



Boletín Latinoamericano y del Caribe de  
Plantas Medicinales y Aromáticas

ISSN: 0717-7917

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Chile

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Boletín Latinoamericano y del Caribe de Plantas Medicinales y Aromáticas, vol. 16, núm.  
6, noviembre, 2017, pp. 585-592  
Universidad de Santiago de Chile  
Santiago, Chile

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## Chemical composition of essential oil from leaves of *Ocotea limae* Vattimo Gil. and *Ocotea gardneri* (Meisn.) Mez. growing wild in Atlantic forest of North-Eastern Brazil

[Composición química del aceite esencial de las hojas de *Ocotea limae* Vattimo Gil. y *Ocotea gardneri* (Meisn.) Mez. nativas de la floresta Atlántica del Nordeste de Brasil]

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**Abstract:** Essential oils from leaves of *Ocotea limae* and *Ocotea gardneri* species were analyzed by GC-FID and GC-MS. The analysis revealed the presence of 48 components accounting for  $98.1 \pm 1.3\%$  e  $98.0 \pm 0.5\%$  of the essential oils from the *O. limae* and *O. gardneri*, respectively. The oils were characterized by high percentage of sesquiterpenes. The mains compounds identified in the essential oils were spathulenol ( $13.3 \pm 0.5\%$ ),  $\beta$ -caryophyllene ( $12.4 \pm 0.5\%$ ), bicyclogermacrene ( $11.3 \pm 0.4\%$ ) and germacrene D ( $10.9 \pm 0.3\%$ ) from the *O. limae* and germacrene D ( $26.9 \pm 0.9\%$ ) e bicyclogermacrene ( $21.7 \pm 0.7\%$ ) from the *O. glomerata*.

**Keywords:** Essential oil, GC-MS, sesquiterpenes, *Ocotea limae* and *Ocotea gardneri*.

**Resumen:** Los aceites esenciales de hojas de *Ocotea limae* y *Ocotea gardneri* fueron analizados por GC-FID y GC-MS. El análisis reveló la presencia de 48 componentes que representan  $98,1 \pm 1,3\%$  y  $98,0 \pm 0,5\%$  de los aceites esenciales de *O. limae* y *O. gardneri*, respectivamente. Los aceites se caracterizaron por un alto porcentaje de sesquiterpenos. Los principales compuestos identificados en los aceites esenciales fueron espatulenol ( $13,3 \pm 0,5\%$ ),  $\beta$ -cariofileno ( $12,4 \pm 0,5\%$ ), bicilogermacreno ( $11,3 \pm 0,4\%$ ) y germacreno D ( $10,9 \pm 0,3\%$ ) de *O. limae* y germacreno D ( $26,9 \pm 0,9\%$ ) y bicyclogermacreno ( $21,7 \pm 0,7\%$ ) de la *O. glomerata*.

**Palabras clave:** Aceites esenciales, GC-MS, sesquiterpenos, *Ocotea limae* y *Ocotea gardneri*.

**Recibido | Received:** May 9, 2017

**Aceptado | Accepted:** July 3, 2017

**Aceptado en versión corregida | Accepted in revised form:** September 18, 2017

**Publicado en línea | Published online:** November 30, 2017

**Declaración de intereses | Declaration of interests:** Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco (FACEPE), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and for awarding a grant (FACEPE BFP-0096-1.06/16; PND-08601.06/16 CNPq – PQ-2 302860/2016-9) and funding this study (FACEPE; APQ-0476-1.06/14 and APQ-10081.06/15).

**Este artículo puede ser citado como | This article must be cited as:** MM de Moraes, CAG da Camara, CA de Araujo. 2017. Chemical composition of essential oil from leaves of *Ocotea limae* Vattimo Gil. and *Ocotea gardneri* (Meisn.) Mez. growing wild in Atlantic forest of North-Eastern Brazil. **Bol Latinoam Caribe Plant Med Aromat** 16 (6): 586 – 593.

