

GAS CHROMATOGRAPHIC EXAMINATION OF THE ESSENTIAL OIL OF *CINNAMOMUM CAMPHORA*

ABDUL SATTAR, ASAD MUSTAFA GILANI AND M. AKBAR SAEED

PCSIR Laboratories Complex, Lahore - 54600, Pakistan

(Received October 28, 1990; revised June, 19, 1991)

The volatile oils obtained by steam distillation of leaves, twigs, wood bark of an old tree and whole young plant of *Cinnamomum camphora* seib. Subsp. eucamphor (Camphor tree) on gas chromatographic analysis revealed the presence of over twenty five monoterpenoids. Camphor was present in highest amounts in oil of leaves (83.78%) followed by whole young plant (64.70%), twigs (61.83%) and wood (51.65%). The bark oil contained least amount of camphor (3.53%). Safrole, linalool and cineol generally present in large amounts in other varieties of *C. camphora*, were found in very small quantities.

Key words: *Cinnamomum camphora*, N. O. Lauraceae, Essential oil, Monoterpenes, Camphor.

Introduction

Cinnamomum camphora (Syn: *C. officinarum*; *Laurus camphora*) belongs to plant family Lauraceae [1] which is a large family comprising of about two thousand species falling into thirty six genera. Most of these species are common as forest trees of tropical and sub-tropical regions of the world. The natural habitat of *C. camphora* is China and Japan. It is an evergreen tree which is cultivated for ornamental purposes and for the commercial extraction of natural camphor. The yield of camphor depends very much on the climatic conditions, locality and strains of species [2]. The camphor oil of commerce is the oil from which major portion of camphor has been removed. The value of camphor oil depends upon its contents of safrole. The Formosa trees, which are stated to be over hundred year old when distilled appear to yield [3] a much larger amount of camphor viz. 3-4 percent on the basis of whole material. It has been presumed that older the tree is, the higher the camphor contents in its wood.

The essential oil of *C. camphora* has been extensively studied [2-6] but no investigations have been carried out on the oil of the species occurring in Pakistan. These studies are part of our programme to explore and develop the essential oil resources of the country.

Experimental

The plant material used in these investigations was obtained from a large tree of *Cinnamomum camphora*, growing in Jinnah Botanical Gardens (Lawrence Gardens), Lahore. The tree was an old one; its age being more than sixty years, fifty feet high and had a maximum circumference of 12-14 ft. The plant is being grown for ornamental purposes in the gardens. The leaves (as such), twigs (cut into small pieces), wood (from branches having a diameter of 8-9 cm and cut into small chips) and the bark (peeled from the trunk) of the old tree were steam distilled to get the volatile oil. The young plant of

C. camphora of approximately one year old was also steam distilled to obtain the volatile oil. The essential oils obtained were dried over anhydrous sodium sulphate. The yields and the physical properties of the oils have been reported in Table 1.

The analysis of the whole oil was carried out on a gas chromatograph using fused silica capillary column (25 cm length x 0.2 mm dia) with two different stationary phases of polarities similar to SE-30 and PEG-20M. The operating conditions were; temperature programmed column from 70- 180° at the initial hold time of 8 min. at 70°, rate of rise in temperature, 4°/min., hydrogen carrier gas flow rate of 1.7 ml per min. with a split injection system. The identification of the components of the oils was made with FID using retention time indices and coinjection of standard samples. The percentage composition of the various components in the oil was found out with the help of a computing integrator (Shimadzu Model C-R6A) and has been reported in Table 2.

Discussion

The physical properties and percentage yield of the steam distilled oils from the various parts of *C. camphora* tree are

TABLE 1. PHYSICAL PROPERTIES OF THE ESSENTIAL OILS
OF *C. CAMPHORA*.

Oil from	Percent yield of oil	Colour	Density at 30°	Refractive index at 30°
Leaves	1.37	Light yellow	0.9251	1.4605
Twigs	0.65	Light yellow	0.9063	1.4689
Wood	0.21	Yellow	0.9325	1.4730
Bark	0.04	Dark yellow	0.9196	1.5018
Whole young plant	1.26	Yellowish white	0.9218	1.4611

reported in Table 1. Besides recording yields of oils from shade-dried leaves, twigs, wood and bark, foliage leaves and fresh green leaves were also examined for their oil contents and these were found to be 1.00 and 1.25% respectively. The young plants of nearly one year old (without roots) were

TABLE 2. COMPOSITION OF *C. CAMPHORA* ESSENTIAL OIL BY GAS CHROMATOGRAPHY.

