

Seasonal Variations in the Composition of Essential Oil of *Eucalyptus citriodora* of Pakistan

MUHAMMAD RAFIQUE AND F. M. CHAUDHARY
PC SIR Laboratories Complex, Lahor-54600, Pakistan

(Received August 18, 1992)

The essential oil of *Eucalyptus citriodora* has been examined for its physico chemical constants and chemical composition using GLC. The oil contains 24 components, the major ones being citronellal (25.6-36.3%) isocitronellal (21.5-31.9%). Hydroxycitronellal (7.9-14.5%) eugenol (1.1-4.5%) citronellol (1.7-7.3%) citronellyl acetate (0.5-2.5) 1, 8-cineol (0.1-1.8%) phellendrene (0.3-0.6%) and P.cymene (0.1-0.9%). In February and July the citronellal content of the oil is above 76% which meet the requirement of international market (65-85%).

Eucalyptus trees are evergreen, the genus is typically of Australian origin [1]. *Eucalyptus* trees are also called "Gum Trees". The oil is produced by steam distillation of fresh leaves which is usually, carried out in 400 gal, shiptanks coupled together and directly fired [2,3].

The oil is used for the production of pharmaceutical flavouring and perfumery products and as a germicide [4-7]. *Citriodora* is the most important species and is a source of citronellal which can be used for the manufacture of citronellol, hydroxy citronellal and menthol. Earlier works have shown wide variations in composition of this oil [8-16]. In the present work a specially designed study of variations in the yield of oil and its citronellal content depending upon seasonal variations in the yield of oil and its citronellal content depending upon seasonal variations was carried out.

Mature Leaves (3 kg) of *E. citriodora* obtained from Government plantation Jallo (Lahore) were taken in 20 litre round bottomed flask. The oil (36.1 gm) was obtained by steam distillation using Deans Stark apparatus. The major quantity of the oil is distilled within 6 hrs but in order to get accurate yield, distillation was carried out for 8 hrs. The yellow oil was dried over anhydrous sodium sulphate. The physico

chemical properties of the essential oil of *E. citriodora* are recorded in Table 1.

Gas chromatographi examination of the essential oil. The oil was examined on a Pye-Unicam 104 gas chromatograph under the following conditions:-

Detector	Flame ionization
Column	W Cot SE-30
Glass column length	25 m.
Carrier gas	Nitrogen
Flow velocity	25 cm/sec.
Split ratio	1:60
Sample size	0.02 µl
Initial temp.	70°C for 5 mins
Increase in temp.	4°C/min.
Final temp.	150°C.
Detector temp.	250°C.
Injection temp.	300°C.

Various components were identified by their retention times and by co-injection with standard compounds [17]. Percentage of individual components was obtained on the basis of peak area using SP-4100 (spectra physics) computing integrator and is recorded in Table 2.

The leaves of *Eucalyptus citriodora* were obtained from Government plantation Jallo (Lahore). To study the effect of seasonal variation on the quantity and quality of oil, the leaves were collected in the first week of every month and steam distilled. The comparative studies indicate that the oil yield is minimum in May (0.9%) and started increasing gradually till it reached a maximum in Dec. (1.3%) and constantly decreased thereafter. These results are well in accordance with the studies made by Singh *et al.* [8] who have reported yield of the oil (green leaves) 1.19% and in pilot plant distillation (1.495). But on the other hand present observations appear to contradict an earlier report by Miranda *et al.* [14] who claimed that their essential oil recovery varied from 2.0% in July to 3.5% in Nov. This difference may be attributed to the soil and ecological conditions which may significantly vary different regions.

TABLE 1. PHYSICO-CHEMICAL VALUE OF THE ESSENTIAL OIL OF *E. CITRIODORA*.

	Jan.	Feb.	Mar.	Apr.	May.	June	July	Sept.	Oct.	Nov.	Dec.
Moisture content of the fresh leaves (%)	42.8	42.7	42.7	42.7	42.6	42.7	42.7	42.7	42.7	42.7	42.8
Yield of oil fresh leaves basis (%)	1.2	1.2	1.1	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.3
Sp. gravity at 25°C	0.893	0.893	0.893	0.893	0.893	0.893	0.893	0.893	0.893	0.893	0.893
Refractive index at 20°C	1.4662	1.4587	1.4644	1.4590	1.4660	1.4610	1.4630	1.4630	1.4680	1.4650	1.4630

TABLE 2. PERCENTAGE COMPOSITION OF *EUCALYPTUS CITRIODORA* ESSENTIAL OILS OBTAINED FROM THE LEAVES COLLECTED THROUGHOUT THE YEAR.