## INTRODUCTION

*Ocotea* is one of the most representative genera of the family Lauraceae, with approximately 400 species. Three hundred species are found in the Americas, 150 of which occur in Brazil (Rohwer, 1993; Quinet et al., 2010), with 52 recorded for the northeastern region of the country and 11 for the state of Pernambuco (Barreto, 1990; Quinet et al., 2010). Many plants in the genus have high commercial value due to the fact that their wood is used in furniture making and civil construction (Moraes, 2005). Predatory extractivism in Brazil has led some species of *Ocotea* to be listed as endangered, which could represent a loss of genetic heritage and chemical knowledge of native aromatic plants (IBAMA, 1992).

Species of this genus are characterized by the production of essential oils that are used in folk medicine in the form of tea or infusions of the leaves for the treatment of headache, fever, cough and diarrhea (Coutinho et al., 2006; Moraes, 2005). Studies on pharmacological activity have demonstrated the species of *Ocotea* have chemical substances with antimicrobial (Leporatti et al., 2014), muscle relaxing (Ribeiro et al., 2003) and anti-inflammatory (Destryana et al., 2014) properties. Previous investigations on the characterization of the chemical constituents of species of *Ocotea* have revealed the occurrence of alkaloids (Dias et al., 2003), flavanoids (Garrett et al., 2012), lignans, neolignans (Barbosa-Filho et al., 1999) and essential oils comprised basically of monoterpenes (Olivero-Verbel et al., 2010), sesquiterpenes, diterpenes (Takaku et al., 2007; Yamacuchi et al., 2013) and phenylpropanoids (Oltamari et al., 2001; Mossi et al., 2013; Leporatti et al., 2014;).

*Ocotea limae* and *Ocotea gardneri* are exclusive to Brazilian flora and are found in fragments of the Atlantic Forest in the state of Pernambuco in the northeastern region of the country, the biodiversity of which is at risk due to anthropogenic pressure. According to information obtained *in loco*, the leaves of these species are used in the form of tea to alleviate headache and stomach problems. However, a survey of the literature reveals that no chemical studies have yet been conducted for the species.

Chemical composition of *O. gardneri* essential oil was previously reported by our research group at two congresses (Botelho et al., 2009; Moraes et al., 2010) and a sample collected in Paraíba-Brazil was also communicated by Dias et al.

(2006). Right now, new triplicate analyzes were performed and a more complete chemical composition of *O. gardneri* oil is presented in the present work. As part of a systematic investigation of the chemical composition of aromatic flora in northeastern Brazil, this paper offers the first report of the chemical composition of essential oils from the leaves of *O. limae* that occur in a fragment of the Atlantic Forest in the state of Pernambuco, Brazil.

## MATERIAL AND METHODS

### Collection of plant material

The fresh leaves of *Ocotea limae* and *Ocotea gardneri* were collected in the Mata de Cruzinha, in Igarassú, Pernambuco state, in March 2008. The geographical coordinates of the collection point were: S 07°49'25.5" W 034° 58'46.6" and S 08°20'05.0" W 035° 47'09.7", respectively. The plant was identified by botanist Dr. Maria RCS de Melo (University Federal Rural of Pernambuco). Voucher of also samples were mounted and deposited in the Vasconcelos Sobrinho Herbarium of the UFRPE, under numbers: 45859 *Ocotea limae* Vattimo Gil. and 45790 *Ocotea gardneri* (Meisn.) Mez.

### Isolation of essential oils

The essential oils from fresh leaves (100 g) were separately isolated using a modified Clevenger-type apparatus and hydrodistillation for 4h. The oil layers were separated and dried over anhydrous sodium sulfate, stored in hermetically sealed glass containers, at a low temperature (-5° C) until analysis. Total oil yields were expressed as percentages (g/100 g of fresh plant material). All experiments were carried out in triplicate.

### Optical rotation

Optical rotation of the essential oils was performed with a digital polarimeter (A. Krüss model Px800, Germany) at 589 nm and 25° C in a dichloromethane solution.

