



UNIVERSIDAD DISTRITAL
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CHEMICAL COMPOSITION OF WOOD ESSENTIAL OIL OF *Aniba cinnamomiflora* C. K. Allen FROM VENEZUELAN ANDES

Composición química del aceite esencial de madera de *Aniba cinnamomiflora* C. K. Allen, Andes Venezolanos.

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Marcano-Pacheco, E., Padilla-Baretic, A., Rojas-Fermin, L., Mora-Vivas, F. & Ferrer-Pereira, H. (2016). Chemical composition of wood essential oil of *Aniba cinnamomiflora* C. K. Allen from Venezuelan Andes. *Colombia Forestal*, 19(2), 233-238.

Recepción: 2 de octubre de 2015

Aprobación: 14 de marzo de 2016

Abstract

Aniba cinnamomiflora C. K. Allen is a tree species of Lauraceae family that produces essential oil. A study on the hydrodistillation product of wood pieces from branches of *Aniba cinnamomiflora* is presented. A 0.05% of essential oil was obtained. The essential oil was analyzed by gas chromatography and Mass spectrometry. Fifteen compounds were identified (98.55%) of the total retrieved. The major component (54.00%) corresponds to the lipid γ -palmitolactone, followed by 1-epi-cubenol (9.56%), δ -cadinene (6.05%), t-cadinol (5.00%), and chamazulene (3.53%). This is the first study on the wood essential oil of *Aniba cinnamomiflora*.

Keywords: hydrodistillation, Lauraceae, γ -palmitolactone

Resumen

Aniba cinnamomiflora C. K. Allen es una especie arbórea de la familia Lauraceae que produce aceite esencial. Se presenta un estudio sobre el producto de la hidrodestilación de partículas de madera provenientes de ramas de *Aniba cinnamomiflora*. El 0,05% de aceite esencial fue obtenido. El aceite esencial fue analizado por cromatografía de gases y espectrometría de masas. Fueron identificados quince compuestos (98.55%) del total recuperado. El principal componente (54.00%) corresponde al lípido γ -palmitolactona, seguido por 1-epi-cubenol (9.56%), δ -cadineno (6.05%), t-cadinol (5.00%) y chamazuleno (3.53%). Este es el primer reporte de estudio del aceite esencial de la madera de *Aniba cinnamomiflora*.

Palabras clave: hidrodestilación, Lauraceae, γ -palmitolactona.

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INTRODUCTION

Lauraceae family comprises species with timber, ornamental and culinary values. *Aniba* is an american genus in this family that includes shrubs or trees up to 25 m high (Marques, 2001). Several chemical components have been isolated in this genus, specially neolignans, stylypyrones, and flavones (Rossi *et al.*, 2007), esters (Gottlieb & Kubitzki, 1981), phenylpropanoids (Vilegas *et al.*, 1998), and sesquiterpenoids (Moreira *et al.*, 2010).

Several *Aniba* species produce essential oils (EO) used as raw materials for perfume industries (Marques, 2001). Two species of the genus *Aniba* fulfill the demand for the production of cosmetics, aromatic, and health products, *A. canelilla* (Kunth) Mez and *A. rosaeodora* Ducke, commonly known as rosewood. The stems EO of *A. canelilla* are mainly composed of 1-nitro-2-phenylethane (Manhães *et al.*, 2012). They have antinociceptive and hypotensive activities as well as fungistatic properties against *Candida albicans* (Oger *et al.*, 1994; Lima *et al.*, 2009; Bezerra *et al.*, 2010). The wood EO of *A. rosaeodora* are mainly composed by linalool (Moreira *et al.*, 2010) which has sedative effects and has been evaluated on epidermic cancer cell lines A43 and HaCaT. The oil has showed cytotoxic activity through apoptosis. Besides, a synergistic effect with gentamicin has been demonstrated against *Acinetobacter baumannii* ATCC 19606 (Nóbrega *et al.*, 2009; Rosato *et al.*, 2010; Sœur *et al.*, 2011).

Aniba cinnamomiflora C. K. Allen is represented by trees up to 14 m high, with alternate leaves, slightly revolute margins and brochidromous to pseudobrochidromous venation with terminal inflorescences in the upper branches. The stems, petioles and peduncles are covered with trichomes, usually tan colored. The flowers are yellow to green-yellow, actinodromous, with six subequal tepals, nine bilocular anthers and unilocular, unilocular, minutely

pubescent ovary, sunk into the floral tube in a hypanthium that develops with fruit ripening forming a turbinated cupule, often 4- to 5-parted, red-colored, with floral remains in the margin. The cupules hold the fruit, which reaches up to 4 cm length. During fruit ripening, the epicarp is dark green with light lenticels and becomes dark purple to black, slightly glaucous at full maturity (Kubitzki & Renner, 1982).

