Journal of Applied Research on Medicinal and Aromatic Plants xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Journal of Applied Research on Medicinal and Aromatic Plants

journal homepage: www.elsevier.com/locate/jarmap

Composition of essential oil compounds from different populations of *Thymus caramanicus* Jalas

Mahdi Bigdeloo[a,*], Javad Hadian[b], Vahideh Nazeri[a]

[a] Department of Horticultural Sciences, Faculty of Agriculture Sciences and Engineering, University of Tehran, Karaj, 31587, Iran
[b] Department of Agriculture, Medicinal Plants and Drugs Research Institute, Shahid Beheshti University, Evin, Tehran, Iran

ARTICLE INFO

Keywords:
Essential oils
Thymus caramanicus
Lamiaceae
Phenolic compounds
Chemotypes

ABSTRACT

Thymus caramanicus Jalas. (Lamiaceae) is an endemic herb growing wild in Iran. Essential oils from the aerial parts of *T. caramanicus*, at full flowering stage of seven locations in three provinces in Iran were obtained by hydrodistillation. The essential oils yield was 0.41–2.9% (w/w). About 97.9–99.9% of the total constituents were detected by gas chromatography and gas chromatography–mass spectroscopy analyses, of which oxygenated monoterpenes (87.5–97.5%) were the main group of the constituents in all populations. The main components of the essential oils were carvacrol (19.8–96.2%), thymol (0.6–61.8%), and p-cymene (0.2–8.2%). Therefore, the phenolic compounds, including carvacrol and thymol, were the most abundant constituents in the oils of all populations, which seem to play a significant role in the adaptation of this species to its environment that is characterized by dry hot climate and calcareous, stony soils.

1. Introduction

The genus *Thymus* L. is well known as medicinal herbs because of their biological and pharmacological properties (Stahl-Biskup and Saez, 2002). It belongs to the Lamiaceae family, and include of about 215 species in the world (Morales, 2002). Fourteen *Thymus* species have been reported in the Flora Iranica, four of them are known to be endemic (Jalas, 1982; Jalas, 1982; Stahl-Biskup and Saez, 2002). *Thymus caramanicus* is one of the endemic species and generally grows on dry, limestone rocky slopes poor in mineral content. It's mostly distributed in central parts of Iran, above 2000 m altitude (Rechinger, 1982). In the Iranian folk medicine, leaves of *T. caramanicus* are used in the treatment of skin disorders, rheumatism and as an antibacterial agent (Zargari, 1990). The medicinal properties of the genus *Thymus* have constructed it one of the most popular medicinal plants (Nickavar et al., 2005). Essential oils and extracts of *Thymus* species are widely used in pharmaceutical, cosmetic, and perfume industries as well as flavoring and preservation of several food products (Nejad Ebrahimi et al., 2008). It is believed that these properties are caused to some extent by the constituents. So, there is a considerable research interest to compositional analysis of *Thymus* essential oil and extract (Stahl-Biskup and Saez, 2002). The chemical polymorphism of *Thymus* essential oils is a general phenomenon (Stahl-Biskup, 1991). Chemical polymorphisms or chemotypes have been reported for some *Thymus* species of Iran, such as *T. pubescens* (Sefidkon et al., 2002a), *T. persicus* (Sefidkon et al., 2002b), *T. daenensis* subsp. *lancifolius* (Sadjadi and Khatamsaz, 2003), *T. eriocalyx* (Kalvandi et al., 2004), *T. transcaspicus* (Miri et al., 2002). A few studies have been reported on the composition of *T. caramanicus* essential oil. The volatile oil of *T. caramanicus* of one sample from Kerman province has been studied, which showed that a carvacrol (68%) chemotype was effective against several Gram-positive and Gram-negative bacteria in vitro (Nejad Ebrahimi et al., 2008). A sample from Isfahan province has been studied and fifteen constituents, representing 99.3% of the oil, were identified, of which the major ones, carvacrol (85.9%), thymol (3.3%), p-cymene (3.2%), γ-terpinene (1.8%), and borneol (1.3%) accounted for 95.6% of the oil (Safaei-Ghomi et al., 2009).

However, there are no reports measuring the major compounds of *T. caramanicus* essential oil growing in different climatic regions of the Iran. The aim of this study was to determine the essential oil composition of different populations in order to identify the bioactive compounds for relevant industries.

2. Materials and methods

2.1. Plant material

The aerial parts of *T. caramanicus* were collected in full blossom during June 2010, from seven populations across three provinces in the central parts of Iran including Kerman, Isfahan and Semnan. Voucher specimens have been deposited in the Herbarium of the Faculty of

* Corresponding author.
E-mail addresses: mahdi.bigdelo@ut.ac.ir, mahdi.bigdelo@gmail.com (M. Bigdeloo).

http://dx.doi.org/10.1016/j.jarmap.2017.06.005
Received 2 February 2016; Received in revised form 2 June 2017; Accepted 25 June 2017

Fig. 1. Natural habitats of *Thymus caramanicus*.