### Chemicals

All monoterpenes ( $\alpha$ -pinene and  $\beta$ -pinene) and sesquiterpenes ( $\beta$ -caryophyllene, aromadendrene,  $\alpha$ -humulene e valencene, germacrene D, bicyclogermacrene spathulenol and caryophyllene oxide) used in the identifications of volatile components were purchased from Sigma-Aldrich - Brazil.

### Gas chromatography analysis

Quantitative GC analysis were carried out using a Hewlett-Packard 5890 Series II GC apparatus equipped with a flame ionization detector (FID) and a non-polar DB-5 fused silica capillary column (30 m x 0.25 mm x 0.25  $\mu$ m) (J & W Scientific). The oven temperature was programmed from 60 to 240° C at a rate 3° C min<sup>-1</sup>. Injector and detector temperatures were 260° C. Hydrogen was used as the carrier gas at a flow rate of 1 mL min<sup>-1</sup> in split mode (1:30). The injection volume was 0.5  $\mu$ L of diluted solution (1/100) of oil in *n*-hexane. The amount of each compound was calculated from GC peak areas in the order of DB-5 column elution and expressed as a relative percentage of the area of the chromatograms. Analysis were carried out in triplicate.

### Gas chromatography-mass spectrometry analysis

The GC-MS analysis of the essential oils was carried out using a Varian 220-MS IT GC system with a mass selective detector, mass spectrometer in EI 70 eV with a scan interval of 0.5 s and fragments from 40 to 550 D fitted with the same column and temperature program as that for the GC experiments, with the following parameters: carrier gas = helium; flow rate = 1 mL min<sup>-1</sup>; split mode (1:30); injected volume = 1  $\mu$ L of diluted solution (1/100) of oil in *n*-hexane.

### Identification of components

Identification of the components was based on GC retention indices with reference to a homologous series of C<sub>8</sub>-C<sub>40</sub> n-alkanes calculated using the Van den Dool and Kratz equation (Van den Dool & Kratz, 1963) and by computer matching against the mass spectral library of the GC-MS data system (NIST version 14 and WILEY version 11) and co-injection with authentic standards as well as other published mass spectra (Adams, 2007). Area percentages were obtained from the GC-FID response without the use of an internal standard or correction factors.

## RESULTS

The essential oils from the leaves of *O. limae* and *O. gardneri* obtained through hydrodistillation had a yellowish coloration and citric aroma, with respective yields of 1.0  $\pm$  0.0% and 0.9  $\pm$  0.1%. The oils were levorotatory, with a specific rotation of  $[\alpha]_{D_{25}} = -25.2^\circ$  (c.=1, CH<sub>2</sub>Cl<sub>2</sub>) for the oil from *O. limae* and  $[\alpha]_{D_{25}} = -29.1^\circ$  (c.=1, CH<sub>2</sub>Cl<sub>2</sub>) for the oil from *O. gardneri*. The chemical analysis using GC-MS

enabled the identification of 48 compounds, representing 98.1  $\pm$  1.3% and 98.0  $\pm$  0.5% of the composition of the oils from *O. limae* and *O. gardneri*, respectively. The oils exhibited a terpene chemical profile, with a predominance of sesquiterpenes (96.8  $\pm$  0.8% and 98.0  $\pm$  0.5% for the oils from *O. limae* and *O. gardneri*, respectively) (Table 1).

Monoterpenes were only identified in *O. limae* at a proportion of less than 1%:  $\alpha$ -pinene (0.5  $\pm$  0.0%) and  $\beta$ -pinene (0.8  $\pm$  0.0%).

