Volatile Oil Constituents of the *Eucalyptus viridis* R. T. Baker and *Eucalyptus oleosa* F. Muell. Leaves from Iran

Jaimand K (Ph.D.)[1]*, Rezaee MB (Ph.D.)[1], Nadery Hajee Bagher Kandy M (Ph.D.)[1]

1- Phytochemistry Group, Department of Medicinal plants & By-products, Research Institute of Forest and Ranglands, Tehran, Iran
*Correspondence author: Phytochemistry group, Department of Medicinal plants & By-products, Research Institute of Forest and Ranglands , P.O.Box: 13185-116, Tehran, Iran
Tel: +98-21-44195901-5, Fax: +98-21-44196575
E-mail: Jaimand@rifr-ac.ir

Receive: 20 Apr. 2008 **Acceptance:** 15 Feb. 2009

Abstract

Background: The genus *Eucalyptus* (family Myrtaceae) comprises well-known plants of over 600 species of trees. Although most of the plants are native to Australia, numerous species have been introduced to other parts of the world, including Iran, as economic and ornamental trees in forest trial provenances, where the plants have become source of important fast-growing hardwood trees and *Eucalyptus* oils.

Objective: Aim of this studu is to determine chemical composition in essential oils of *Eucalyptus* for medicinal uses.

Methods: The essential oils isolated by hydrodistillation from the leaves of two Eucalyptus *viridis* R. Baker and *Eucalyptus oleosa* F. Muell. were analysed by GC and GC/MS.

Results: The main components identified in *E. viridis* oil were 1,8-cineole (84.7%), α - pinene (4.4%), trans-pinocarveol (2.2%) and in *E. oleosa* were 1,8-cineole (89.4%), β-pinene (1.2%) and α - pinene (1%).

Conclusion: The chemical composition of the oils with high content of 1,8-cineole (84.7 and 89.4%) are classified as a "eucalyptol or medicinal" type.

Keywords: *Eucalyptus viridis* R. Baker and *Eucalyptus oleosa* F. Muell., Essential oil compostion, 1,8-cineole, α - pinene

[DOR: 20.1001.1.2717204.2009.8.29.32.3]

Introduction

The genus *Eucalyptus* (family Myrtaceae) comprises well-known plants of over 600 species of trees [3]. Although most of the plants are native to Australia, numerous species have been introduced to other parts of the world, including Iran, as economic and ornamental trees in forest trial provenances [4], where the plants have become source of important fast-growing hardwood trees [5] and essential oils [6]. The *Eucalyptus* essential oils could be grouped into three types on the basis of their chemical constituents (medicinal, industrial and perfumery) [7, 8, 9].

Consequently, *Eucalyptus* essential oils composition from various countries have been extensively investigated due to their numerous uses in the Pharmaceutical and Cosmetics industries. The eucalyptus essential oils are valued because of the their main component, 1,8-cineole, which is an antiseptic used in the treatment of respiratory tract infection. Thus, its major use is in the pharmaceutical industry. French and English pharmacopoeias require the 1,8-cineole content to be at least 70%. However, the yield and chemical composition of the leaf oil vary widely between species, individual trees as well as with the growing environment [8, 9, 10]. Previous studies of the leaf oil compositons of *Eucalyptus* species used commercially as a natural source of 1,8- cineole have been reported [3, 11]. Much research has been done on the oil composition of different *Eucalyptus* specis. The essential oils of some of these *Eucalyptus* species and their chemical constituents were not investigated in Iran. Practically nothing whatsoever is known about the constituents of the Iran-grown *Eucalyptus viridis* and *Eucalyptus oleosa*, in spite of their important industrial uses. It was therefore necessary to investigate the chemical composition of the essential oils of these plants and correlate the economic potential of the essential oils with the volatile oil constituents. This paper now reports for the first time the results of the analysis of leaf essential oil of *Eucalyptus viridis* R. Baker and *Eucalyptus oleosa* F. Muell. growing in Iran.

