Characterization of the leaf essential oil from laurel (*Laurus nobilis* L.) grown in Colombia

Clara Elizabeth Quijano y Jorge A. Pino*

Universidad de los Andes, Facultad de Ciencias, Departamento de Química, Cra. 1ª Este No. 18-A-10 Edif. (Q-826), Bogotá, Colombia. E-mail: cquijano@uniandes.edu.co. *Instituto de Investigaciones para la Industria Alimenticia, Carretera al Guatao kilómetro 3½, La Habana, Código Postal 19200, Cuba. E-mail: jpino@iiia.edu.cu.

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Palabras clave: laurel, *Laurus nobilis*, aceite de hoja, 1,8-cineol, linalol, acetato de α-terpinilo, β-cariofileno.
Key words: laurel, *Laurus nobilis*, leaf oil, 1,8-cineole, linalool, α-terpinyl acetate, β-caryophyllene.

RESUMEN. El laurel (*Laurus nobilis* L.) es un árbol perenne que se cultiva en muchas regiones cálidas del mundo, particularmente, en los países del Mediterráneo. Las hojas secas y su aceite esencial obtenido por destilación poseen un aroma y sabor especial, que favorecen su uso en numerosos productos alimenticios. El aceite esencial fue obtenido a partir de 200 g de hojas mediante hidrodestilación por 3 h en un equipo Clevenger, los cuales rindieron un contenido del 0,2 %. La composición química del aceite de las hojas del laurel cultivado en Colombia fue estudiada por Cromatografía de Gases-Espectrometría de Masas usando una columna capilar de cuarzo del tipo HP-5MS. En total, se identificaron 112 compuestos volátiles que representan el 95 % de su composición química. De ellos, 47 se reportan por primera vez en el laurel. Es interesante señalar la presencia de numerosos ésteres aromáticos no reportados anteriormente. Los componentes mayoritarios fueron 1,8-cineol (22,0 %), linalol (16,4 %), acetato de α-terpinilo (11,1 %) y β-cariofileno (9,0 %). El aceite de la hoja de laurel cultivado en Colombia posee similitud con la composición de otros aceites de laurel y pudiera ser usado como sustituto de los productos importados.

ABSTRACT. Laurel (*Laurus nobilis* L.) is an evergreen tree cultivated in many warm regions of the world, particularly in the Mediterranean countries. The dried leaves and their steam distilled oil possess a spicy flavor and are extensively used in flavoring many food products. The essential oil was obtained from 200 g of leaves by hydrodistillation for 3 h in a Clevenger-type apparatus, yielding 0.2 %. The chemical composition of leaf oil from laurel grown in Colombia was studied by GC-MS using a HP-5MS fused silica column. In total, one hundred and twelve volatile compounds, representing 95 % of the total composition, were identified in the leaf oil. Of them, 47 are reported for the first time in laurel. It is interesting to note the presence of many aromatic esters which were not found in previous papers. The most abundant components found in the leaf oil were 1,8-cineole (22.0 %), linalool (16.4 %), α-terpinyl acetate (11.1 %) and β-caryophyllene (9.0 %). The Colombian laurel oil has some similarities with the composition of other laurel oils and could be used as a substitute of those imported.

INTRODUCTION

Laurel (*Laurus nobilis* L.) is an evergreen tree cultivated in many warm regions of the world, particularly in the Mediterranean countries. The dried leaves and their steam distilled oil possess a spicy flavor and are extensively used in flavoring many food products, such as meats, soups, sausages, and confecionary.[1,2]

Many studies have been devoted to the chemical composition of laurel leaf oil which are reviewed in the literature,[3-9] and in some of them have been claimed that a certain amount of natural variance exists in its chemical composition in dependence of the geographical origin of the species.[10,11] For the best knowledge, the leaf oil of *Laurus nobilis* grown in Colombia has not been the object of previous studies. This was the aim of the present work.