The major constituents in the oil from *O. gardneri* were germacrene D (26.9  $\pm$  0.9%) and bicyclogermacrene (21.7  $\pm$  0.7%). Other compounds found in expressive quantities were  $\beta$ -caryophyllene (6.1  $\pm$  0.0%), germacrene B (4.9  $\pm$  0.1%), caryophyllene oxide (4.0  $\pm$  0.0%), viridiflorol (4.5  $\pm$  0.0%) and  $\alpha$ -cadinol (3.3  $\pm$  0.0%). The major constituents in the oil from *O. limae* were spathulenol (13.3  $\pm$  0.5%),  $\beta$ -caryophyllene (12.4  $\pm$  0.5%), bicyclogermacrene (11.3  $\pm$  0.4%) and germacrene D (10.9  $\pm$  0.3%). Other compounds found in expressive quantities were aromadendrene (5.7  $\pm$  0.0%), viridiflorol (5.3  $\pm$  0.4%), *epi*- $\alpha$ -muurolol (4.4  $\pm$  0.1%) and  $\alpha$ -cadinol (3.8  $\pm$  0.0%).

## DISCUSSION

No significant differences were found in the yields of oils from the fresh leaves of the two *Ocotea* species that grow wild in fragments of the Atlantic Forest in the state of Pernambuco, northeastern Brazil. The yields from both *O. limae* and *O. gardneri* are within the range reported in the literature for leaf oils from other species that occur in Brazil, such as 0.23% for *O. nigrescens*, 0.35% for *O. splendens* (Yamaguchi et al., 2013), 0.70% for *O. duckei* (Barbosa-Filho et al., 2008) and 1.5% for *O. puchury-major* (Leporatti et al., 2014). Differences in the yields between the plants examined herein and congeners may be explained by the influence of abiotic factors, such as temperature, luminosity, seasonality, nutrition and water availability. With regard to specific rotation, the oils of the species analyzed herein were levorotatory, with similar rotation angles (Table 1). No measures of specific rotation were found in the literature for essential oils from species of *Ocotea*.

Among the major constituents identified in the oil from *O. limae*, only spathulenol was not found in the oil from *O. gardneri*.  $\beta$ -caryophyllene was the second major component of the *O. limae* oil, but was found in the *O. gardneri* oil at a proportion of less

than 10%. The overall similarity in the constituents identified in the two species was 33.3%, indicating

that the chemical profiles of these oils differ both qualitatively and quantitatively.

**Table 1**  
**Percentage composition, yield and optical rotation of essential oils from *Ocotea limae* and *Ocotea gardneri***

