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Chemotypes of Algerian and Moroccan *Thymus ciliatus*

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Abstract

Essential oils compositions of hydrodistilled fresh aerial parts of *Thymus ciliatus* (Lamiaceae), growing in various soils of Algeria and Morocco with different climates, are compared here. Carvacrol (0.2-80.3%), *p*-cymene (0.8-19.6%), γ-terpinene (0.2-14.6%), thymol (0.2-79.1%), camphor (7.5%), α-pinene (8.7%), α-terpinene (12.3%), *trans*-β-ocimene (25.8%) and nerolidol (6.9%) were the main components of the studied essential oils.

Keywords: *Thymus ciliatus; Lamiaceae; essential oil.*

1. Introduction

Species of *Thymus* genus (Lamiaceae) produce an essential oil, and several representatives are important herbs and species used in all part of the world. To date, the oils of 162 taxa of the *Thymus* genus have been chemically investigated revealing about 360 volatiles components in total and wide essential oil polymorphism. The phenolic terpenes, thymol and carvacrol, rank highest in importance [1]. In Algerian flora, there are 12 *Thymus* species from which 9 are endemic [2], while in Morocco, the genus *Thymus* is represented by 21 species, 13 of which are endemic [3]. Several thyme species are used as medicinal remedies against a variety of diseases as well as for aromatic, culinary, and food preservative purposes [4]. A wide range of biological and pharmacological properties have been reported for these species, such as antiseptic, antitussive, expectorant, antispasmodic, and anti-inflammatory activities [5-7]. Several studies have shown that they have strong antibacterial, antifungal, antiviral and antioxidant activities [5, 8, 9]. These biological and pharmacological properties have been mainly attributed to the rich essential oils contained in the majority of thyme species as well as non-volatile compounds [10]. In continuation of our works on Lamiaceae essential oils [11-26], we report here a comparative study of hydrodistilled essential oils compositions of *T. ciliatus* from Algeria and Morocco.

2. Material and methods

2.1. Plant material: see Table 1

2.2. Extraction

Fresh flowering aerial parts of the reported plants (Tc1-Tc13), with detailed localities in Table 1 [19, 21, 27-29], were submitted for three hours to hydrodistillation in a Clevenger-type apparatus [19, 21, 27-29]. The obtained essential oils were dried over anhydrous sodium sulphate then stored at 4 °C until analyzed.

Table 1. Plant material data of *Thymus ciliatus* from Algeria and Morocco.

Code	Origin	Reference
Tc1	Algeria (Imama)	[27]
Tc2	Algeria (Aïn el Hadjar)	[27]
Tc3	Algeria (Koudia)	[27]
Tc4	Algeria (Mansoura)	[27]
Tc5	Algeria (Hammam Schiguer)	[27]
Tc6	Algeria (Sebâa Chioukh)	[27]
Tc7	Algeria (Sebdou)	[27]
Tc8	Algeria (Tlemcen)	[27]
Tc9	Algeria (Oum El Bouaghi)	[21]
Tc10	Algeria (Bir Chouhada)	[21]
Tc11	Algeria (Batna)	[19]
Tc12	Morocco (Imilchi)	[28]
Tc13	Morocco (Azrou)	[29]

3. Results and Discussion

From Table 2, it appears that carvacrol is a chemotype of most reported essential oils of species grown at Algeria (Tc1-Tc8). The essential oil of the species grown at Tlemcen (Western Algerian) (Tc8) is the highest carvacrol-content (80.3%). However, essential oils of plants grown at Oum El-Bouaghi (Eastern Algerian) (Tc9) and Batna (Eastern Algerian) (Tc11) where thymol chemotype (54.9% and 71.9%, respectively). From Morocco, the essential oil collected from Imilchi (Tc12) is carvacrol/thymol (26.2%/17.3%) chemotype whereas the essential oil of the species grown at Azrou (Tc13) was thymol (44.2%) chemotype with the exclusive main presence of α-terpinene (12.3%) and *trans*-β-ocimene (25.8%). In addition, the couple *p*-cymene/γ-terpinene was characterizing most *Thymus ciliatus* essential oils with the highest percentage in the Moroccan species Tc12 (19.6/14.6%). In another hand, the essential oil of the species grown at Bir Chouhada-Ain Mlila province (Eastern Algerian) (Tc10) is quite different from the other reported species with the absence of thymol or carvacrol as major components and with the main presence of α-pinene (8.7%), camphor (7.5 %) and nerolidol (6.9%).