MATERIALS AND METHODS

Leaves were collected from trees grown in Tabio municipality in the savanna of Bogota, Colombia. The identification of the plants was carried out by the Universidad Nacional de Colombia, where a voucher speci-

Correspondencia:
Dra.Clara Elizabeth Quijano Celís
Universidad de los Andes, Facultad de Ciencias, Departamento de Química, Cra. 1ª Este No. 18-A-10 Edif. (Q-826), Bogotá, Colombia. E-mail: cquijano@uniandes.edu.co

men was deposited (Herbarium No. 512581, Collection J. Rangel).

The essential oil was obtained from 200 g of leaves by hydrodistillation for 3 h in a Clevenger-type apparatus, yielding 0.2 %.

For GC/MS analysis a HP 6890 Series II equipped with a mass selective detector HP-5973N and a HP-5MS fused silica column (30 m X 0.25 mm X 0.25 μm film thickness) were employed. The column temperature was programmed as follows: 70 °C hold 2 min, to 230 °C at 4 °C/min, then hold 10 min . Helium carrier gas was used at a flow rate of 1 mL/min . The injector was maintained at 230 °C . Sample injection volume was 0.3 μL with a split ratio of 1 : 10. Mass spectra were recorded in the electron-impact (EI) mode at 70 eV by 1.8 scans/s; the mass range used was m/z 35-400; ion source and connecting parts temperature were 230 °C . Linear retention indices (RI) were calculated using n-paraffin standards.

Compounds were preliminarily identified by comparison of mass spectra with those of reference standards (FLAVORLIB library) or those in NIST, NBS/Wiley, as well as mass spectra from the literature,[12] and then the identities of most were confirmed by comparison of their linear retention indices with those of reference standards or with published data.[12]

Quantitative analysis was made by the normalization method from the electronic integration of the TIC peak areas without the use of correction factors.

RESULTS AND DISCUSSION

The constituents of laurel leaf oil from Colombia are listed in order of their elution on the HP-5MS column (Table 1). One hundred and twelve volatile compounds, representing 95 % of the total composition, were identified in the leaf oil. Of them, 47 are reported for the first time in laurel. It is interesting to note the presence of many aromatic esters which were not found in previous papers. These compounds normally have important contribution due to their flavoring properties.[13]

The most abundant components found in the leaf oil were 1,8-cineole (22.0 %), linalool (16.4 %), α-terpinyl acetate (11.1 %) and β-caryophyllene (9.0 %). According to published data,[3-11] 1,8-cineole is within 27 to 60 %, so the analyzed leaf oil is lower in this oxide which is important for the characteristic flavor of this spice.[5]

Table 1. Composition of laurel leaf oil from Colombia.

Compound	RI	%
2-Furfural[1]	836	t
(E)-2-Hexenal	855	t
(Z)-3-Hexenol	859	0.1
1-Hexanol	871	t
2-Heptanone[1]	892	t
Heptanal[1]	902	t
α-Thujene	930	0.2
α-Pinene	939	2.9
Camphene	954	0.1
Benzaldehyde	960	t
Sabinene	975	1.5
β-Pinene	979	6.1
Dehydro-1,8-cineole	991	t
Myrcene	993	1.3
p-Cymene	1025	t
Limonene	1029	t
1,8-Cineole	1031	22.0
Benzyl alcohol[1]	1033	t
(Z)-β-Ocimene	1037	0.3
2-Phenylacetaldehyde[1]	1042	t
γ-Terpinene	1060	0.6
Acetophenone	1065	t
Cis-sabinene hydrate	1070	0.4
Trans-linalool oxide (furanoid)	1073	0.1
Cis-linalool oxide (furanoid)	1087	t
Terpinolene	1089	0.3
2-Nonanone	1090	t
p-Cymenene	1091	t
Linalool	1097	16.4
Endo-fenchol[1]	1117	t
Cis-*p*-2-menthen-1-ol	1122	0.1
Cis-*p*-mentha-2,8-dien-1-ol	1138	t
Trans-pinocarveol	1139	0.1
Cis-verbenol[1]	1141	t
Benzyl acetate[1]	1162	0.1
Pinocarvone[1]	1165	t
Terpinen-4-ol	1177	1.6
p-Methyl-acetophenone[1]	1182	t
Cryptone[1]	1184	t
(Z)-3-Hexenyl butanoate	1186	t
Dill ether[1]	1187	t
α-Terpineol	1189	4.9
Methyl salicylate[1]	1192	t
Methyl chavicol	1196	t
Myrtenol[1]	1198	t
Decanal[1]	1202	t
Verbenone[1]	1205	t
Trans-piperitol[1]	1208	t
Nerol	1230	t

To be continued on following page.