Compounds	RI <sup>a</sup>	RI <sup>b</sup>	<i>O. limae</i>	<i>O. gardneri</i>	Method of Identification
Yield (%) ± SD			1.0 ± 0.0	0.9 ± 0.1	
[α] <sub>D</sub> <sup>25</sup> (c.=1,CH <sub>2</sub> Cl <sub>2</sub> )			-25.2°	-29.1°	
<i>α</i> -pinene	935	932	0.5 ± 0.0	-	RI, MS, CI
<i>β</i> -pinene	980	974	0.8 ± 0.0	-	RI, MS, CI
<i>δ</i> -elemene	1335	1335	1.0 ± 0.0	1.8 ± 0.0	RI, MS
<i>α</i> -cubebene	1345	1345	0.4 ± 0.1	0.1 ± 0.0	RI, MS
<i>α</i> -elangene	1374	1373	1.6 ± 0.3	0.3 ± 0.0	RI, MS
<i>α</i> -copaene	1379	1374	-	0.3 ± 0.0	RI, MS
<i>β</i> -elemene	1389	1389	2.3 ± 0.5	2.2 ± 0.0	RI, MS
<i>β</i> -longipinene	1402	1400	-	0.1 ± 0.0	RI, MS
<b><i>β</i>-caryophyllene</b>	<b>1414</b>	<b>1417</b>	<b>12.4 ± 0.5</b>	<b>6.1 ± 0.0</b>	RI, MS, CI
<i>β</i> -copaene	1434	1430	1.0 ± 0.0	0.4 ± 0.0	RI, MS
<i>β</i> -gurjunene	1435	1431	0.6 ± 0.1	-	RI, MS
<i>α</i> - <i>trans</i> -bergamotene	1436	1432	0.4 ± 0.3	-	RI, MS
<i>γ</i> -elemene	1438	1434	-	0.9 ± 0.0	RI, MS
Aromadendrene	1442	1439	5.7 ± 0.0	0.8 ± 0.0	RI, MS, CI
6,9-guaiadiene	1446	1442	-	0.7 ± 0.0	RI, MS
Spirolepechinene	1449	1449	-	0.6 ± 0.0	RI, MS
<i>α</i> -humulene	1452	1452	2.1 ± 0.0	2.6 ± 0.0	RI, MS, CI
9- <i>epi</i> -( <i>E</i> )-caryophyllene	1469	1464	1.3 ± 0.1	-	RI, MS
<b>germacrene D</b>	<b>1488</b>	<b>1484</b>	<b>10.9 ± 0.3</b>	<b>26.9 ± 0.9</b>	RI, MS, CI
<i>β</i> -selinene	1492	1489	0.4 ± 0.0	-	RI, MS
<i>γ</i> -amorphene	1499	1495	0.5 ± 0.0	0.1 ± 0.0	RI, MS
<b>Bicyclogermacrene</b>	<b>1505</b>	<b>1500</b>	<b>11.3 ± 0.4</b>	<b>21.7 ± 0.7</b>	RI, MS, CI
<i>γ</i> -cadinene	1515	1513	-	1.4 ± 0.2	RI, MS
<i>δ</i> -cadinene	1526	1522	2.0 ± 0.1	2.9 ± 0.1	RI, MS
Zonarene	1532	1528	2.5 ± 0.0	-	RI, MS
<i>α</i> -cadinene	1536	1537	0.7 ± 0.1	1.3 ± 0.2	RI, MS
italicene epoxide	1550	1547	1.3 ± 0.0	-	RI, MS
germacrene B	1558	1559	-	4.9 ± 0.1	RI, MS
Maaiol	1567	1566	-	1.2 ± 0.1	RI, MS
<b>Spathulenol</b>	<b>1581</b>	<b>1577</b>	<b>13.3 ± 0.5</b>	-	RI, MS, CI
Caryophyllene oxide	1583	1582	-	4.0 ± 0.0	RI, MS, CI
Viridiflorol	1589	1592	5.3 ± 0.4	4.5 ± 0.0	RI, MS
Carotol	1599	1594	3.8 ± 0.2	-	RI, MS
Widdrol	1601	1599	0.8 ± 0.2	-	RI, MS
Rosifoliol	1604	1600	-	1.5 ± 0.0	RI, MS
Cedrol	1605	1600	1.3 ± 0.1	-	RI, MS
Junenol	1619	1618	0.6 ± 0.1	2.1 ± 0.1	RI, MS
<i>α</i> -acorenol	1635	1632	0.7 ± 0.3	-	RI, MS
<i>cis</i> -caden-4-em-7-ol	1636	1635	-	0.8 ± 0.0	RI, MS
<i>epi</i> - <i>α</i> -muurolol	1643	1640	4.4 ± 0.1	-	RI, MS

$\alpha$ -muurolol	1651	1644	$0.8 \pm 0.1$	-	RI, MS
$\beta$ -eudesmol	1654	1649	$0.6 \pm 0.1$	-	RI, MS
$\alpha$ -cadinol	1658	1652	$3.8 \pm 0.2$	$3.3 \pm 0.0$	RI, MS
$\alpha$ -selin-11-em-4-ol	1660	1658	-	$3.5 \pm 0.1$	RI, MS
<i>trans</i> -calamene-10-ol	1672	1668	$3.3 \pm 0.2$	-	RI, MS
eudesm-7 (11)-em-4-ol	1696	1700	-	$0.3 \pm 0.0$	RI, MS
6 <i>R</i> ,7 <i>R</i> -bisabolone	1735	1740	-	$0.3 \pm 0.0$	RI, MS
$\beta$ -costol	1764	1765	-	$0.3 \pm 0.2$	RI, MS
Monoterpenes			$1.3 \pm 0.1$	-	
Sesquiterpenes			$96.8 \pm 0.8$	$98.0 \pm 0.5$	
Total			$98.1 \pm 1.3$	$98.0 \pm 0.5$	

<sup>a</sup>Retention indices calculated from retention times in relation to those of a series of n-alkanes on a 30m DB-5 capillary column. <sup>b</sup>Linear retention indices from the literature. RI = retention index, SD = standard deviation, MS = mass spectrum, CI = co-injection with authentic standards.

