Essential Oils of Camphor Tree (*Cinnamomum camphora* Nees & Eberm) Cultivated in Southern Brazil

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ABSTRACT

The essential oils of two varieties of Camphor tree (Cinnamomum camphora *Nees & Eberm, Lauraceae), known as Hon-Sho and Ho-Sho cultivated in experimental stands in Southern Brazil were studied. The essential oils were obtained from the leaves and twigs of young plants by hydrodistillation. The identification of the components was performed using GC, GC/MS and retention indexes on methyl silicone and carbowax phases. The main components identified were linalool in the Ho-Sho and camphor in the Hon-Sho.*

Key Words: *Cinnamomum camphora;* leaves; essential oils; GC/MS; linalool; camphor.

INTRODUCTION

Camphor tree (*Cinnamomum camphora* Nees & Eberm, Lauraceae) essential oils have been extensively studied (Guenther,1950). The tree is native to China, Formosa and Japan (Yoshida et al., 1969). The traditional oils are obtained from the wood and bark (Stahl, 1957; Dung and Khien, 1991; Pandey et al., 1997). The oil with a high content of camphor has an important antifungal activity (Takaoka et al., 1976; Sattar et al., 1991).

C. camphora has several chemical varieties which have different essential oil compositions (Hattori, 1981; Huergo et al., 1978; Lin et al., 1994; Akeng´a et al., 1994; Moellenbeck et al., 1997; Dung et al., 1993). Two varieties have been exploited commercially, Hon-Sho (*C. camphora* Nees & Eberm.), the most valuable for the presence of camphor, and Ho-Sho (*C. camphora* Nees & Eberm var. *linaloolifera* Fujita) for it high content of linalool. These varieties are morphologically similar, but they show different essential oil compositions and for this reason are considerated physiological varieties (Guenther, 1950).

The oils obtained from the leaves by steam distillation have economic importance as their main components are camphor and linalool (Guenther, 1950), and their explotation is less detrimental to the trees . The compositions of the essential oils from aerial parts have been reported by many authors (Fujita et al., 1974; Pellisier et al., 1995; Stahl, 1957).

MATERIALS AND METHODS

Plant material. The aerial parts of young plants of Camphor tree (*C. camphora* Nees & Eberm and *C. camphora* Nees & Eberm var *linaloolifera* Fujita) were collected in May 1998 at the Experimental Farm of the Instituto de Biotecnologia of the Universidade de Caxias do Sul, Brazil. The specimens were identified and deposited at the Herbarium of the Museu de História Natural of the Universidade de Caxias do Sul (*C. camphora* Nees & Eberm, Hon-sho,Voucher Nº HUCS 12.892 and *C. camphora* Nees & Eberm var. *linaloolifera* Fujita, Ho-sho, Voucher Nº HUCS 12.891).

Essential oil. The essential oil was obtained with a yield of 0.84% (w/w) to the Ho-Sho and 0.72 % (w/w) to the Hon-Sho from the aerial parts, by a 1 hour hydrodistillation in a Clevenger-type apparatus, and dried over anhydrous Na_2SO_4.

Analytical. GC analysis were performed on a Hewlett Packard 6890 Series, equipped with a HP-Chemstation data processor, in two columns. The

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first was a HP-5 bonded phase capillary column (30 m x 320 μm i.d.), 0.25 μm film thickness (Hewlett Packard, Palo Alto, USA); FID detector; column temperature, 60°C (8min) to 180°C at 3°C/min, 180-230°C at 20°C/min, 230°C (20min.); injector temperature 250°C ; split ratio 1:50; detector temperature 275°C; carrier gas H_2 (32 kPa), volume injected 0.1 μL.

The second was a HP-Innowax bonded phase capillary column (30 m x 320 μm i.d.), 0.50 μm film thickness (Hewlett Packard, Palo Alto, USA), column temperature, 40°C (8min.) to 180°C at 3°C/min, 180-230°C at 20°C/min, 230°C (20min.); injector temperature 250°C ; split ratio 1:50; detector temperature 250°C;carrier gas H_2 (34 kPa), volume injected 0.1 μL.

GC-MS analysis were conducted using a Shimadzu QP 5050 equipped with Adams library, using two capillary columns. The first was a fused silica capillary column, (25 m x 250 μm i.d.), stationary phase SE-52, 0.25 μm film thickness (Mega, Legnano, Italy) ; column temperature, 60ºC (8 min) to 180ºC at 3ºC/min, 180-230ºC at 20ºC/min, injector temperature 250ºC; split ratio 1 :40 ; volume injected, 0.2 μL of the oil. He gas was used as a carrier, using 122.2 kPa (51.6 mL/min); interface temperature 250ºC ; detector 1.15 kV ; acquisition mass range 40-400 ; solvent cut, 2 min.

The second was a fused silica capillary column, (25 m x 250 μm i.d.), stationary phase BP-20, 0.25 μm film thickness (SGE, Australia); column temperature, 40ºC (8 min) to 180ºC at 3ºC/min, 180-230ºC at 20ºC/min. Injector temperature 250ºC ; split ratio 1 :40 ; volume injected, 0.2 μL of the oil. Carrier gas was He, 92.6 kPa (55.9 mL/min); interface temperature 250ºC ; detector 1.10 KV ; acquisition mass range 40-400 ; solvent cut, 2 min.