Components	Percentage in oils of				
	Leaves	Twigs	Wood	Bark	Young plant
α -pinene	0.82	2.08	0.38	—	0.49
Camphene	0.98	1.41	0.22	—	0.34
β -pinene	0.50	1.27	0.20	—	0.24
α -Phallendrene	0.31	0.91	0.39	—	—
3-Carene	—	0.48	0.09	0.14	0.04
α -Terpinene	0.02	2.61	0.09	—	0.19
P-cymene	0.31	—	1.28	—	0.40
Limonene	0.91	—	0.19	0.78	0.91
Cineol	1.58	8.42	7.59	1.06	1.98
r-Terpinene	—	0.17	0.05	0.13	0.18
Terpinolene	0.23	—	0.05	0.14	—
Fenchone	0.09	—	0.04	0.48	—
Linalool	1.30	0.16	0.11	0.27	0.00
Thujone	—	0.18	0.10	—	—
Fenchol	0.06	0.32	0.12	—	—
Camphor	83.78	61.83	51.65	3.53	64.70
Isoborneol	—	0.31	0.63	—	—
Menthol	0.16	1.36	3.05	0.11	0.91
α -Terpineol	1.03	1.92	6.01	—	1.64
Citronellol	—	—	0.14	—	—
Nerol	—	0.04	—	—	0.09
Safrole	0.83	0.10	3.47	—	3.61
Geraniol	0.05	—	0.87	—	0.46
Linalylacetate	0.08	—	—	—	0.04
Geranyl acetate	0.01	0.13	1.86	—	0.26
Eugenol	—	—	—	3.70	—
Methyl eugenol	—	1.15	1.10	—	—
Longifolene	—	0.35	0.13	1.01	—
Caryophyllene	0.96	0.98	0.91	0.93	0.85
Unidentified	—	—	—	—	—
Monoterpenes	1.53	2.91	3.48	3.40	5.16
Unidentified	—	—	—	—	—
Sesquiterpenes	4.52	10.58	16.67	84.40	16.85

chopped and steam distilled to obtain the oil. The maximum yield of oil was found in leaves (1.37%). The gas chromatographic analysis of the essential oils from various parts is presented in Table 2. The percentage of camphor in the oils was highest in the leaves (83.78%) followed by twigs (61.83%) and wood (51.65%). The bark volatile oil contained the least amount of camphor (3.53%). The volatile oil from the whole young plant had a fair amount of camphor (64.70%). Monoterpenoids were found to be the major components of the oils of leaves, twigs, wood and young plant (over 80%), whereas bark oil was rich in sesquiterpenoids (nearly 85%). Safrole was present in small quantities in the oils of leaves (0.83%), twigs (0.10%), wood (3.47%) and young plant (3.61%), whereas bark oil contained only traces of this monoterpene. Linalool and cineol were also present in much smaller quantities in these oils. The proportion of unidentified monoterpenoids and sesquiterpenoids in the oils are also reported. The results of the analysis indicates that the plant under investigation was *Cinnamomum camphora* Sieb. sub sp. eucamphor [5-6].

References

1. E. Nasir and A. I. Ali, *Flora of West Pakistan No. 118*, N. O. Lauraceae, (Stewart Herbarium, Gordon College, Rawalpindi, 1978).
2. S. C. Hood, *J. Ind. Eng. Chem.*, **9**, 552 (1917).
3. B. S. Rao, J. J. Sudborough and H. E. Watson, *J. Ind. Inst. Sci. Madras*, **8 A**, (Part X), 143, (1925), References cited therein.
4. E. Guenther, *The Essential Oils* (D. Van Nostrand and Co Inc., USA, 1952), Vol. IV, pp. 295.
5. N. Hirota and M. Hiroi, *Perf. Ess. Oil Rec.*, **58**, 364 (1967).
6. B. M. Lawrence, *Perfumer and Flavourist*, **4** (4), 49 (1979).