A. cinnamomiflora is distributed from Costa Rica to northern South America. In Venezuela it has been reported in Amazonas, Apure, Aragua, Mérida, Miranda, Táchira and Trujillo states, ranging from 600 to 2400 m of altitude. Usually it represents the tallest trees in the Andean and coastal cloud forests, and rainforests of the Orinoco (Hokche *et al.*, 2008). The aim of this paper is to determine the chemical composition of the essential oil obtained from the wood of *A. cinnamomiflora*, not previously reported.

MATERIALS AND METHODS

A. cinnamomiflora branches were collected in the vicinity of the School of Forestry, Faculty of Forestry and Environmental Sciences (FCFA) at the Universidad de Los Andes (ULA), Mérida, Venezuela. The geographical coordinates at this location are 08°37'19.6" north latitude and 71°08'23.3" west longitude, at 1765 m of altitude. A voucher # 054 432 was deposited at the "Carlos Liscano" MER Herbarium, FCFA. The wood essential oil of *A. cinnamomiflora* was obtained by hydrodistillation using a Clevenger trap.

GC analyses were performed using a Perkin-Elmer AutoSystem gas chromatograph equipped with a FID. A 5% phenylmethyl polysiloxane fused-silica capillary column (AT-5, Alltech Associates Inc., Deerfield, IL), 60 m x 0.25 mm, film thickness 0.25 µm, was used. The initial oven temperature was 60 °C; it was heated at 4 °C/min to 260 °C, and maintained for 20 min.

The injector and detector temperatures were 200 °C and 250 °C, respectively. The carrier gas was helium at 1.0 mL/min. The sample was injected using a split ratio of 50:1. Retention indexes were calculated relative to C₈-C₂₄ *n*-alkanes, and compared to values reported in the literature (Adams, 2007).

The GC-MS analyses were carried out on a Hewlett-Packard GC-MS system, Model 5973, fitted with a HP-5MS fused silica capillary column (30 m x 0.25 mm i.d., film thickness 0.25 µm, Hewlett-Packard). The oven temperature program was the same as that used for the HP-5 column for GC analysis; the transfer line temperature was programmed from 150 °C to 280 °C; source temperature 230 °C; quadrupole temperature 150 °C; carrier gas, helium, adjusted to a linear velocity of 34 cm/s; scan range, 40:500 amu; 3.9 scans/s; ionization energy, 70 eV. The sample was diluted with diethyl ether (20 µL in 1 mL) and 1 µL was

injected using a Hewlett-Packard ALS injector with a split ratio of 50:1. The identification of the oil components was based on a Wiley MS data library (6th ed.), followed by comparisons of ms data with published literature (Sandra & Bicchi, 1987; Davies, 1990; Adams, 2007).

RESULTS

The wood essential oil of *A. cinnamomiflora* was obtained by hydrodistillation using a Clevenger trap obtaining a 0.05% yield. The chemical composition was determined by gas chromatography / mass spectrometry (Table 1). Fifteen components of the oil were identified corresponding to a 98.55%, the major ones are γ-palmitolactone (54.0%), 1-*epi*-cubenol (9.6%), δ-cadinene (6.1%), *t*-cadinol (5.0%) and chamazulene (3.5%).

Table 1. Chemical composition of the essential oil of *Aniba cinnamomiflora*.

Compound	Peak Area (%)	KI	KI Literature (Adams, 2007)
Linalool	1.0	1101	1098
α-Bisabolene	1.2	1520	1506
δ-Cadinene	6.1	1535	1524
<i>trans</i> -Nerolidol	1.9	1570	1564
Spathulenol	1.4	1584	1577
Gleenol	3.0	1590	1586
Guaiol	3.3	1600	1600
1- <i>epi</i> -Cubenol	9.6	1617	1627
<i>t</i> -Cadinol	5.0	1624	1633
α-Cadinol	1.9	1630	1652
1,3,5-Trimethoxy-2-propenyl-benzene	2.6	1707	-
Chamazulene	3.5	1723	1725
Benzyl benzoate	1.3	1756	1759
Phenyl ethyl benzoate	2.7	1850	1815
γ-Palmitolactone	54.0	2097	2081
Total	98.5		