The constituents of the oil were identified by the combination of mass spectral and retention indexes and they were compared with both those of reference authentic compounds and from library spectra data and literature (Adams, 1995; Jennings and Shibamoto, 1980) and are reported in Tables 1 (Hon-sho) and 2 (Ho-sho).

RESULTS AND DISCUSSION

The Hon-Sho leaf oil obtained in Caxias do Sul showed 31 components. 94% of the composition is made by monoterpenes and 2% by sesquiterpenes. Oxygenated terpenes represented 81% of the total, camphor being the main component (68%) and linalool the second most important (9%).

The camphor content was similar to that described for Pakistan (Sattar et al., 1991) and Ivory Coast (Pelissier et al. 1995) leaf oils.

The Ho-Sho leaf oil was almost exclusively formed by linalool (95%), with no other constituent representing more than 1%. In this the product is similar to the most common compositions described in the literature (Lin and Hua, 1987; Tao et al., 1987; Fujita et al. , 1974; Dung et al., 1993), where linalool content varied from 66 to 91%. Contents of cineol and nerolidol described for cetain samples (Lin and Hua, 1987; Nguyen et al., 1994) could not be confirmed in Brazilian samples.

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RESUMO

Os óleos essenciais de duas variedades da árvore canforeira (*Cinnamomum camphora* Nees & Eberm, Lauraceae), conhecidas como Hon-Sho e Ho-Sho cultivadas em canteiros experimentais no sul do Brasil foram estudados. Os óleos essenciais foram obtidos das folhas e ramos de plantas jovens por hidrodestilação. A identificação dos componentes foi feita por GC, GC/MS e índices de retenção nas fases metil silicone e carbowax. Os principais componentes foram linalol no Ho-Sho e cânfora no Hon-Sho.

Table 1 - The Volatile Composition of Hon-Sho

Peak	Identification	%Area (w/w)	R.I. [(a)]	%Area (w/w)	R.I. [(b)]
1	α-thujene	0.20	922	0.98	1015
2	α-pinene	3.15	928	2.29	1023
3	camphene	1.83	941	1.95	1030
4	sabinene	0.19	969	1.35	1077
5	β-pinene	1.16	971	1.16	1050
6	β-myrcene	1.90	990	2.90	1112
7	α-phellandrene	0.56	1003		
8	limonene	3.59	1027	5.11	1132
10	(E)-β-ocymene	0.27	1048	0.19	1169
11	γ-terpinene	0.21	1057		
12	α-terpinolene	0.61	1085	0.87	1200
13	linalool	8.92	1100	18.84	1526
14	camphor	68.03	1144	54.47	1467
15	1-borneol	0.54	1163		
16	terpinen-4-ol	0.67	1175	1.29	1600
17	α-terpineol	0.96	1188	1.35	1676
19	β-citronellol	0.08	1231	0.15	1741
20	neral	0.07	1242	0.35	1700
21	isobornyl acetate	0.98	1284		
22	γ-elemene			1.79	1683
24	β-caryophyllene	0.66	1400	1.26	1546
25	α-humulene	0.27	1440	0.55	1625
26	germacrene D	0.14	1473	0.45	1658
27	bicyclogermacrene	0.56	1491	0.11	1760
28	elemol	0.07	1547	0.25	2052
29	(E)-nerolidol	0.08	1563	0.19	2000
30	spathulenol	0.14	1573	0.25	2100
31	nerol			0.12	1769
32	safrol			0.69	1800
33	globulol	0.12	1578	0.16	1938
34	α-cadinol			0.11	2180
	Total	95.96		99.18	

(a) measured retention index on a HP-5 column
(b) measured retention index on a HP-Innowax column

Table 2 - The Volatile Composition of Ho-Sho.

Peak	Identification	%Area (w/w)	R.I. [(a)]	%Area (w/w)	R.I. [(b)]
2	α-pinene	0.08	928	0.01	1028
4	sabinene			0.06	1078
5	β-pinene	0.10	971	0.17	1075
6	β-myrcene	0.08	990	0.09	1116
8	limonene	0.08	1027	0.30	1144
9	1,8-cineole	0.15	1030		
10	(E)-β-ocymene	0.48	1045	0.46	1200
11	γ-terpinene	0.01	1057		
13	linalool	95.29	1100	93.14	1521
14	camphor	0.40	1136	0.46	1453
15	1-borneol	0.11	1163	0.20	1428
16	terpinen-4-ol	0.08	1172		
17	α-terpineol	0.37	1184		
18	p-cymen-9-ol	0.05	1203		
21	isobornyl acetate	0.11	1284		
22	γ-elemene			0.27	1662
23	aromadendrene			0.09	1691
24	β-caryophyllene	0.46	1400	0.64	1533
25	α-humulene	0.15	1440	0.22	1600
26	germacrene D	0.26	1473	0.30	1625
27	bicyclogermacrene	0.26	1491	0.12	1753
28	elemol	0.10	1547	0.01	2087
29	(E)-nerolidol	0.09	1563	0.11	2000
30	spathulenol			0.05	2100
32	safrol			0.03	1828
	Total	98.71		96.73	

(a) measured retention index on a HP-5 column
(b) measured retention index on a HP-Innowax column

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