	Jan.	Feb.	Mar.	April	May	June	Jul.	Sept.	Oct.	Nov.	Dec.
α -pinene	0.4	0.7	0.7	0.2	0.1	0.4	0.1	1.4	0.1	0.2	0.1
β -pinene	0.3	0.3	0.2	0.2	0.1	0.8	1.2	0.3	0.1	0.2	0.1
Unidentified	0.1	0.1	-	0.1	-	-	0.1	-	-	-	0.1
Unidentified	0.1	-	-	-	0.1	0.2	0.1	-	-	-	0.2
Unidentified	0.1	-	-	-	-	-	0.4	0.2	-	-	-
γ -cymene	0.5	0.1	0.4	0.9	0.4	0.2	0.1	0.7	0.1	0.5	0.4
Unidentified	0.2	-	-	0.1	0.1	0.8	0.4	-	0.4	-	0.1
1,8-cineole	1.8	0.5	0.5	1.7	1.1	0.4	0.1	0.2	0.2	0.3	0.8
Phellendrene	0.3	0.6	0.4	0.3	0.4	0.5	0.4	0.5	0.5	0.3	0.4
Unidentified	0.3	-	-	0.6	0.1	0.3	0.2	0.1	0.2	0.1	0.3
Unidentified	0.2	-	-	0.3	0.4	0.4	-	0.3	0.4	0.5	0.3
Unidentified	0.5	0.6	0.1	0.1	-	0.3	-	0.1	0.1	-	-
Unidentified	0.2	-	-	4.8	-	-	-	-	0.1	-	-
Citronellal	34.8	36.3	29.4	28.1	25.6	25.8	31.4	31.5	28.2	27.3	29.7
Isocitronellal	28.8	29.8	30.3	29.0	21.5	25.1	31.9	30.0	22.7	23.0	29.8
Hydroxycitronellal	10.6	10.4	11.8	7.9	8.1	10.0	14.1	14.5	11.2	8.0	11.2
Unidentified	1.5	-	-	2.9	2.7	-	-	-	-	-	2.9
Eugenol	4.5	1.7	1.1	-	4.1	4.4	2.2	3.9	3.6	2.2	3.3
Citronellol	4.8	6.3	7.1	7.0	7.3	7.0	4.2	1.3	1.3	1.1	5.4
Citronellyl acetate	0.5	1.0	1.5	2.5	1.5	1.1	1.6	1.1	1.2	1.8	1.3
Methyl eugenol	2.7	0.5	-	-	-	-	-	-	-	-	0.2
Caryophyllene	1.7	-	-	-	-	-	-	-	-	-	-
Isoeugenol	0.4	-	-	-	-	-	-	-	-	-	-

Isoeugenol and caryophyllene could be detected only in the oil obtained in the month of Jan. alone while methyl eugenol was detected in the oils obtained in the months of Dec., Jan. and Feb. but their presence could not be established in the essential oils distilled in the other months. The percentage of citronellal is maximum in Feb. (76.5%) and July (77.4%).

Key words: *E. citriodora*, Seasonal variation, Composition of oil.

References

- Ernest Guenther, *The Essential Oils*. D. Van Nostrand Company Princeton, New Jersey, Toronto, New York, London, Rev. Ed., 1965), Vol. IV, pp.438.
- A. R. Penfold, *Australasian J. Pharm.*, **16**, 29 (1935).
- Ernest Guenther, *The Essential Oils* (D. Van Nostrand Company Princeton, New Jersey, Toronto, New York, London, rev. Ed., 1965), Vol. IV, pp.444.
- Ibid*, **IV**, pp.448.
- T. Siva Sankara Rao and S. S. Nigam, *Indian perform.*, **22** (2), 118 (1978).
- Adames Marlene, Medoza Edith and Ospina de Nigrinis, Luz Stella. *Rev. Colomb. cienc. Quim. Farm*, **4** (1), 95 (1983).
- M. Hmamouchi, A. Tantaoui-Elaraki, N. Es-Safi and A. Agoumi, *Plant Med. Phytother.*, **24** (4), 278 (1990).
- A. Singh, S. R. Singh, R. N. Dave, C. L. Vithalbhai and P. Drysdale, *Fiji Agric. J.*, **39** (1), 33 (1977).
- Shigeko Sugimoto and Tokinobu, *Koto Kanzei Chuo Bunsekisho HO.* **3**, 31 (1983), *C. A.* **99**, 76654 f (1983).
- P. S. Rao and V. K. Sood, *Soap perfumery & Cosmetics*, **34**, 1123 (1961).
- S. Talalaj, *W. African Pharmacist*, **8** (6), 117 (1966).
- K. K. Baslas and R. K. Baslas, *Indian perfume*, **11** (1), 13 (1967).
- Adames Marlene, Mendoza Edith, Ospian de Nigrinis; Luz, Stella, *Rev. Colomb. Cienc. Quim. Farm.*, **4** (1) 95 (1983).
- Migdalia Miranda and Jose Zayas, Perez, *Rev. Cubana Farm.*, **19** (1), 121 (1985).
- V. K. Sood, John P. Rier and R. C. Ghosh, *perfum. Kosmet*, **68** (8), 495, 498 (1987).
- Rakhshinda panda and Himadri panda, *Indian For.*, **113** (6), 434 (1987).
- A. I. M. Kuleman, *Gas Chromotography* (Reinhold Publishing Corp. New York, 1959), 2nd ed., pp. 27.