REVIEW OF RESEARCH

IMPACT FACTOR : 5.7631(UIF) UGC APPROVED JOURNAL NO. 48514 ISSN: 2249-894X

VOLUME - 8 | ISSUE - 5 | FEBRUARY - 2019

VOLATILE COMPOSITION, ANATOMICAL AND TECHNOLOGICAL ASPECTS OF DEMOLITION WOOD FROM *Ocotea neesiana* (MIQ.) KOSTERM

Joelma Moreira Alcântara[1], Claudete Catanhede do Nascimento[1], Marcia Ortiz M. Marques[2], Roselaine Facanali[2], Jorge Alves de Freitas and Maria da Paz Lima[1]

[1]Coordenação de Tecnologia e Inovação, Instituto Nacional de Pesquisas da Amazônia, Manaus-AM, Brasil

[2]Centro de Pesquisa e Desenvolvimento de Recursos Genéticos Vegetais, Instituto Agronômico de Campinas, Campinas-SP, Brasil.

ABSTRACT

Ocotea neesiana (Miq.) Kosterm. (Lauraceae) commercially known in the Amazon as "louro-aritu" was widely used for decades in civil construction but there is little knowledge pertaining to its chemical and anatomy of wood. The objective this study was to evaluate the composition of essential oil, technological aspects and contribute to the identification of louro-aritu wood from demolition. Thus, a part of demolition wood used at least the last forty-five years as roofing structure was submitted to volatile constituents extraction through hydrodistillation in a Clevenger system. (1.70-1.87) associated with the general Analyzes of anatomical characteristics confirmed the identity of the wood as belonging to species Ocotea neesiana (Miq.). Kosterm. Basic density (0.69 g cm3) and anisotropy coefficient characteristics confirm the technological potential this wood for producing several artifacts. The chemical identification of essential oil was carried out by gas chromatography, the monoterpenes α-terpineol (53.89%), α-borneol (16.20%) and fenchol (9.80%) showed to be predominant. In this study was also evidenced that the essential oil producing cells of this wood are individualized and only release the volatile compounds after their rupture.

KEYWORDS: *Lauraceae, essential oil, monoterpenes, wood anatomy .*

INTRODUCTION

Ocotea Aubl. is the largest Neotropical genus of Lauraceae, comprising ca. 300 species (Van der Werff 1991; Rohwer 1993) with 172 occurring in Brazil (van der Werff 2002; Quinet *et al*. 2018). Several species this genus arouse considerable economic interest for use in papermaking, carpentry and civil construction (Marques 2001), with particular emphasis for *Ocotea porosa* (Nees & Mart.) Barroso known as "imbuia" and *O. pretiosa* Benth. & Hook ("sassafras") (Lourenzi 2002) inserted in the list of Brazilian Flora as species with extinction risk (MMA 2008).

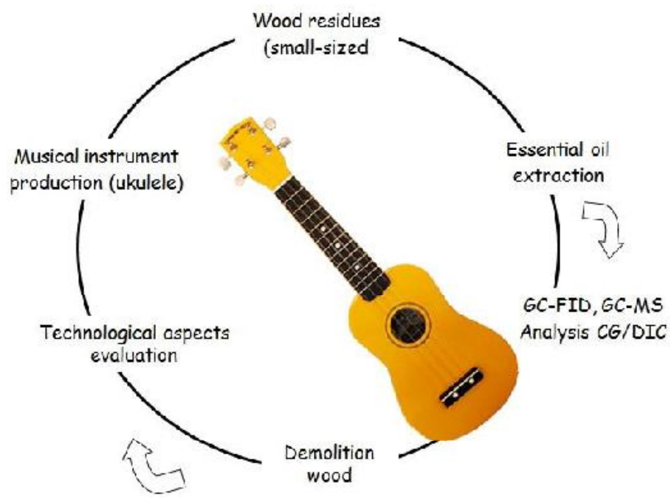
Essential oils of *Ocotea* are characterized by terpenoids and phenylpropanoids constituents presenting some studies reported on the biological activities as cytotoxic agent (Chaverri *et al*. 2011), fungicidal (Castro & Lima 2011; Terreaux *et al*., 1994; Prietro *et al*. 2010; Silva *et al*. 2018, Scalvenzi *et al*, 2016), anti-inflammatory (Ballabeni *et al*. 2010), acaricidal (Figueiredo *et al*. 2018), insecticidal effect (Mossi *et al*. 2014; Pinto-Junior *et al*. 2010), antiplatelet and antithrombotic activities (Ballabeni *et al*. 2007; Yamaguchi *et al*. 2013).