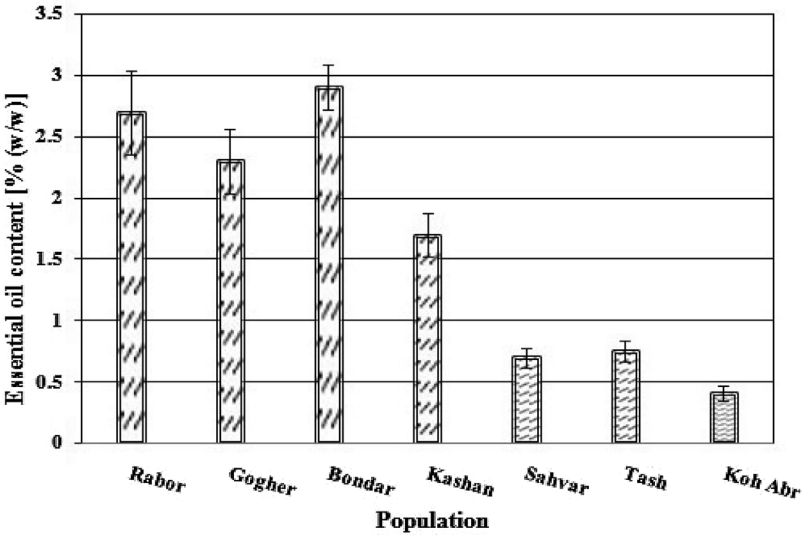

Fig. 2. Variation of the essential oil contents among different populations of *Thymus caramanicus*.

Table 1
Essential oil composition of the seven populations of *Thymus caramanicus*.

	Compounds	RI[a]	Rabor	Goghar	Bondar	Kashan	Tash	Shahvar	Koh Abr
1	Tricyclene	914	–	–	0.1	0.1	–	–	0.1
2	α-Thujene	926	tr[b]	tr	0.2	0.2	tr	0.2	0.8
3	α-Pinene	940	tr	0.1	0.1	0.2	0.2	0.5	0.6
4	3-Octanone	952	tr	–	0.1	–	tr	0.1	–
5	β-Pinene	973	tr	–	0.3	0.2	–	–	–
6	Myrcene	982	tr	–	–	–	0.1	0.2	–
7	α-Phellandrene	1006	–	tr	0.4	0. 2	–	–	0.1
8	*p*-cymene	1022	0.8	0.6	4.5	2.2	1.7	0. 2	8.2
9	Limonene	1026	tr	–	tr	0.1	tr	4.4	0.1
10	1,8-Cineole	1031	0.1	tr	0.1	0.2	0.1	0.1	–
11	γ-Terpinene	1059	0.3	0.8	2.7	1.1	0.7	0.6	0.4
12	trans-Sabinene hydrate	1069	tr	tr	0.1	–	0.2	0.4	0.4
13	Linalool	1099	0.1	–	–	0.3	0.1	1.6	0.1
14	Borneol	1202	0.2	0.4	0.1	0.6	0.3	0.3	5.2
15	4-Terpineol	1210	tr	tr	0.1	–	0.1	–	0.1
16	Geraniol	1257	tr	–	tr	–	–	0.1	0.1
17	Neral	1268	–	–	–	–	–	6	–
18	Geranial	1280	–	–	–	–	–	0.2	–
19	Thymol	1293	21.5	0.6	23.3	0.8	14.2	22.2	61.8
20	Carvacrol	1305	75.6	96.2	65.7	93.4	81.1	61.7	19.8
21	β-Caryophyllene	1420	tr	0.2	tr	0.2	0.5	0.8	0.1
22	α-Humulene	1451	–	–	–	–	0.1	0.1	0.2
23	α-Bisabolene	1460	–	–	–	–	0.1	0.2	–
24	Germacrene-D	1470	0.1	–	0.1	–	–	–	0.1
Monoterpene hydrocarbons			1.1	1.5	8.4	4.3	2.7	6.2	10.3
Oxygenated monoterpenes			97.5	97.2	89.4	95.3	96.1	92.6	87.5
Sesquiterpene hydrocarbons			0.1	0.2	0.1	0.2	0.7	1.1	0.4
	Total%	–	98.7	98.9	97.9	99.8	99.5	99.9	98.2

[a] RI: Retention indices determined relative to n-alkanes (C6–C24) on a DB-5 GC column.
[b] tr: Trace (< 0.05%).