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RESEARCH REPORT

Composition of the Bark and Flower Oils of *Cinnamomum bejolghota* (Buch. - Ham.) Sweet from two Locations of Assam, India

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Abstract

Essential oils from the bark and flowers of *Cinnamomum bejolghota* (Buch. - Ham.) Sweet, Lauraceae, obtained from two different locations of Assam, India, were investigated by a combination of high resolution GC and GC/MS. The bark from both areas yielded the same quantity of oil (0.08%), whereas the oil yield from the flowers varied between 0.13% and 0.6% from the two locations (Jorhat and Sibsagar, respectively). Between 32 and 75 compounds have been identified, accounting for 92.0-99.7% of the various oils. The major constituents of the bark oils from Jorhat and Sibsagar were 1,8-cineole (31.3% and 7.2%), α-terpineol (21.3% and 12.7%) and linalool (20.0% and 19.9%). The predominant components in the flower oils were α-pinene (42.9% and 17.0%) and β-pinene (24.9% and 17.2%). The chemical composition of the oils from the two different places exhibited marked variations.

Key Word Index

Cinnamomum bejolghota, Lauraceae, essential oil composition, 1,8-cineole, α-terpineol, linalool, α-pinene, β-pinene.

Introduction

Cinnamomum bejolghota (Buch. - Ham.) Sweet, previously known as *C. obtusifolium* (Roxb.) Nees (1), is a large robust tree, distributed throughout the central and outer-eastern Himalayas, East Bengal, Assam and the Andaman Islands (2). In Assam (where it is locally known as "patichunda"), the plant is well distributed in the Jorhat, Sibsagar, Golaghat, Nowgong and Kamrup districts. It also grows in the Khasi, Garo and Jaintia districts of Meghalaya and in a few places of Nagaland in northeast India (3). The plant is found up to an altitude of 2,700 m MSL (4).

In Assam this plant is used as a secondary food plant for muga silk worms (*Antheraea assama* W/w) (5-7), as well as for other uses (2,8).

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Table I. Percentage composition of the oils of *Cinnamomum bejolghota* Sweet (Lauraceae) from two locations of Assam, India

Compound	RI[a]	Bark oil		Flower oil	
		Jorhat	Sibsagar	Jorhat	Sibsagar
toluene	746	-	-	t	-
hexanal	770	-	t	-	-
n-octane	800	-	-	t	-
(Z)-3-hexen-1-ol	833	-	t	-	-
1-hexanol	847	-	t	-	-
tricyclene	916	-	-	t	t
α-thujene	921	t	0.5	t	-
α-pinene	928	0.7	2.9	42.9	17.0
α-fenchene	938	-	0.1	-	-
camphene	940	-	0.1	1.7	2.0
thuja-2,4(10)-diene	944	-	-	0.2	-
sabinene	962	0.2	2.0	-	-
β-pinene	967	0.9	2.5	24.9	17.2
myrcene	982	0.2	0.9	0.9	-
α-phellandrene	994	-	0.3	-	-
α-terpinene	1008	0.1	2.1	-	-
p-cymene	1010	1.3	2.4	0.3	0.2
1,8-cineole	1016	31.3	7.2	0.5	1.0
limonene	1019	1.1	2.2	3.3	3.3
(Z)-β-ocimene	1027	t	t	t	-
(E)-β-ocimene	1038	0.7	0.3	-	-
γ-terpinene	1047	0.5	2.9	-	-
trans-linalool oxide (furanoid)	1056	-	0.2	-	1.2
cis-linalool oxide (furanoid)	1070	-	0.2	-	1.0
p-cymenene	1071	-	-	t	-
terpinolene	1077	0.2	0.6	-	-
linalool	1084	20.0	19.9	0.6	10.1
endo-fenchol (α-fenchol)	1094	-	t	0.2	0.7
α-campholenal	1099	-	-	0.3	-
nopinone	1101	-	-	-	0.9
cis-pinene hydrate	1103	-	0.2	-	-
trans-pinocarveol	1118	-	0.1	1.7	2.5
trans-pinene hydrate	1120	-	0.3	0.1	-
trans-verbenol	1124	-	-	1.4	2.2
camphene hydrate	1127	-	t	-	-
pinocarvone	1133	-	-	0.3	0.1
trans-β-terpineol	1140	0.7	0.3	-	-
p-mentha-1,5-dien-8-ol	1142	-	-	0.1	-
borneol	1144	-	-	-	0.3
cis-pinocarveol	1154	-	-	0.1	-
p-cymen-8-ol	1158	-	-	t	-
terpinen-4-ol	1158	3.2	8.3	0.4	0.2
myrtenal	1165	-	t	0.6	1.3
α-terpineol	1169	21.3	12.7	0.7	1.9
verbenone	1175	-	-	-	0.3
myrtenol	1176	-	t	1.4	1.7
cis-piperitol	1177	-	t	-	-
trans-piperitol	1187	-	0.1	-	-
trans-carveol	1194	-	-	0.1	0.1
nerol	1209	-	t	-	-