Materials and methods

Plant Sample

The seeds of *Eucalyptus viridis* R. Baker and *Eucalyptus oleosa* F. Muell. were purchased from the trial plots established at the propagated from seed supplied by the Kimberly Seed Co. Perth, Australia in 1993. The plants were cultivaed on 1994 in south of Iran in Fars provience south of Iran which in Sarab Bahram and Shosh Mamesani with 7 km distances are with ecological conditions of latitude 51º 2´, longitude 30º 4´, elvation 900 m, precipitation 580 mm, Maximum of temperature 40ºC and Minimum of temperature 15ºC, soil texture clay and sandy loam.

Fresh leaves of *Eucalyptus viridis* R. Baker and *Eucalyptus oleosa* F. Muell. were collected on 5 May 2007 from Srab Bahram and Mamesanee Noor Abad which is in south of Iran. The plants were cultivaed on 1994.

Isolation of Volatile Oil

About 80 gr. leaves of the two *Eucalyptus* species were air – dried and subjected to hydrodistillation for two hours using a Clevenger – type apparatus [13]. The oils were separated from the water by decantation and were dried by filtration over anhydrous sodium sulfate. The oil yields were 1.4 % and 3.2 %, for *E. viridis* and *E. oleosa*, respectively.

[DOR: 20.1001.1.2717204.2009.8.29.32.3]

GC Analyses

GC analyses were performed using a Shimadzu-9A gas chromaph equipped with a flame ionization detector, and quantitation was carried out on Euro Chrom 2000 from Knauer by the area normalization method neglecting response factors. The analysis was carried out using a DB-5 fused-silica column (30 m × 0.25 mm, film thickness 0.25 µm, J & W Scientific Inc., Rancho Cordova, CA, USA). The operating conditions were as follows: injector and detector temperature, 250 °C and 265 °C, respectively; carrier gas, Helium, oven temperature programe, 60°- 210°C at the rate of 3 °C/min.

GC/MS Analyses

The GC/MS unit consisted of a Varian Model 3400 gas chromatograph coupled to a Saturn II ion trap detector was used . The column was same as GC, and the GC conditions were as above. Mass spectrometer conditions were: ionization potential 70 eV; electron multiplier energy 2000 V.

Identification of Constituents

The identity of the oil components was established from their GC retention indices, relative to C_7- C_{25} n-alkanes, by comparison of their MS spectra with those reported in the literature [13, 14, 15] and by computer matching with the Wiley 5 mass spectra library, whenever possible, by co-injection with standards available in the laboratories.

Results and discussion

Results obtained for the qualitative and quantitative analysis of two eucalyptus oils have been shown in table 1 is related to 1,8-cineol in both genus. Because of the high content of 1,8-cineole, 89.4% and 84.7% in *E. viridis* and *E. oleosa*, respectively, the oil was classified as a "eucalyptol or medicinal" type [7, 8, 9, 10]. Six minor compounds were also identified in this species. Aproximately 89.4 % and 84.7 % of the oil compositions were characterized. Bignell, et al. 1995, Worked on the volatile leaf oils of *Eucalyptus oleosa* F. Muell., isolated by vacuum distillation, were analysed by GC-MS. Main components were 1,8- cineole (52.04 %), α- pinene (24.7 %), p-cymene (3.39 %) and β-pinene (2.59 %) [1]. Bignell, et al. 1995, Worked on the volatile leaf oils of *E. viridis* R.T. Baker, isolated by vacuum distillation, were analysed by GC-MS and by GC. Main components were 1,8- cineole (43.89 %), Aromadendrene (18.32 %), α- pinene (5.28 %), globulol (4.27 %) [2]. The study on essential oil of the two Eucalyptus species has shown that there is potential for commercial exploition of medicinal Eucalyptus oil in Iran for both the domestic and export markets. Much will depend on how these species perform in different regions of the country.