The chemical composition of *O. gardneri* leaves oil found in the present study differed from the composition presented at a congress by Dias et al. (2006) for a sample collected in Paraíba-Brazil, where  $\beta$ -caryophyllene (29.1%) was identified as a major component, whereas germacrene D, the main constituents found in the sample collected in Pernambuco-Brazil ( $26.9 \pm 0.9$ ) was found in a percentage lower than 10% in the oil collected in Paraíba. Bicyclogermacrene, characterized as the second main constituent of *O. gardneri* oil collected in Pernambuco ( $21.7 \pm 0.7$ ), was not identified in the sample investigated by Dias et al (2006).

The literature offers reports of the chemical composition of essential oils from different parts of plants of the genus *Ocotea* that occur in different regions of Brazil and are rich in monoterpenes, sesquiterpenes and/or phenylpropanoids. In contrast to the oils from *O. limae* and *O. gardneri* analyzed herein from the state of Pernambuco, which were rich in sesquiterpenes, phenylpropanoids were to be the main group of compounds in oil from the fruit of *O. odorifera* occurring in the state of Rio Grande do Sul in southern Brazil (Oltamari et al., 2001) and oil from the leaves of *O. pucburi-major* collected in the state of Amazonas in the northern region of the country (Leporatti et al., 2014). Monoterpenes are reported to be the major constituents in oil from the fruit of *O. duckei* in the state of Paraíba in northeastern Brazil (Barbosa-Filho et al., 2008) as well as leaf oil from *O. odorifera* collected in the state of Rio Grande do Sul in the southern region of the country (Mossi et al., 2013). However, studies with other species of *Ocotea* report sesquiterpenes to be the most abundant class, such as *O. bracteosa* and

*O. duckei* collected in the state of Paraíba in the northeastern region (Coutinho et al., 2007; Barbosa-Filho et al., 2008), *O. quixos*, *O. nigrescens* and *O. splendens* collected in the state of Amazonas in the northern region (Sacchetti et al., 2006; Yamaguchi et al., 2013), *O. notata* collected in the state of Rio de Janeiro in the southern region (Garrett et al., 2010) and *O. puberula* collected in the state of Paraná in the southern region of the country (Farago et al., 2005).

The predominance of sesquiterpenes in the chemical composition of the essential oils from species of *Ocotea* that occur in the state of Pernambuco is consistent with data reported in the literature for the majority of congeners distributed throughout different regions of Brazil. This sesquiterpene profile has also been observed in species of *Ocotea* that occur outside of Brazil, such as oils from the fruit and shoots of *O. quixos* in Ecuador (Bruni et al., 2004; Destryana et al., 2014), oils from the leaves of *O. meziana*, *O. valeriana* and *O. whitei* in Costa Rica (Wright et al., 2007; Takaku et al., 2007) and oil from the leaves of *O. caudata* in Colombia (Gil et al., 2016).

The similarity in the chemical composition of the essential oils from the leaves of *O. limae* and *O. gardneri* with correlated data reported in the literature is not only related to the sesquiterpene chemical profile, but also the main component identified in the oils. Spathulenol ( $13.3 \pm 0.5\%$ ), which was the main component in the oil from *O. limae* and absent from the oil from *O. gardneri*, is reported to be the a major constituent of the oil from leaves of *O. whitei* (15.3%) and the bark of stems from *O. puberula* (15.73%) collected in Costa Rica and Brazil, respectively (Takaku et al., 2007; Farago

et al., 2005). The major component in the oil from *O. gardneri* [Germacrene D (26.9 ± 0.9%)] was found at a significant proportion in the oil from *O. limae* (10.9 ± 0.3%) and is also reported to be a major constituent of oils from the leaves of *O. valeriana* (69.7%) (Takaku et al., 2007) and *O. mezina* (50.6%) collected in Costa Rica (Wright et al., 2007), *O. botrantha* (35.2%) collected in the United States (Scora & Scora, 2001) and *O. caudata* (55.8%) collected in Colombia (Gil et al., 2016).

