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Chemical Composition of *Eucalyptus globulus* grown in Iran

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ABSTRACT: *Eucalyptus* (family, Myrtaceae) is one of the world's most widely planted genera. The aim of this study was to identify of the chemical components of *Eucalyptus globules* grown in Iran. The aerial parts of the plants were collected from Tehran province in 2014. The essential oil was extracted by a Clevenger approach and analyzed using GC/MS. In total, twenty three compounds were identified in the essential oil from the aerial parts *Eucalyptus globulus*. The results obtained in our study indicated that the major components in the oil were 1,8-cineole (76.65%), α -Pinene (5.65%), α-terpineol acetate (4.85%) and alloaromadendrene (3.98%).

Key words: *Eucalyptus globulus*, Chemical Composition, GC-MS

INTRODUCTION

Eucalyptus (family, Myrtaceae) is one of the world's most widely planted genera (Batish *et al.,* 2008). *Eucalyptus globulus* Labill, commonly referred to as Tasmanian Blue Gum, is a fast growing, evergreentree, bearing pendant leaves, native to Tasmania and south-east Australia (Oyedeji *et al.*, 1999). The genus Eucalyptus, which is indigenous to Australia, consists of over 800 species and spreads worldwide due to its easy adaptability and fast growth (Coppen, 2002). *Eucalyptus* has been prized a rich source of essential oils. Essential oils of various species have been used in the pharmaceutical, cosmetics (Tsiri *et al.,* 2003), food (Jae-Seoun *et al.,* 2000), industries and medicinal purposes (Giamakis *et al.,* 2001). The minimum 1,8-cineole content of pharmaceutical-grade Eucalyptus essential oil as defined in most standards is 70% (Barton *et al.,* 1989).

Since morphological characteristics can vary under different agroclimatic conditions, interactions between genotype and environment (Salehi *et al.,* 2014; Golparvar *et al.,* 2015).

In studies (Maciel *et al.,* 2010) indicated the major components aerial parts of *Eucalyptus globules* Labill from Brazil were 1,8-cineole (83.89%), (+) Limonene (8.16%) and α -Pinene (4.15%). In the cosmetics industry Eucalyptus essential oil is used in detergents (Penfold and Willis, 1961), toiletries and little employed in perfumes and as a flavoring agent in food (Ahmad *et al.,* 2005). The European Pharmacopoeia monograph for Eucalyptus oil specifies a chromatographic profile: 1,8-cineole (=eucalyptol; not less than 70%), limonene (4-12%), α-pinene (2-8%), α-phellandrene (less than 1.5%), β-pinene (less than 0.5%), camphor (less than 0.1%). The aim of this study was to identify of the chemical components of *Eucalyptus globules* grown inIran.

MATERIALS AND METHODS

A. Plant materials, Essential oil extraction

The aerial parts of *Eucalyptus globulus* were collected from Tehran province,during 2014. The aerial parts of plants analyzed by using GC/MS in Islamic Azad University, Science and Research Branch (Tehran). Hundred gram powdered plant material was subjected to hydro-distillation (1000 ml distillated water) for 3 h using a Clevenger-type apparatus as recommended method in British pharmacopeia. Samples were dried using anhydrous sodium sulfate (Merck Co. Germany) and then kept in amber vials at 4 ± 1°C prior to use.

B. GC/MS analysis

GC-MS analysis was performed using a Hewlett Packard 5973 with a fused silica capillary column5% phenyl-poly-dimethyl-siloxane (DB-5MS 30 m x 0.25 mm i.d. and 0.25 µm film thickness). The column temperature was programmed as follows: from 60 C for 5°C and finally held at 220°C/min to 220° (3 min hold) then raised at 5 min. The carrier gas (helium) flow rate was 1mL/min. Identification of the essential oil components was accomplished based on comparison of retention times with those of authentic standards and by comparison of their mass spectral fragmentation patterns (WILLEY/Chem Station data system) (Adams, 2007).

RESULT AND DISCUSSION

The chemical constituents identified by GC-MS, are presented in Table 1. 23 compounds were identified in the essential oil from the aerial parts *Eucalyptus globulus*.

Table 1: Chemical composition of the essential oils from *Eucalyptus globulus*.