Table 1: Percentage composition of the oil of *E. viridis* and *E. oleosa*

Compound name	R.I.	*E. viridic*	*E. oleosa*
α – pinene	941	4.4	1.0
β- pinene	986	1.4	1.2
1,8-cineol	1045	84.7	89.4
trans- pinocarveol	1138	2.2	0.6
δ- terpineol	1155	0.8	0.4
terpinen – 4 –ol	1173	0.3	0.9
Aromadendrene	1443	0.9	---

a R.I. = retention indices on DB-5 column

[DOR: 20.1001.1.2717204.2009.8.29.32.3]

Acknowledgments

The authors wishes to thank directory of Research Institute of Forests and Rangelands for support of this investigation.

References

1. Bignell CM, Dunlop PJ, Brophy JJ, Jackson JF. Volatile leaf oils of some South-western and Southern Australian species of the genus *Eucalyptus.* Part V. subgenus symphyomyrtus, section bisectaria, series oleosae., *Flavour and Fragrance J.* 1995; 10 (5): 313 –7.

2. Bignell CM, Dunlop PJ, Brophy JJ, Jackson, JF. Volatile leaf oils of some South-western and Southern Australian species of the genus *Eucalyptus* part VI - subgenus symphyomyrtus, section adnataria., *Flavour and Fragrance J.* 1995; 10 (6): 359 – 64.

3. Boland, Douglas and Brophy, J. J. and House APN and CSIRO. and Australian Centre for International Agricultural Research. Eucalyptus leaf oils: use, chemistry, distillation and marketing / D.J. Boland, co-ordinating editor; J.J. Brophy, chemical editor; A.P.N. House, technical editor Inkata Press, Melbourne: 1991, 25 – 155. ISBN 0-909605-69-6.

4. Hutchinson J. The families of Flowering plants. *University Press*, London. 1959; 2: 303.

5. Dassanajake MD. A Revised Handbook to the Flora of Ceylon, Amerind Publishing Co., Washington, DC. 1981; 2: 403 - 5.

6. Lawrence MB. Progress in Essential Oils. *Perfum. Flav*. 1987; 13: 39 - 40.

7. Oyedeji AO, Olawore ON, Ekundayo O and Koenig WA. Volatile leaf oil constituents of three Eucalyptus species from Nigeria, *Flavour and Fragrance J.* 1999; 14: 241 - 4.

8. Robbins SRJ. Selected markets for the essential oils lemongrass, citronella and eucalyptus., *Tropical products Institute*. 1983.

9. Penfold AR and Willis JL. The Eucalyptus. Botany, cultivation, chemistry and utilization. Leonard Hill (Book) Limited, London, *Interscinence publishers*, Inc., New York, 1961.

10. Coppen JJ and Hone GA. Eucalyptus oils, A review on production and Markets., *Natural Resources Institute*, Bulletin 56, 1992.

11. Dethier M, Nduwmana A, Cordier Y, Menut C, and LamatyG. Aromatic plants of Tropical central Africa XVI. Studies on essential oils of five *Eucalyptus* species grown in Burundi., *J. Essent. Oil Res*. 1994; 6: 469 - 73.

12. *British Pharmacopoeia*, Vol. 2, HMSO, London. 1988; A137 - A138.

13. Shibamoto T, Retention Indices in Essential Oil Analysis. In: Capillary Gas Chromatography in Essential oil analysis. Edits., P. Sandra and C. Bicchi, Dr. Alfred Huethig *Verlag, Heidelberg*. 1987; 259 - 74.

14. Davies NW, Gas Chromatographic Retention Index of Monoterpenes and Sesquiterpenes on Methyl silicone and Carbowax 20 M phases. *J. Chromatogr*. 1990; 503, 1 - 24.

15. Adams RP. Identification of essential oils by Ion trap Mass Spectroscopy. Academic Press, San Diego, CA. 1989.

[DOR: 20.1001.1.2717204.2009.8.29.32.3]