Essential Oil Composition of Marrubium vulgare L. Cultivated in Egypt


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Abstract

The essential oil of the aerial parts of Marrubium vulgare L. (Lamiaceae) obtained by hydro distillation was analyzed by GC/MS in order to determine their chemical composition. Thirty-two components in the oil of M. vulgare were identified. The GC/MS revealed the presence of carvacrol (36.28%), β-phellandrene (15.49%), carvyl acetate (11.52%) which represents the main compounds of volatile oil extracted from Marrubium vulgare fresh herb. Other important compounds as trans-caryophyllene (4.06%), linalool (3.86%), α-terpinene (3.83%), β-pinene (3.53%), trans-sabinene hydrate (3.29%), β-thujone (2.93%), 1-octen-3-ol (2.48%), 1,8-cineol (1.49%), α-Pinene (1.44%) and borneol (1.12%) were reported in Marrubium vulgare essential oil cultivated in Egypt.

Keywords

Marrubium Vulgare, Essential Oil, Carvacrol, β-Phellandrene, Carvyl Acetate

1. Introduction

Marrubium vulgare L. (Lamiaceae), commonly known as white horehound, is a perennial, herbaceous medicinal plant native to temperate regions. It is distributed across Mediterranean Europe, southern America and northern Africa and used for medicinal purposes and as ingredient in skin cosmetics and cough lozenges (Zerbe et al., 2014). This plant was frequently employed as folk medicine to treat a variety of ailments, exhibits antispasmodic and antinociceptive effects. It possesses tonic, aromatic, stimulant, expectorant, diaphoretic and diuretic properties. It is helpful for bronchial asthma and nonproductive cough. It was formerly much esteemed in various uterine, visceral and hepatic affections and in phthisism (Adel et al., 2011). The plant is reported to possess hypoglycemic (Jorge et al., 2012), antibacterial (Masoodi et al., 2008), antidiabetic (Boudjelal et al., 2012), gastroprotective activity (Oliveira et al., 2011) and many other reported biological activities. Essential oils extracted by distillation from aromatic plants are appreciated for their bioactive efficacy as fungicides, bactericides (Zarai et al., 2011), antioxidant (Jorge et al., 2012) and other biological activities. Marrubiin is diterpenoid lactone that constitutes the bitter principle of the horehound and many other medicinal plants of the family Lamiaceae, which are used in several countries to treat different pathologies (Marrelli et al., 2013). Extensive pharmacological studies have demonstrated that marrubiin displays a suite of activities including antinociceptive (De Jesus et al., 2000), antioxidant, antigenotoxic (Mnonopi et al., 2011), cardio protective (Laonigro et al., 1979), vasorelaxant (El Bardai et al., 2003), gastroprotective (Paula de Olivera et al., 2011), antispasmodic (Zaabat et al., 2011), immunomodulating (Karioti et al, 2007), antioedematogenic (Hellen et al., 2006), analgesic (De Souza et al., 1998; Meyre-Silva et al., 2005), and antidiabetic

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properties (Mnonopi et al., 2012).

The crude extract of Marrubium vulgare is widely used as antihypertensive treatment in traditional medicine. It has been shown to decrease systolic blood pressure in spontaneously hypertensive rats and to inhibit KCl-induced contraction in rat aorta (El Bardai et al., 2001). The essential oil and the extract obtained from the aerial parts of Marrubium vulgare have been shown to have strong antimicrobial and antioxidant activities (Firuzi et al., 2010). The main active ingredient that is produced and accumulated in the aerial parts of the plant is a diterpenoid known as marrubiin (Piccoli and Bottini, 2008). A substantial antioxidant, anticoagulant, antiplatelet and antiinflammatory effects have been attributed to marrubiin (Mnonopi et al., 2011). Marrubium vulgare, also contains marrubenol and phenylpropanoid esters which have been shown to exhibit L-type calcium channel blocking and cyclooxygenase (COX) inhibitors activities (El-Baradai et al., 2003; Sahpaz et al., 2002). Further, phenylpropanoids have been proved to protect cardiomyocyte against hypoxia-induced death (Zhang et al., 2009). Biological activities of M. vulgare are attributed to an array of diterpenoids, sterols, flavonoids and phenylpropanoids (Meyer-Silva and Cechinel-Filho, 2010). The aim of this study was to identify and establish the chemical composition of the essential oil of Marrubium vulgare growing in Egypt.

2. Materials and Methods

2.1. Plant Material

Seeds of white horehound (Marrubium vulgare L.) were obtained from the HEM ZADEN B.V - P.O. Box 4 - 1606 ZGVenhuizen - The Netherlands. Seeds were sown in the nursery on 15th February, 2012. On 10 April 2012, uniform seedlings were transplanted into the experimental farm of the Faculty of Pharmacy, Cairo University, Giza, Egypt, which represents clay-loamy soil. The flowering fresh herb was collected at the end of July.