KI: Kovats index

DISCUSSION

The oil obtained from *A. cinnamomiflora* wood was not predominantly composed of terpenoids, but a type of lipid component. The major component identified, γ -palmitolactone, in the essential oil of *Aniba cinnamomiflora* wood has been evaluated and applied in cosmetics. This compound, also known as γ -hexadecalactone, is used as fragrance component (Panten *et al.*, 2011). Although the total content of components of *A. cinnamomiflora* oil is not very similar to the composition of *Aniba* essential oils previously reported, several of them are common. For example, benzyl benzoate (1.3%) is also present in *A. riparia* (R. Luz *et al.*, 2002) and *A. hostmanniana* (De Lima *et al.*, 2015) essential oils. This compound is considered a characteristic feature of the genus *Aniba* (Gottlieb & Kubitzki, 1981), and is commercially used as a topical medication against several parasitoses (Silva *et al.*, 2009). Although a minor component of this species (0.9%), the monoterpene linalool, usually present in high proportion in rosewood *A. rosaeodora* (Moreira *et al.*, 2010; Almeida *et al.*, 2013), has anti-inflammatory, antioxidant, and inhibitory activities, as well as bactericidal effects (Peana *et al.*, 2002; Liu, *et al.*, 2012). The t -cadinol, a common component in the oil of *A. hostmanniana* (De Lima *et al.*, 2015), has shown bactericidal effect on *Staphylococcus aureus* (Claeson *et al.*, 1992); the δ -cadinene, also a main component of *A. hostmanniana* (De Lima *et al.*, 2015), is anti-inflammatory and sedative (Dogna, 2009).

The chamazulene possesses anti-inflammatory and antioxidant activity (Safayhi *et al.*, 1994). The 1-nitro-2-phenylethane, a vasorelaxant major component in *Aniba canelilla* (Leal *et al.*, 2013), was not found in *A. Cinnamomiflora*.

CONCLUSIONS

This is the first study on the essential oil of *Aniba cinnamomiflora* wood obtained with 0.05% yield. The main components of the oil were identified as γ -palmitolactone (54.0%), 1-epi-cubenol (9.6%), δ -cadinene (6.1%), t -cadinol (5.0%), and chamazulene (3.5%). The high concentration of the lipid γ -palmitolactone allows the use of this oil as a fragrance component in perfume industry.

ACKNOWLEDGMENTS

The authors would like to thank Dr. Alfredo Usubillaga for collaboration with GC-MS analysis and Professor Armando Rondón for helping in field collection.

BIBLIOGRAPHIC REFERENCES

- Adams, R. (2007). Identification of essential oils components by gas chromatography/mass spectrometry. USA: Allured Publishing Corporation. 804p.
- Almeida, M., Fidelis, C., Barata, L. & Poppi, R. (2013). Classification of Amazonian rosewood essential oil by Raman spectroscopy and PLS-DA with reliability estimation. *Talanta*, 117, 305-311.
- Bezerra, R., Bulcão, F., Leal, L., Pinto, G., Caldas, P., Silva, T., Rosário, J., Soares, J., da Cunha, P., Leal-Cardoso, J. & Lahlou, S. (2010). 1-Nitro-2-phenylethane, the main constituent of the essential oil of *Aniba canelilla*, elicits a vago-vagal bradycardiac and depressor reflex in normotensive rats. *European Journal Pharmacology*, 638 (1-3), 90-98.
- Claeson, P., Radström, P., Sköld, O., Nilsson, A. & Höglund, S. (1992). Bactericidal effect of the sesquiterpene τ -cadinol on *Staphylococcus aureus*. *Phytoterapy Research*, 6 (2), 94-98.