Ocotea neesiana (Miq.) Kosterm. [syn. *Nectandra neesiana* Miq., *Ocotea fallax* (Miq.) Mez, *Ocotea florulenta* (Meisn.) Mez and *Oreodaphne florulenta* Meisn.] (MOBOT 2018) commercially known in the Amazon as "louro-aritu" was widely used for decades by civil construction, yet very little knowledge pertaining to its chemical, anatomy and technological properties of wood. Thus, the objective this study was to evaluate the composition of essential oil, technological aspects and contribute to the identification of louro-aritu wood from demolition.

MATERIALS AND METHODS

Chain for obtainment wood residues

The study proposal is illustrated in scheme 1 which a part of the demolition wood still well conserved and peculiarly strong smelling from one of the INPA departments' roofing structure was became available for evaluation of its technological properties also production of artifacts including the ukulele (a 4 string musical instrument) developed by students of Iniciação Científica middle level. The small-sized residues left over from the production of artifacts were subjected to the odours extraction process.



Scheme 1. Study proposal for demolition wood *O. neesiana* used in the ukulele instrument

Determination of basic density and dimensional stability

The determination of the density (ratio between the oven dry wood sample mass and saturated state volume) was conducted on 2 x 2 x 3 cm wood blocks, their tangential and radial contractions were determined by direct mensuration with the aid of digital pachymeter. Furthermore, each wood sample's anisotropy coefficient (relation between the tangential and radial contractions) was calculated.

Macroscopic and microscopic wood identification

The wood species was identified via macroscopic analysis and comparison with samples available in the Xylotheque of Instituto Nacional de Pesquisas da Amazônia (INPA). For microscopic level descriptions was used Stereo Zoom Stereo Microscopy Luxeo 4D LABOMED; Projector UP-360 TII Olympus and Microscope Carl Zeiss 47 3050 9901 The image was captured by using a Stereoscopic Zoom Microscope Nikon SMZ745T Camera Moticam 2300 AXIOMAT Carl Zeiss. Samples were identified and characterized following Oradi & Bolzon (1991) and COPANT (2018) recommendations.

Oil distillation and analysis

The wood sample was submitted to hydrodistillation for 4 hours, using a Clevenger-type apparatus and the obtained essential oil dried over anhydrous sodium sulfate.The volatile compounds analysis was performed on Shimadzu QP-5000 GC-MS instrument under the following conditions: a DB-5 (30 m x 0.25 mm x 0.25 µm) fused silica capillary column; temperature programme, 60-240 ºC (3 ºC.min); injection temperature, 220 ºC; carrier gas, helium (flow 10 mL.min-1); injection type, splitless (1:20), injection volume, 1 µL; EIMS, 70 eV. The quantitative dates were obtained by using a Shimadzu GC 2010 GC-FID instrument operated under the same GC-MS conditions. The retention indices (Adams 2007) were calculated in relation to the essential oil compounds and a homologous series of n-alkanes co-injected with the sample in GC-FID elution times. Volatile constituents were identified with the retention indices and mass spectra data set and compared to the published literature data (Mclafferty & Stauffer 1989) and databank (NIST 62 lib).