Table 2. Chemical composition of the essential oils of Algerian and Moroccan *Thymus ciliatus*

Compound	RI	Tc1	Tc2	Tc3	Tc4	Tc5	Tc6	Tc7	Tc8	Tc9	Tc10	Tc11	Tc12	Tc13
α-Thujene	930	0.2	0.8	0.7	1.7	1.2	1.1	1.2	0.3	2.4	0.5	0.4	1.2	-
α-Pinene	937	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.4	2.3	**8.7**	1.6	1.4	-
Camphene	952	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.1	-	-	-
1-Octen-3-ol	961	-	-	-	-	-	-	-	-	-	-	0.1	0.2	-
Verbenene	967	-	-	-	-	-	-	-	-	-	0.1	-	-	-
-Pinene	971	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	3.3	Tr	0.3	-
Sabinene	974	-	-	-	-	-	-	-	-	0.3	0.7	--	-	-
Myrcene	989	1.4	1.6	1.7	2	1.6	1.5	1.6	1.1	2.6	2.5	0..4	1.2	-
α-Phellandrene	1002	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.1	0.5	0.3	Tr	0.2	-
δ-3-Carene	1010	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	-	-	-
α-Terpinene	1016	1.4	1.4	1.6	1.7	1.2	1.3	1.2	0.7	2.8	0.1	0.3	1.6	**12.3**
Limonene	1021	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-	1.8	-	0.9	-
p-Cymene	1024	**7.2**	**5.6**	**6.2**	4.7	4.2	4.2	4.3	**6.1**	**6.6**	0.8	**5.6**	**19.6**	-
β-Phellandrene	1029	0.6	0.5	0.5	0.2	0.2	0.2	0.2	0.2	1.0	-	-	-	-
1,8-Cineole	1030	0.6	0.5	0.5	0.2	0.2	0.2	0.2	0.2	tr	4.5	Tr	-	-
cis-β-Ocimene	1037	-	-	-	-	-	-	-	-	-	0.1	-	-	-
trans-β-Ocimene	1047	-	-	-	-	-	-	-	-	0.1	1.1	-	-	**25.8**
γ-Terpinene	1060	4.8	**5.0**	**6.2**	**7.8**	4.7	**5.8**	**5**	1.6	**11.3**	0.2	4.1	**14.6**	-
trans-Sabinene hydrate	1063	0.1	0.4	0.3	0.3	0.3	0.4	0.3	0.1	-	-	-	-	-
cis-Sabinene hydrate	1068	-	-	-	-	-	-	-	-	0.5	0.6	-	-	-
p-Cymenene	1073	0.1	0.1	Tr	0.1	Tr	Tr	tr	Tr	-	-	-	-	-
cis-Linalool oxide	1075	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Terpinolene	1079	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	-	-	-	-
α-Terpinolene	1091	-	-	-	-	-	-	-	-	0.1	-	-	-	-
Linalool	1095	1.1	1.9	1.2	0.6	1.4	1.5	1.3	1.4	3.8	2.7	3.5	3.4	-
Camphor	1146	-	-	-	-	-	-	-	-	-	**7.5**	-	-	-
Borneol	1150	0.3	0.3	0.3	0.1	0.3	0.4	0.2	0.3	0.1	3.1	-	3.4	-
Terpinen-4-ol	1163	0.8	0.7	0.7	0.8	0.7	0.6	0.7	0.8	-	-	Tr	0.3	-
Isomenthone	1167	-	-	-	-	-	-	-	-	-	0.5	-	-	-
-terpineol	1174	0.2	0.2	Tr	0.2	0.1	0.1	0.1	0.2	-	0.9	-	-	-
4-Terpineol	1179	-	-	-	-	-	-	-	-	0.44	0.7	-	-	-
p-Cymen-8-ol	1185	-	-	-	-	-	-	-	-	-	0.3	-	-	-