Table 1. *(Continued.)*

Compound	RI	%
(Z)-3-Hexenyl 2-methylbutanoate[1]	1234	t
Neral[1]	1238	t
Carvone	1243	t
Piperitone[1]	1254	t
Linalyl acetate	1257	0.3
Ethyl salicylate[1]	1270	t
(E)-Cinnamaldehyde	1271	t
Bornyl acetate	1289	0.6
Trans-sabinyl acetate[1]	1291	0.1
2-Undecanone	1294	t
Benzyl isobutanoate[1]	1296	t
Trans-pinocarvyl acetate[1]	1298	t
Carvacrol[1]	1300	t
(E)-Cinnamyl alcohol	1304	t
δ-Elemene[1]	1338	t
α-Terpinyl acetate	1349	11.1
Eugenol	1359	2.0
Neryl acetate	1362	0.2
Hydrocinnamyl acetate	1368	0.2
α-Ylangene	1375	t
Geranyl acetate	1381	0.1
β-Bourbonene	1388	t
Benzyl isopentanoate[1]	1389	0.1
β-Elemene	1391	0.3
Methyl eugenol	1404	2.9
β-Caryophyllene	1419	9.0
α-Guaiene	1440	0.1
(E)-Cinnamyl acetate	1446	2.2
(E)-Isoeugenol[1]	1451	t
α-Humulene	1455	t
(Z)-Methyl isoeugenol	1454	t
Ethyl (E)-cinnamate[1]	1467	t
Germacrene D	1485	0.1
β-Selinene	1490	0.1
α-Zingiberene[1]	1494	t
Bicyclogermacrene	1500	0.9
α-Muurolene	1502	t
α-Bulnesene	1510	0.4
γ-Cadinene	1514	0.1
Cubebol[1]	1515	0.1
δ-Cadinene	1523	0.3
α-Cadinene[1]	1539	0.1
Benzyl hexanoate[1]	1547	0.1
Elemol	1550	0.1
Elemicin	1557	0.9
(E)-Nerolidol[1]	1563	0.1
Spathulenol	1578	0.7
Caryophyllene oxide	1584	0.3
Viridiflorol	1593	0.2

To be continued on following page.

On the other hand, linalool and eugenol, another flavor-important compounds in laurel, are reported in the concentration ranges of 6 to 18 %, and 1 to 6 %, respectively,[5,11] which means that for these two important compounds the analyzed essential oil is in accordance with oils from the Mediterranean region. The other two major compounds and β-caryophyllene have been also reported in higher amounts in the leaf oil from Albanian laurel (12 % for α-terpinyl acetate and 1 % for β-caryophyllene).[5,11]

The Colombian laurel oil has some similarities with the composition of laurel oils from other regions of production and could be used as a substitute of those imported.

CONCLUSIONS

The leaf oil obtained from laurel grown in Colombia was characterized by means of GC-MS and as a result one hundred and twelve volatile compounds were identified. Of them, 47 are reported for the first time in laurel. It is interesting to note the presence of many aromatic esters which were not found in previous papers.

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Table 1. *(Continued.)*

Compound	RI	%
Guaiol[1]	1601	0.1
1,10-Di-epi-cubenol[1]	1619	0.2
10-Epi-γ-eudesmol[1]	1624	0.1
1-Epi-cubenol[1]	1629	0.1
α-Muurolol[1]	1646	t
β-Eudesmol	1651	0.6
α-Cadinol[1]	1655	0.5
Selin-11-en-4-α-ol[1]	1660	0.1
Butyl salicylate[1]	1671	0.1
Benzyl benzoate[1]	1760	0.1
Propyl tetradecanoate[1]	1856	t
Benzyl salicylate[1]	1866	t
Benzyl cinnamate[1]	2092	t
Phytol acetate[1]	2218	t

t Means < 0.1 %.
RI Retention index.
[1] Reported for the first time in laurel.

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