RESULTS AND DISCUSSION

Wood sample yellowish-brown coloured, medium-textured, right-grained, slightly irregular, glossy-surfaced, smooth to touch, soft to cut has a peculiarly active and pleasant odour. The samples' density value showed to be 0.69 g cm3 and anisotropy coefficient range from 1.70 to 1.87. Table 1 describes the macroscopic characteristics of this demolition wood and figure 1 shows the growth layers, which are outlined by dark fibrous tissue areas, vascular lines and contrasted of wood sample. Demolition wood presented average density and accounts for the soft surface during the machining process. The value of the coefficient of anisotropy found allowed to classify the wood of this species as stable. The wood's density together with general characteristics confirm its technological potential for manufacturing several artifacts including musical instrument. Findings from the analyzes macroscopic have confirmed the demolition wood as *Ocotea neesiana* (Miq.). Kosterm.

Table 1: Macroscopic description of louro-aritu wood

Ocotea neesiana Wood	Description
Parenchyma	• axial - little contrasted, visible under lens
	• paratracheal - scarce vasicentric with some short oblique confluences
Pores	• visible to the naked-eye, medium to large
	• few in number, solitary, multiple 2-4
	• vazios, some obstructed by organic inclusion similar to oleoresin
Vascular lines	• long and straight, sometimes filled by organic inclusion similar to oleoresin
Rays	• top - visible under lens, fine and numerous
	• tangential face - little contrasted, visible under lens, low and irregular disposal
	• radial face - visible to the naked-eye, contrasted

The essential oil producing cells of louro-aritu samples and other Lauraceae species have shown to be difficult to be macroscopically observed even with the aid of a magnifying lens. The microscopy for all planes (Figure 2) of observation allowed us to visualize and locate these cells surrounding the vessels, usually associated with axial parenchyma or dispersed between the fibrous tissue, also associated with the radial parenchyma often at the apex or at the ends of the rays. Findings from the analyzes macroscopic have confirmed the demolition wood as *Ocotea neesiana* (Miq.). Kosterm.

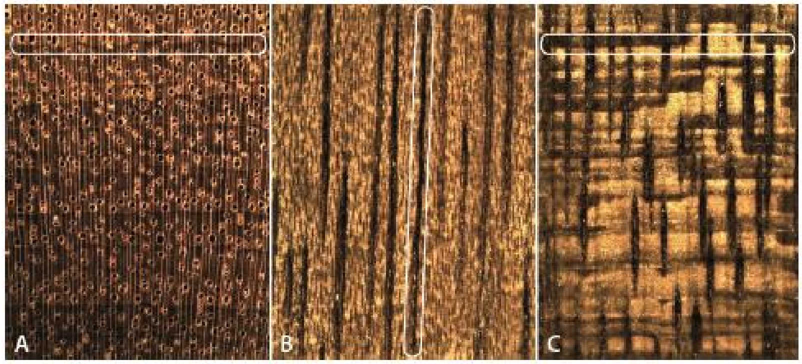


Figure 1. Macrophotographies of observation planes (10 X): Scanty axial parenchyma and vasicentric (transverse section, A), parenchyma cells irregularly distributed (tangential section, B), radial parenchyma with fibrous tissue (radial section, C)

