rio de Janeiro could have desirable phenols values for international trade, prin-

cipally, if we will consider that plant material was collected during the Brazilian spring (*i.e.*, not flowering plants). In spring, the values of thymol trend to increase and the values of *p*-cymene and γ -terpinene are at their lowest, as pointed by other workers.^{19,20}

TABLE I. Chemical composition of the essential oil from leaves of *Thymus vulgaris* L. from Rio de Janeiro State, Brazil

Compound	Content, %
1,3-Octadiene	0.3
1,7-Octadiene	0.1
2,4-Dimethyl-2,4-heptadiene	1.5
α -Pinene	0.8
Camphene	0.3
Sabinene	0.1
<i>para</i> -Menthene-1	1.8
<i>para</i> -Menthene-3	0.1
Myrcene	2.4
α -Phellandrene	0.3
α -Terpinene	1.8
<i>p</i> -Cymene	18.6
Limonene	0.8
(<i>Z</i>)- β -Ocimene	0.1
(<i>E</i>)- β -Ocimene	0.1
γ -Terpinene	16.5
Mentha-3,8-diene	0.4
α -Terpinolene	0.2
<i>p</i> -Cimenene	0.1
Borneol	0.5
<i>trans</i> -Dihydrocarvone	0.2
Thymol methyl ether	0.1
Thymol	44.7
Carvacrol	2.4
Carvacrol acetate	< 0.1
β -Caryophyllene	0.8
Calamenene	< 0.1
δ -Cadinene	0.1
Total	95.1

Due to the extent of the inhibitory effect of the oil on micro-organisms being attributed to the presence of aromatic nuclei containing a polar functional group, especially the thymol phenol group, it can be awaited that the studied essential oil would exhibit good antimicrobial properties, but this was not evaluated.

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ИЗВОД

ХЕМИЈСКИ САСТАВ ЕТАРСКОГ УЉА БИЉКЕ *Thymus vulgaris* L.
ИЗ ДРЖАВЕ РИО ДЕ ЖАНЕИРО, БРАЗИЛALEXANDRE PORTE¹ и RONOEL L. O. GODOY²¹Instituto de Tecnologia – Universidade Federal Rural do Rio de Janeiro, BR 465, km 47, Seropédica, Cep 23890-000, Rio de Janeiro и ²Embrapa Agroindústria de Alimentos, Avenida das Américas, 29501, Guaratiba, Cep 23020-470, Rio de Janeiro, Brazil

Етарско уље свежих листова биљке *Thymus vulgaris* L. из државе Рио де Жанеиро, Бразил, изоловано је дестилацијом воденом паром и анализирано комбинацијом GC и GC/MS. Идентификована једињења чине 95,1 % уља. Детектовано је 39 састојака, од којих је 28 идентификовано на основу хроматографских ретенционих индекса и масених спектра. Главни састојци уља су били тимол (44,7 %), *p*-цимен (18,6 %) и γ -терпинен (16,5 %).

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