The second major constituent in the oil from *O. gardneri* (21.7 ± 0.7%) and third major constituent in the oil from *O. limae* (11.3 ± 0.4%) was bicyclogermacrene, which is reported in quantities less than 10% in oils from the leaves of *O. morae* (8.8%) (Chaverri et al., 2011) and *O. caudata* (8.0%) (Gil et al., 2016) as well as oil from the bark of stems of *O. puberula* (9.38%).  $\beta$ -caryophyllene, which was the second major constituent of the oil from *O. limae* (12.4 ± 0.5%), is the most reported compound in the literature as a major component in other species of the genus *Ocotea*, such as oils from leaves of *O. meziana* (24.8%), *O. whitei* (15.3%) (Takaku et al., 2007), *O. duckei* (60.54%) (Barbosa-Filho et al., 2008), *O. notata* (22.9%) (Garrett et al., 2010), *O. nigrescens* (37.9%) and *O. splendens* (51.0%) (Yamaguchi et al., 2013) as well as oils from the shoots (28.2%), leaves (15.1%) and fruit (15.1%) of *O. quixos* (Destryana et al., 2014; Bruni et al., 2004; Sacchetti et al., 2006).

## CONCLUSION

This is the first report of the chemical composition of essential oils from *O. limae*. The present study demonstrated that neither species has phenylpropanoids and both are basically comprised of sesquiterpenes. The chemical profile of the oils of the two species differs both qualitatively and quantitatively. The major constituents in the oil from *O. limae* were spathulenol and  $\beta$ -caryophyllene, whereas the major constituents in the oil from *O. gardneri* were germacrene D and bicyclogermacrene and differed from those previously communicated for a sample from Paraíba-Brazil by Dias et al (2006).

## ACKNOWLEDGEMENTS

The authors are grateful to the Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco (FACEPE), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and for awarding a grant (FACEPE BFP-0096-1.06/16; PND-

08601.06/16 CNPq – PQ-2 302860/2016-9) and funding this study (FACEPE; APQ-0476-1.06/14 and APQ- 10081.06/15).

## REFERENCES

- Adams RP. 2007. **Identification of Essential Oil Components by Gas Chromatography/Quadrupole Mass Spectroscopy**, 4<sup>th</sup> Ed. Allured Publishing Corporation: Carol Stream, USA..
- Barbosa-Filho JM, Cunha RM, Dias CS, Athayde PF, Silva MS, Cunha EVL, Machado MIL, Craveiro AA, Medeiros IA. 2008. GC-MS Analysis and cardiovascular activity of the essential oil of *Ocotea duckei*. **Rev Bras Farmacogn** 18: 37 - 41.
- Barbosa-Filho JM, Vargas MRW, Silva IG, Franca IS, Moraes LCSL, Cunha EVL, Silva MS, Souza EFV, Chaves MCO, Almeida RN, Agra MF. 1999. *Ocotea duckei*: exceptional source of yangambin and other furofuran lignans. **An Acad Bras Cienc** 71: 231 - 238.
- Barreto RC. 1990. O gênero *Ocotea* Aubl. (Lauraceae) no estado de Pernambuco. **Anais do 36° Congresso Nacional de Botânica** 1: 175 - 199.
- Botelho PS, Moraes MM, Neves IA, Neves RCS, Ribeiro NC, Born FS and Camara CAG. 2009. Composição química e Ação Repelente do óleo essencial *Ocotea gardneri* (Meisn) Mez. sobre o ácaro rajado *Tetranychus urticae* Koch. **IX - Jornada de Ensino Pesquisa e Extensão, 2009**, Recife, Pernambuco, Brazil.
- Bruni R, Medici A, Andreotti E, Fantin C, Muzzoli M, Dehesa M, Romagnoli C, Sacchetti G. 2004. Chemical composition and biological activities of Ishpingo essential oil, a traditional Ecuadorian spice from *Ocotea quixos* (Lam.) Kosterm. (Lauraceae) flower calices. **Food Chem** 85: 415 - 421.
- Chaverri C, Diaz C, Ciccio JF. 2011. Chemical Analysis of Essential Oils from *Ocotea gomezii* WC Burger and *Ocotea morae* Gomez-Laur. (Lauraceae) Collected at "Reserva Biológica Alberto M. Brenes" in Costa Rica and their Cytotoxic Activity on Tumor Cell Lines. **J Brazil Chem Soc** 22: 741 - 745.
- Coutinho DF, Agra MDFT, Barbosa-Filho JM, Basílio IJLD. 2006. Morfo-anatomia foliar de