No	Compound	RT	(%)
1	α -Pinene	6.99	5.65
2	camphene	7.23	0.02
3	β-pinene	8.15	0.31
4	sabinene	8.67	0.65
5	Limonene	9.11	0.84
6	1,8-cineole	10.78	76.65
7	cis-β-ocimene	11.01	0.15
8	γ-terpinene	11.32	0.63
9	terpien-4-ol	15.53	0.37
10	α-terpineol	16.15	1.96
11	trans-carveol	17.01	0.06
12	α-terpineol acetate	22.07	4.85
13	geranyl acetate	23.06	0.06
14	isoledene	23.21	0.54
15	isopulegol acetate	23.92	0.02
16	α-gurjunene	24.44	0.85
17	(-)-cis-carvyl acetate	24.68	0.02
18	β-panasinsene	24.92	0.02
19	β-gurjunene	25.15	0.36
20	alloaromadendrene	25.53	3.98
21	aromadendrene	26.12	0.51
22	α-guaiene	26.99	0.01
23	epiglobulol	29.17	0.04
	Total		98.55

Compounds listed in order of elution RT (retention time)

The results obtained in our study indicated that the oil components corresponding to 98.55% and the major components in the oil were 1,8-cineole (76.65%), α -Pinene (5.65%), α-terpineol acetate (4.85%) and alloaromadendrene (3.98%). An earlier report by (Song *et al.,* 2009) indicated the major components aerial parts of *Eucalyptus globules* Labill from China were 1,8-eucalyptol (72.71 %), α-terpineol (2.54 %), terpinen-4-ol (0.34 %), and linalool (0.24 %) were the main oxygenated monoterpenes, while α-pinene (9.22 %), and β-pinene (0.4 %) were the main monoterpenes and α-eudesmol (0.39 %), (-)-globulol (2.77 %), and epiglobulol (0.44 %) were the main sesquiterpene.

In studies (Sefidkon *et al.,* 2007) twenty-two components were identified in the oil of *Eucalyptus microtheca*. The major components were 1,8-cineole (34.0%), p-cymene (12.4%), α-pinene (10.7%), β-pinene (10.5%) and virdiflorene (5.2%). Twenty-one compounds were identified in the oil of *Eucalyptus spathulata*. The main components of this oil were 1,8-cineole (72.5%), α-pinene (12.7%) and trans-pinocarveol (3.3%. Twenty-six compounds were characterized in the oil of *Eucalyptus largiflorens*. The main components of this oil were 1,8-cineole (37.5%), p-cymene (17.4%), neo-isoverbenol (9.1%), limonene (6.5%) and terpinen-4-ol (3.6%). Sixteen compounds were characterized in the oil of *Eucalyptus torquata*. The main components of this oil were 1,8-cineole (66.9%) α-pinene (13.9%), trans-pincarveol (6.3%) and p-cymene (4.2%).

Silva *et al.,* (2011)report the essential oils from different plant parts of Eucalyptus cinerea, 1,8-cineole was the main compound, particularly in fresh leaves-Spring (74.98%), dried leaves-Spring (85.32%), flowers-Winter (78.76%) and Fruits-Winter (80.97%). Other compounds were found in the aerial parts in all seasons: α-pinene (2.41% to 10.13%), limonene (1.46% to 4.43%), α-terpineol (1.73% to 11.72%), and α-terpinyl acetate (3.04% to 20.44%).

The volatile oils of leaves of *Eucalyptus nutans*, *E. platypus* Hook. var. platypus, *E. platypus* Hook. var. heterophylla Blakely, *E. spathulata* Hook. subsp. *spathulata*, *E. spathulata* Hook. subsp. *grandiflora* (Benth.) L.A.S. Johnson and D.F. Blaxell, *E. steedmanii* C.A. Gardner, E.eremophila(Diels) Maiden subsp. eremophila, *E. salubris* F. Muell. subsp. salubris, *E. ravida* L.A.S. Johnson and K.D. Hill, *E. campaspe* S. Moore, *E. dipteral* C.R.P. Andrews, *E. terebra* L.A.S. Johnson and K.D. Hill, *E. doratoxylon* F. Muell., and *E. decurva* F. Muell, isolated by vacuum distillation, were analysed by GC and GC-MS. All species contained α-pinene (2.8-32.5%), 1,8-cineole (8.2-51.2%), p-cymene (0.3-3.3%), aromadendrene (2.3-19.0%) and bicyclogermacrene (0.3-28.6%) as principal leaf oil components (Bignell *et al.,* 1996). Differences in the volatile composition of the plants could be attributed to genetic, chemotype, distinct environmental and climatic conditions (Hadipanah *et al.,* 2015).

CONCLUSION

In conclusion, the results obtained in our study indicated that the major components of oil of *Eucalyptus globules* collected from Tehran were1,8-cineole, α -Pinene, α-terpineol acetate and alloaromadendrene.

The results indicated that essential oils and their chemical compositions of *Eucalyptus globules* are strongly affected by environmental conditions and agronomic management practices.

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