- Davies N.** (1990). Gas chromatographic retention indices of monoterpenes and sesquiterpenes on methyl silicone and Carbowax 20 M phases. *Journal of Chromatography A*, 503, 1-24.
- De Lima, W., Rojas-Fermín, L., Koteich-Khatib, S., Lucena, M. & Carmona, J.** (2015). Volatile Constituents of the Leaves of *Aniba hostmanniana* (Lauraceae) and their Antibacterial Activities. *Natural Product Communications*, 10 (7), 1321-1322.
- Dogna, M.** (2009). 280 Huiles essentielles. Les Petits Répertoires. Paris: Guy Trédaniel Éditeur. Saint-Séverin. 128p.
- Gottlieb, O. & Kubitzki, K.** (1981). Chemogeography of *Aniba* (Lauraceae). *Plant Systematics and Evolution*, 137, 281-289.
- Hokche, O., Berry, P.E. & Huber, O.** (2008). Nuevo catálogo de la flora vascular de Venezuela. Caracas: Fundación Instituto Botánico de Venezuela. 859p.
- Kubitzki, K. & Renner, S.** (1982). Lauraceae I (*Aniba* and *Aiouea*). *Flora Neotropica*, 31, 1-124.
- Leal, L., dos Ramos-Alves, F., Bezerra, Xavier, F., Pinto, G., Caldas, P., Soares, J., da Cunha, P. & Lahlou, S.** (2013). Vasorelaxant effects of 1-nitro-2-phenylethane, the main constituent of the essential oil of *Aniba canelilla*, in superior mesenteric arteries from spontaneously hypertensive rats. *European Journal of Pharmaceutical Sciences*, 48 (4-5), 709-716.
- Lima de, A., Santana, M., Cardoso, A., da Silva, J., Maia, J., Carvalho, J. & Sousa, P.** (2009). Antinociceptive activity of 1-nitro-2-phenylethane, the main component of *Aniba canelilla* essential oil. *Phytomedicine*, 16 (6-7), 555-559.
- Liu, K., Chen, Q., Liu, Y., Zhou, X. & Wang, X.** (2012). Isolation and biological activities of decanal, linalool, valencene, and octanal from sweet orange oil. *Journal of Food Science*, 77 (11), 1156-1161.
- Manhães, A., Veiga-Júnior, V., Wiedemann, L., Fernandes, K. & Sampaio, P.** (2012). Biomass production and essential oil yield from leaves, fine stems and resprouts using pruning the crown of *Aniba canelilla* (H.B.K.) (Lauraceae) in the Central Amazon. *Acta Amazónica*, 42 (3), 355-362.
- Marques, C.** (2001). Importancia económica de familia Lauraceae Lindl. *Floresta e Ambiente*, 8 (1), 195-206.
- Moreira J., de Lima, K. & da Veiga, V.** (2010). Composição química de óleos essenciais de espécies de *Aniba* e *Licaria* e suas atividades antioxidante e antiagregante plaquetária. *Química Nova*, 33 (1), 141-145.
- Nóbrega, R., Machado, D., Ramos, J., Costa, F., de Sousa, D., Leite, J., Mattei, R., Campana, M., Barbosa, J., Santos, J., & Soares, J.** (2009). Rosewood oil induces sedation and inhibits compound action potential in rodents. *Journal of Ethnopharmacology*, 124 (3), 440-443.
- Oger, J. Richomme, P., Guinaudeau, H., Bouchara, J. & Fournet, A.** (1994). *Aniba canelilla* (H.B.K.) Mez. Essential oil: analysis of chemical constituents, fungistatic properties. *Journal Essential Oil Research*, 6, 493-496.
- Panten, J., Oelkers, E., Correll, J. & Kurzenne, P.** (2011). Use of carboxylic acid esters as a fragrance substance. **United States Patent Application US 2011/0104092 A1.**
- Peana, A., D'Áquila, P., Panin, F., Serra, G., Pippia, P. & Moretti, M.** (2002). Anti-inflammatory activity of linalool and linalyl acetate constituents of essential oils. *Phytomedicine*, 9 (8), 721-726.
- R. Luz, A., da Silva, J., B. Zoghbi, M., A. Andrade, E. & S. Maia, J.** (2002). Essential oil from *Aniba riparia* (Nees) Mez. *Journal of Essential Oil Research*, 14, 218-219.
- Rosato, A., Piarulli, M., Corbo, F. Muraglia, M., Carone, A., Vitali, ME. & Vitali, C.** (2010). *In vitro* synergistic antibacterial action of certain combinations of gentamicin and essential oils. *Current Medicinal Chemistry*, 17 (28), 3289-3295.
- Rossi, M., Yoshida, M. & Soares, J.** (2007). Neolignans, styrylpyrones and flavonoids from an *Aniba* species. *Phytochemistry*, 45 (6), 1263-1269.

- Safayhi, H., Sabieraj, J., Sailer, E.-R. & Ammon, H.** (1994). Chamazulene: an antioxidant-type inhibitor of leukotriene B₄ formation. *Planta Medica*, 60 (5), 410-413.
- Sandra, P. & Bicchi, C.** (1987). Capillary gas chromatography in essential oil analysis. Huethig, Heidelberg. 449p.
- Silva, J., do Carmo, D., Reis, E., Machado, G., Leon, L., da Silva, B., Ferreira, J. & Amaral, A.** (2009). Chemical and biological evaluation of essential oils with economic value from Lauraceae species. *Journal of the Brazilian Chemical Society*, 20 (6), 1071-1076.
- Sœur, J., Marrot, L., Perez, P., Iraqui, I., Kienda, G., Dardalhon, M., Meunier, JR., Averbek, D. & Huang ME.** (2011). Selective cytotoxicity of *Aniba rosaeodora* essential oil towards epidermoid cancer cells through induction of apoptosis. *Mutation Research*, 718 (1-2), 24-32.
- Vilegas, J., Lanças, F. & Vilegas, W.** (1998). Composition of the volatile compounds from *Aniba canelilla* (H.B.K.) Mez. extracted by CO₂ in the supercritical state. *Revista Brasileira de Farmacognosia*, 7-8 (1), 13-19.