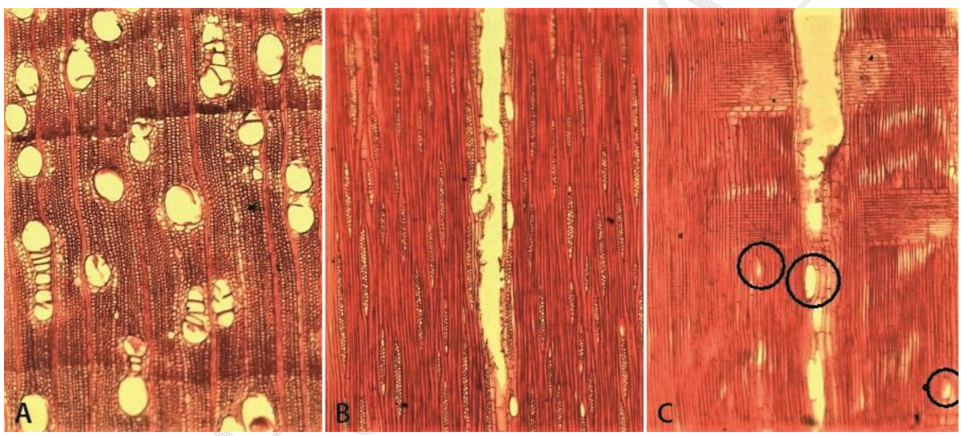


Figure 2. Microphotographies (50 X) on transverse (A), tangential (B) and radial (C) planes

The demolition wood essential oil content found in the present work showed to be 0.81% (v/w). The chromatographic analysis resulted in the identification of 24 chemical components (Table 2): hydrocarbon (1.35%) and oxygenated (96.8%) monoterpenes, phenylpropanoid derivates (1.14%) and oxygenated sesquiterpene (0.39%). The monocyclic oxygenated monoterpenes α-terpineol (53.89%) followed by bicyclic α-borneol (16.20%) and fenchol (9.80%) (Figure 3) showed to be the constituents major of essential oil. The demolition wood intense pine balsamic-mixed scent justifies these three monoterpenes high concentrations.

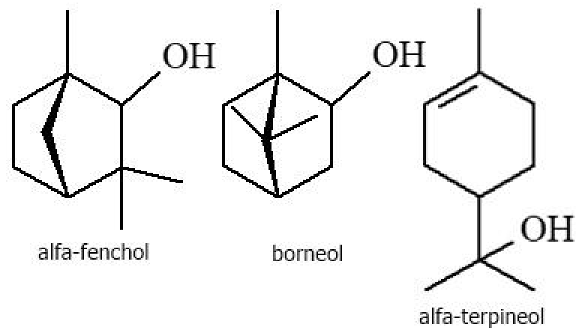


Figure 3. Chemical structure of the predominant constituents of the essential oil from O. *neesiana*

The essential oil content found was considered to be high when compared to that from other *Ocotea* species (0.2-0.02%) obtained by wood hydrodistillation (Chaverri and Cicció 2005; Chaverri *et al*. 2011). This essential oil presented different chemical characteristics from those reported for *Ocotea* wood that showed predominance of sesquiterpenes from species from Costa Rica (Chaverri & Cicció 2005; Chaverri *et al*. 2011), and benzylbenzoate and sesquiterpenes from Brazilian species (Reynolds & Kite, 1995; Gottlieb *et al*. 1981). For *Ocotea* genus the α-terpineol was solely detected in the bark of *O. cymbarum* Kunth (34.9%) (Ávila *et al*. 2016) and *O. usambarensis* (4.21%) (Terreaux *et al*. 1994), but in lower rates than those found in the present work.

Table 2. Composition (%) of the essential oil of *Ocotea neesiana*

Volatile constituents	Retention index	%
α-pinene	930	0,49
p-cymeno	1021	0,41
limonene	1025	0,45
1,8-cineole	1027	2,01
p-mentha-3,8-diene	1068	0,32
fenchone	1084	1,63
α-fenchol	1110	**9,80**
trans-pinocarveol	1135	0,47
camphor	1140	2,58
camphene hydrate	1144	0,63
isoborneol	1153	0,62
trans-pinocamphone	1156	0,25
borneol	1162	**16,20**
terpinen-4-ol	1174	4,44
p-cymen-8-ol	1181	1,84
α-terpineol	1187	**53,89**
mirtenal	1194	0,93
verbenone	1205	0,61
endo-fenchyl acetate	1217	0,48
isobornyl acetate	1282	0,42

methyleugenol	1399	0,63
myristicin	1516	0,26
elimicin	1552	0,25
(*E*)-nerolidol	1560	0,39

CONCLUSIONS

The essential oil secretory cells are individualized and only release volatiles constituents after breaking the cell walls. This has confirmed that this structure type to contribute with the storage of the essential oil within the wood for at least the last forty-five years. The volatile odour was first smelled during the wood unfolding process for manufacturing of artifacts. The results obtained in this work are unpublished and extremely important to add knowledge about the chemical anatomical and aspects of over four decades old used demolition wood.