Table I. Continued

Compound	RI[a]	Bark oil		Flower oil	
		Jorhat	Sibsagar	Jorhat	Sibsagar
carvone	1211	-	-	t	-
geraniol	1234	-	t	-	-
cis-pinocarvyl acetate	1286	-	-	0.4	-
neryl acetate	1344	-	t	-	-
α-cubebene	1344	-	0.1	-	-
geranyl acetate	1362	-	t	-	-
α-copaene	1370	0.6	2.5	0.1	0.6
β-elemene	1384	0.2	0.6	0.3	0.9
δ-selinene	1403	-	-	t	-
α-gurjunene	1405	-	0.1	-	-
β-caryophyllene	1411	0.2	0.4	0.8	-
aromadendrene	1431	t	-	0.4	0.9
α-humulene	1444	0.4	0.8	0.2	-
allo-aromadendrene	1451	-	t	0.1	-
β-cadinene	1462	-	0.2	-	-
γ-muurolene	1466	0.2	0.4	-	-
germacrene D	1470	-	0.2	-	-
β-selinene	1476	-	t	0.7	2.5
α-selinene	1486	-	t	0.4	-
bicyclogermacrene	1487	0.9	t	-	-
α-muurolene	1489	0.3	0.5	0.1	-
δ-guaiene (α-bulnesene)	1495	-	t	-	-
γ-cadinene	1501	0.4	-	-	-
cis-calamenene	1505	-	0.4	-	-
α-panasinsene	1506	-	t	0.1	-
δ-cadinene	1510	1.3	2.4	0.1	-
cubenene	1520	-	0.4	-	-
α-copaen-11-ol	1521	-	0.3	-	-
α-calacorene	1524	-	-	t	-
α-cadinene	1525	-	0.1	-	-
elemol	1530	-	t	-	-
(E)-nerolidol	1547	-	t	0.2	-
α-caryophyllene alcohol	1555	-	-	0.3	0.1
spathulenol	1557	0.7	0.2	-	-
caryophyllene oxide	1562	-	0.7	6.0	14.6
globulol	1566	1.4	0.8	0.9	1.5
viridiflorol	1574	0.5	0.5	0.4	0.8
humulene oxide*	1588	-	1.8	0.9	-
tetradecanal	1593	-	2.0	-	-
10-epi-γ-eudesmol	1599	-	0.1	-	-
epicubenol	1609	0.5	1.7	0.1	-
T-muurolol + T-cadinol	1621	4.1	3.8	0.4	1.8
δ-cadinol	1623	0.7	1.8	t	-
β-eudesmol	1628	-	0.3	-	-
α-cadinol	1632	3.3	4.6	-	-
selin-11-en-4α-ol	1633	-	0.1	0.7	3.1
oxo-α-ylangene	1649	-	2.6	-	-
(E,E)-farnesol	1700	-	-	0.1	-
other compounds		1.7	0.1	3.3	8.0