2.2. Gas Chromatography/Mass Spectrometry (GC/MS)

Extraction of essential oil: Fresh herb (100 g) was extracted by water distillation using Clevenger apparatus for 2 h according to Guenther (1961). GC/MS Analytical Condition: The volatile oil analysis was carried out using gas chromatography-mass spectrometry instrument stands at the Central Laboratories, National Research Center with the following specifications. Instrument: a TRACE GC Ultra Gas Chromatographs (THERMO Scientific Corp., USA), coupled with a THERMO mass spectrometer detector (ISQ Single Quadrupole Mass Spectrometer). The GC/MS system was equipped with a TG-WAX MS column (30 m x 0.25 mm i.d., 0.25 µm film thickness). Analyses were carried out using helium as carrier gas at a flow rate of 1.0 mL/min and a split ratio of 1:10 using the following temperature program: 40 °C for 1 min; rising at 4.0 °C/min to 160 °C and held for 6 min; rising at 6 °C/min to 210 °C and held for 1 min. The injector and detector were held at 210 °C. Diluted samples (1:10 hexane, v/v) of 0.2 µL of the mixtures were always injected. Mass spectra were obtained by electron ionization (EI) at 70 eV, using a spectral range of m/z 40-450. Most of the compounds were identified using two different analytical methods: relative retention time and mass spectra (authentic chemicals, Wiley spectral library collection and NSIT library).

3. Results and Discussion

The essential oil of Marrubium vulgare growing in Egypt was subjected to detailed GC/MS analysis. Exactly 32 compounds, mostly aromatic, were identified, representing 99.39 % of the total oil. The major compounds were carvacrol 36.28%, β-phellandrene 15.49% and carvyl acetate 11.52%. Other important compounds were trans-caryophyllene (4.06%), linalool (3.86%), α-terpinene (3.83%), β-pinene (3.53%), trans-sabinene hydrate (3.29%), β-thujone (2.93%), 1-octen-3-ol (2.48%), 1,8-cineole (1.49%), α-Pinene (1.44%) and bornone (1.12%).

The chemical compositions of M. vulgare essential oil from various origins have been the subject of many studies. The literature reveals the occurrence of several chemotypes. From Lithuania, (Z)-β-farnesene, β-caryophyllene, (E)-2-hexenal, α-humulene and germacrene-D were the main components of M. Vulgare essential oil (Weel et al., 1999). From Czech Republic, the main constituents of M. vulgare essential oil were β-caryophyllene and germacrene-D (Nagy and Sjädelénka, 1998). In Poland, the main components of the oil of Marrubium vulgare were E-caryophyllene, germacrene D and δ-amorphene (Zawislak, 2012). In Tunisia, β-bisabolene (28.3 %), β-caryophyllene (7.8 %), (E)-β-farnesene (7.4 %) and 1,8-cineole (4.8 %) were the major constituents of M. vulgare oil, Hamdaoui et al. (2013). From different region of Iran, the main constituents of M. vulgare essential tricyclene, β-pinene, bisabolol, β-elemone and isomethion-8-thiol(Saleh and Glombitz, 1989), bisabolene, β-caryophyllene, and E-β-farnesene (Asadipour et al., 2005), caryophyllene oxide, β-caryophyllene and germacrene D (Khanavi et al., 2005), β-bisabolene, β-caryophyllene, germacrene-D and E-β-farnesene (8.3%) (Mahnaz et al., 2005), γ-eudesmol, germacrene, D-citronellyformate, β-Citronellol, geranyltiglate, geranylformate (Bokaeian et al., 2014). From Libya, carvacrol, E-β-farnesene and thymol (EL-Hawary et
were carvacrol, β-phellandrene and carvyl acetate. In Egypt, Salama et al., (2012) reported that thymol and γ-cadinenenes major components. Finally, this study indicated that carvacrol, β-phellandrene, carvyl acetate as the main component of the oil of *Marrubium vulgare*. The available literature does not indicate carvacrol and carvyl acetate as the main component of the oil of *Marrubium vulgare*. The results presented from previously studies indicated that the essential oils obtained from *Marrubium vulgare* showed significant variability in their chemical composition depending on location and stages of development as mentioned before (Lawrence, 1981; Tucker and Maciarello, 1990; Mockute et al., 2003).

<table>
<thead>
<tr>
<th>Compound</th>
<th>%</th>
<th>Compound</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>β-thujene</td>
<td>2.93</td>
<td>camphore</td>
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<td>α-Pinene</td>
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<td>borneol</td>
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<td>sabinene</td>
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<td>2,6-dimethylheptadecane</td>
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<td>1-octen-3-ol</td>
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<td>β-pinene</td>
<td>3.53</td>
<td>thymol</td>
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<tr>
<td>3-octanol</td>
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<td>0.60</td>
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<td>α-cubebene</td>
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<tr>
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<td>1.49</td>
<td>7-epi-sesquisabinine hydrate</td>
<td>0.27</td>
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<tr>
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<td>cubenol</td>
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<td>α-copaene</td>
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<td>cis- sabinene hydrate</td>
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<td>E-β-farnesene</td>
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</table>

### 4. Conclusion

It can be concluded that the major constituents of *Marrubium vulgare* L. essential oil grown in Egypt from the aerial parts were carvacrol, β-phellandrene and carvyl acetate.

### References


Nastrand Comp. Inc. New York.


Marrubium vulgare. parviforum