ACKNOWLEDGMENTS

The authors thank the Brasilian agencies Fundação de Amparo à Pesquisa do Estado do Amazonas (FAPEAM), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), INCT-Madeiras da Amazônia Project for their financial support.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

REFERENCES

Adams, R. P. (2007). Identification of essential oil components by gas chromatography/ mass spectrometry. 4ºed. Illinois USA: Allured Publishing Corporation, Carol Stream.

Ávila, W. A. D., Suárez, L. E. C., & Caroprese, J. F. (2016). Chemical composition of essential oil of *Ocotea cymbarum* Kunth (cascarilla and/or sassafras) from the Orinoquía region. Revista Cubana de Plantas Medicinales, 21, 248-260.

Ballabeni, V., Tognolinia, M., Bertonia, S., Brunib, R., Guerrinib, A., Ruedac, G.,M., & Barocellia, E. (2007). Antiplatelet and antithrombotic activities of essential oil from wild *Ocotea quixos* (Lam.) Kosterm. (Lauraceae) calices from Amazonian Ecuador. Pharmacological Research, 55, 23-30.

Ballabeni, V., Tognolini, M., Giorgio, C., Bertoni, S., Bruni, R., & Barocelli, E. (2010). *Ocotea quixos* Lam. essential oil: *In vitro* and *in vivo* investigation on its anti-inflammatory properties. Fitoterapia, 81, 289-295.

Castro, R. D., Lima, E. O. (2011). Antifungal activity of Brazilian sassafras (*Ocotea odorifera* Vell.) and rosemary (*Rosmarinus officinalis* L.) essential oils against genus *Candida*. Revista Brasileira de Plantas Medicinais, 13, 203-208.

Chaverri, C., & Cicció, J. F. (2005). Essential oil of trees of the genus *Ocotea* (Lauraceae) in Costa Rica. I**.** *Ocotea brenesii*. Revista de Biologia Tropical, 53, 431-436.

Chaverri, C., Díaz, C., & Cicció, J. F. (2011). Chemical analysis of essential oils from *Ocotea gomezii* W.C. Burger and *Ocotea morae* Gómez-Laur. (Lauraceae) collected at "Reserva Biológica Alberto M. Brenes" in Costa Rica and their cytotoxic cctivity on tumor cell lines. Journal of the Brazilian Chemical Society, 22, 741-745.

COPANT- Pan American Standards Commission. Available at http://apps.copant.org/ catalogue-public. Accessed October, 02, 2018.

Figueiredo, F., Nascimento, L. M., Lopes, L. G., Giglioti, R., Albuquerque, R. D. D. G., Santos, M. G., Falcão, D. Q., Nogueira, J. A. P., Rocha, L., Chagas, A. C. S. (2018). First report of the effect of *Ocotea elegans* essential oil on *Rhipicephalus (Boophilus) microplus*. Veterinary Parasitology, 252, 131-136.

Gottlieb, O. R., Koketsu, M., Magalhães, M. T., Maia, J. G. S., Mendes, P. H., Da Rocha, A. I., Da Silva, M. L., & Wilberg, V. C. (1981). Óleos esenciais da Amazônia VII. Acta Amazonica, 11, 143-148.

Lorenzi, H. (2002). Árvores Brasileiras:Manual de Identificação e Cultivo de Plantas Arbóreas Nativas do Brasil, 4a ed. Nova Odessa: Instituto Plantarum.

Marques, C. A. (2001). Importância econômica da família Lauraceae Lindl. Floresta e Ambiente, 8, 195-206.

Mclafferty, F. W., & Stauffer, D. 1989. The Wiley/NBS Registry of Mass Spectra*l* Data. New York: Wiley-Interscience Pub.