[a]measured linear retention indices on a HP-1 column, relative to n-alkanes; *correct isomeric form not identified; t = trace (< 0.1%)

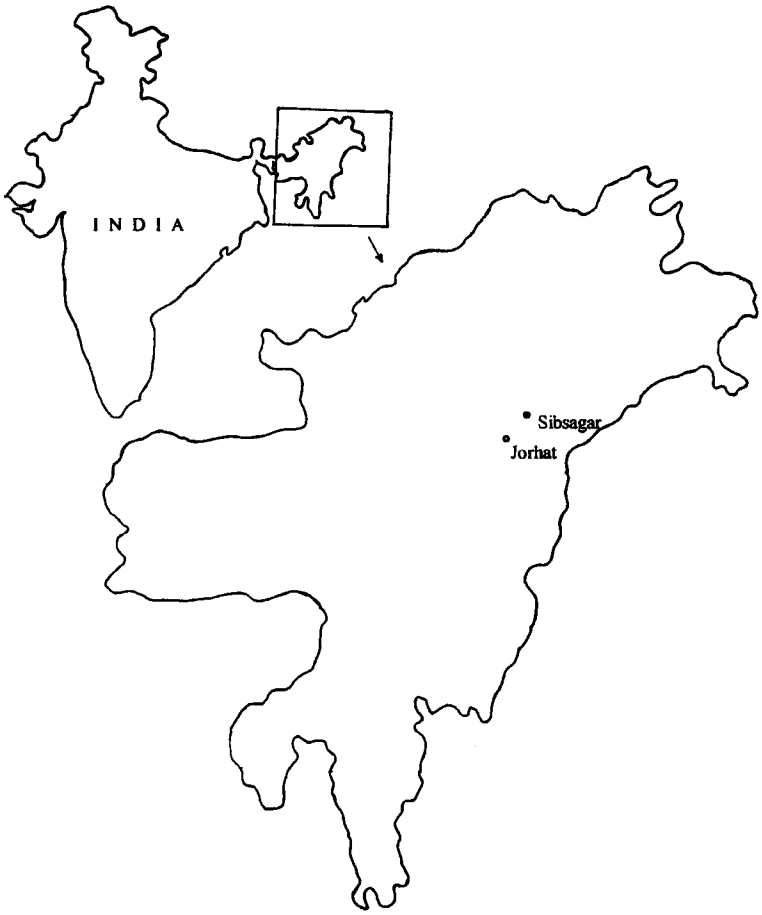

Figure 1. Map of northeast India showing the sampling locations of *Cinnamomum bejolghota*

A literature survey yielded only four publications on the chemical composition of *C. bejolghota*. The oils of the bark and leaves of a Burman variety were analyzed and found to contain cinnamaldehyde as major constituent (9). Cinnamaldehyde, cinnamic acid and cinnamic alcohol were detected in commercial *C. bejolghota* bark (10). Seven new methylflavan-3-ols and one 1,3-diarylpropan-2-ol were isolated from this plant and identified by NMR (11). An acylated flavan-3-ol glucoside and several procyanidins were isolated from the bark (12).

The composition of the bark and flower oils of *C. bejolghota* from two different districts of Assam (Jorhat and Sibsagar), India, was investigated and is presented here.

Experimental

Plant Material: Fresh bark and flowers were collected from the Jorhat and Sibsagar districts of Assam during the month of March, 1996 (Figure 1). Voucher specimens have been deposited in the herbarium of the Regional Research Laboratory, Jorhat, Assam, India.

Isolation of the Essential Oils: Fresh bark (500 g) and flowers (300 g) were hydrodistilled in a Clevenger-type apparatus for 5 and 3 h, respectively. The yield of bark oil was 0.08% for both locations,

while the yield of flower oil varied between 0.13% and 0.6% from the two locations (Jorhat and Sibsagar, respectively).