Myrtenol	1197	-	-	-	-	-	-	-	-	-	0.8	-	-	-
Verbenone	1207	-	-	-	-	-	-	-	-	-	0.5	-	-	-
trans-(+)-Carveol	1220	-	-	-	-	-	-	-	-	-	0.4	-	-	-
β –Fenchyl acetate	1226	-	-	-	-	-	-	-	-	0.1	-	-	-	-
cis-(+)-Carveol	1233										tr	-	-	-
Thymol methyl ether	1238	-	-	-	-	-	-	-	-	0.7	0.1	0.1	-	-
Pulegone	1240	-	-	-	-	-	-	-	-	-	0.3	-	-	-
Neral	1244	-	-	-	-	-	-	-	-	0.1	-	-	-	-
trans-Geraniol	1260	-	-	-	-	-	-	-	-	-	0.5	-	-	-
Thymol	1267	0.2	0.4	0.5	0.3	0.3	0.4	0.3	0.3	**54.9**	3.38	**79.1**	**17.3**	**44.2**
Carvacrol	1283	**74.8**	**74.2**	**72.4**	**72.8**	**77.2**	**75.5**	**77.7**	**80.3**	4.9	0.2	4.4	**26.2**	-
Borneol acetate	1289	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Carvacryl acetate	1345	0.2	0.1	0.3	0.4	0.3	1.6	0.3	0.2	-	-	-	-	-
α-Terpinenyl acetate	1358	-	-	-	-	-	-	-	-	-	2.1	-	-	-
α-Copaene	1385	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Geranyl acetate	1389	-	-	-	-	-	-	-	-	-	2.6	-	-	-
β- Bourbonene	1390	-	-	-	-	-	-	-	-	tr	-	-	-	-
β-Elemene	1399	-	-	-	-	-	-	-	-	-	0.1	-	-	-
β-Caryophyllene	1421	1.8	1.9	1.7	2.2	1.9	1.7	1.7	1.8	-	0.8	-	3.4	-
α-humulene	1454	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	0.1	-	-	-
Germacrene D	1491	-	-	-	-	-	-	-	-	0.4	0.4	-	-	-
β-Bisabolene	1502	0.2	0.2	0.1	Tr	0.2	0.2	0.1	Tr	-	1.1	-	-	-
-Cidinene	1530	-	-	-	-	-	-	-	-	-	1.9	-	-	-
(E)-α-Bisabolene	1534	0.1	0.2	0.1	Tr	0.1	0.1	0.1	0.1	-	-	-	-	-
Nerolidol	1569	-	-	-	-	-	-	-	-	-	**6.9**	-	-	-
Caryophyllene oxide	1575	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.8	1.0	0.3	Tr	0.6	-
Spathulenol	1584	-	-	-	-	-	-	-	-	-	2.0	Tr	-	-
α-Muurolene	1625	-	-	-	-	-	-	-	-	0.3	0.1	-	-	-
Dehydroabietane	2037	0.1	Tr	0.3	Tr	Tr	Tr	tr	0.1	-	-	-	-	-

4. Conclusion

Through this investigation of chemotypes of *Thymus ciliatus* essential oils, it appears that carvacrol is a chemotype of most plants grown at Algeria. The couple carvacrol/thymol is a chemotype of the Moroccan species grown at Imilchi whereas thymol was a chemotype of the Moroccan species collected from Azrou. The essential oil of the species collected from Bir Chouhada-Ain Mlila province (Eastern Algerian) was characterized by the absence of thymol or carvacrol as main components.

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