MMA (Ministério do Meio Ambiente). Instrução normativa n 6, de 23/09/2008. Lista oficial das espécies da Flora Brasileira ameaçadas de extinção (http://www.mma. gov.br/estruturas/179/arquivos/179_05122008033615.pdf). Accessed October, 02, 2018.

MOBOT-Missouri Botanical Garden-W3 (http://mobot.mobot.org/W3T/Search/ vast.html. Accessed on 02/10/2018.

Mossi, A. J., Zanella, C. A., Kubiak, G., Lerin, L. A. (2014). Essential oil of *Ocotea odorifera*: An alternative against *Sitophilus ze*amais**.** Renewable Agriculture and Food Systems, 29, 161-166.

Pinto-Junior, A.R., de Carvalho, R. I. N., Netto, S. P., Weber, S. H., de Souza, E., Furiatti, R. S. (2010). Bioactivity of essential oils of Brazilian sassafras and eucalyptus against lesser mealworm. Ciencia Rural, 40, 637-643.

Prieto, J. A., Pabon, L. C., Patino, O. J., Delgado, W. A., Cuca, L. E. (2010). Chemical constituents and insecticidal and antifungal activities of the essential oils of leaves of two Colombian species of the genus *Ocotea* (Lauraceae). Revista Colombiana de Química, 39, 199-209.

Oradin, V. T. R.; Bolzon de Muniz, G. I. (1991). Normas de procedimentos em estudos de anatomia de madeira: I. Angiospermae; II. Gimnospermae. Ed. IBAMA. DIRPED. LPF. Brasilia, DF.

Quinet, A.; Baitello, J. B.; Moraes, P. L. R.; Alves, F.M.; Assis, L. Lauraceae. Lista de Espécies da flora do Brasil. Jardim Botânico do Rio de Janeiro (http://floradobrasil. jbrj. gov.br/jabot/floradobrasil/FB143). Accessed October, 02, 2018.

Reynolds, T., & Kite, G. (1995). Volatile constituens of *Ocotea porosa* (*Phoebe porosa*) Mez. Journal of Essential Oil Research, 7, 415-416.

Rohwer, J. G. (1993). Lauraceae. In: Kubitzki, K.; Rohwer, J. G.; Bittrich, V. (Ed.). The families and genera of vascular plants, v. 2. Springer: Berlin, Germany, p. 366-391.

Scalvenzi, L., Yaguache-Camacho, B., Cabrera-Martinez, P., Guerrini, A. (2016). *In vitro* antifungal activity of essential oils of *Ocotea quixos* (Lam.) Kosterm. and *Piper aduncum* L. Bioagro, 28, 39-46.

Silva, D. T., Pinheiro, C. G., Bianchini, N. H., Batista, B. F., Diefenthaeler. J., Muniz, M. F. B. (2018). Microbiological damage influences the content, chemical composition and the antifungal activity of essential oils in a wild-growing population of *Ocotea lancifolia* (Schott) Mez. Journal of Essential Oil Research, 30, 265-277.

Terreaux, C., Maillard, M., Hostettmann, K., Gaetano, L., & Hakizamungu, E. (1994). Analysis of the fungicidal constituents from the bark of *Ocotea usambarensis* Engl. (Lauraceae*).* Phytochemical Analysis*,* 5, 233-238.

Van der Werff, H. **(**1991). A key to the genera of Lauraceae in the new world. Annals of the Missouri Botanical Garde*n*, 78, 377-387.

Van der Werff, H. (2002). A synopsis of *Ocotea* (Lauraceae) in Central America and southern Mexico. Annals of the Missouri Botanical Garden, 89, 429-451.

Yamaguchi, K. K. L, Alcantara, J. M., Lima, E. S., Veiga-Junior, V. F. (2013). Chemical composition and platelet aggregation activity of essential oils of two species of the genus *Ocotea* (Lauraceae). Journal of Essential Oil Bearing Plants, 16, 518-523.