GC: A Perkin-Elmer 8500 gas chromatograph equipped with a FID detector and a HP-1 fused silica column (24 m x 0.32 mm, 0.17 μm film thickness) was used. The samples, dissolved in hexane, were injected in the split mode, using pressure controlled helium as carrier gas at a linear velocity of 30 cm/s (at 60°C). Injector and detector temperatures were maintained at 250°C. The column oven temperature was programmed from 60°C (after 2 min) to 250°C at 4°C/min. The final temperature was held for 20 min. Peak areas and retention times were measured by electronic integration. The relative amounts of individual components are based on the peak areas obtained, without FID response factor correction. Temperature programmed (linear) retention indices of the compounds were determined relative to n-alkanes.

GC/MS: Analyses were carried out on a Hewlett-Packard 5970A mass selective detector (MSD), directly coupled to a HP 5790A gas chromatograph. A 25 m x 0.20 mm fused silica HP-1 column, with a film thickness of 0.33 mm, was employed. The column oven temperature was programmed from 60°C (after 3 min) to 300°C at 5°C/min. The injector and GC/MS interface temperatures were maintained at 280 and 300°C, respectively. Helium carrier gas was pressure controlled to give a linear gas velocity of 44 cm/s (at 60°C). Electron ionization mass spectra were acquired over the mass range 10-400 Da at a rate of 2/s.

Component Identification: The constituents of the oils were identified by matching their 70 eV mass spectra and linear temperature programmed retention indices with reference libraries (13-21).

Results and Discussion

The chemical components of the bark and flower oils of *C. bejolghota* from two places revealed a marked difference in quantity as well as quality. No difference was found in the bark oil content (0.08% from both sources), but the flower oil content differed substantially (0.13% from Jorhat, 0.06% from Sibsagar).

The composition of the oils is presented in Table I. In the bark oils, 34 and 75 components were identified, accounting for 98.1% and 99.7% of these oils from Jorhat and Sibsagar, respectively. The flower oils contained 55 and 32 identified compounds, accounting for 96.4% and 92.0%, respectively. In general, the bark oils were found to be richer in 1,8-cineole, α-terpineol and linalool than the flower oils. In contrast, the flower oils contained more α- and β-pinene and caryophyllene oxide than the bark oils.

The bark and flower oils from the two sources exhibited marked differences in the compositions of individual components. The bark oil from the Jorhat sample contained 31.3% of 1,8-cineole, while that from the Sibsagar sample comprised only 7.2% of 1,8-cineole. Similarly, α-terpineol constituted 21.3% in the Jorhat sample, while the Sibsagar bark oil contained only half this amount (12.7%). Minor variations were found in the contents of T-muurolol + T-cadinol from the Jorhat (4.1%) and Sibsagar (3.8%) bark oils. On the other hand, certain constituents (e.g., terpinen-4-ol, α-copaene, α-cadinol and δ-cadinene) were comparatively more abundant in the bark oil from Sibsagar. Furthermore, certain constituents were found to be present in one sample and were entirely absent in the other. The linalool oxides, α-phellandrene, pinene hydrates, cubenene, α-copaen-11-ol, humulene oxide, tetradecanal and oxo-α-ylangene were present in the Sibsagar bark oil, while absent in the Jorhat sample. On the contrary, thuja-2,4(10)-diene, myrcene, α-campholenal, cis-pinocarvyl acetate, β-caryophyllene, α-humulene, α-selinene, (E)-nerolidol, humulene oxide and other minor compounds were present in the flower oil from Jorhat but not in the Sibsagar sample.

The significant differences in essential oil content, percentages of individual components in the oils and qualitative differences show that northeast Indian germplasm may have considerable variation of the species in natural conditions.

Note added by editor: The chemical composition of the leaf, panicle and stem bark oil of *Cinnamomum bejolghota* was recently reported by Baruah et al., J. Essent. Oil Res., **9**, 243-245 (1997) after receipt of this paper.

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