- Ocotea gardneri* (Meisn.) Mez (Lauraceae-Lauroidae). **Rev Bras Farmacogn** 16: 178 - 184.
- Coutinho DF, Dias CS, Barbosa-Filho JM, Agra MF, Martins RM, Silva TMS, Cunha EVL, Silva MS, Craveiro AA. 2007. Composition and molluscicidal activity of the essential oil from the stem bark of *Ocotea bracteosa* (Meisn.) mez. **J Essent Oil Res** 19: 482-484.
- Destryana RA, Young DG, Woolley CL, Huang TC, Wu HY, Shih WL. 2014. Antioxidant and Anti-inflammation Activities of *Ocotea*, Copaiba and Blue Cypress Essential Oils *in vitro* and *in vivo*. **J Am Oil Chem Soc** 91: 1531 - 1542.
- Dias CS, Silva IG, Cunha EVL, Silva MS, Braz-Filho R, Barbosa-Filho JM. 2003. Isolamento e identificação de novos alcaloides de *Ocotea duckei* vattimo (Lauraceae). **Rev Bras Farmacogn** 13: 62 - 63.
- Dias CS, Coutinho DF, Martins RM, Silva TMS, Craveiro, AA, Agra MF, Barbosa-Filho JM. 2006. Análise por CG-EM e atividade moluscicida do óleo essencial das folhas de *Ocotea gadneri* (Meisn.) Mez (Lauraceae). **29ª Reunião Anual da Sociedade Brasileira de Química**, Águas de Lindóia, São Paulo, Brazil.
- Farago PV, Budel JM, Duarte MR, Nakashima T. 2005. Análise morfoanômica de folhas de *Ocotea puberula* (Rich.) Nees, Lauraceae. **Rev Bras Farmacogn** 15: 250 - 255.
- Garrett R, Romanos MTV, Borges RM, Santos MG, Rocha L, Silva AJR. 2012. Antiherpetic activity of a flavonoid fraction from *Ocotea notata* leaves. **Rev Bras Farmacogn** 22: 306 - 313.
- Garrett R, Cruz RAS, Rocha L, Santos MG, da Silva AJR. 2010. Chemical composition and toxicity of *Ocotea notata* (Nees). **Mez Essent Oil Jeobp** 13: 455 - 459.
- Gil E, Cuca LE, Delgado WA. 2016. Chemical composition and antimicrobial activity of the essential oil of the leaves of *Ocotea caudata* (Nees) Mez (Lauraceae) from Colombia. **Bol Latinoam Caribe Plant Med Aromat** 15: 258 - 263.
- IBAMA - Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. Portaria n. 37-N, 3 de abril 1992. **Lista oficial de flora brasileira ameaçada de extinção**. [http://www.mma.gov.br/estruturas/179/\\_arquivos/179\\_05122008033627.pdf](http://www.mma.gov.br/estruturas/179/_arquivos/179_05122008033627.pdf) [Consulted Setember 28, 2017].
- Leporatti ML, Pintore G, Foddai M, Chessa M, Piana A, Petretto GL, Masia MD, Mangano G, Nicoletti M. 2014. Chemical, biological, morphoanatomical and antimicrobial study of *Ocotea puchury-major* Mart. **Nat Prod Res** 28: 294 - 300.
- Moraes PLR. 2005. Sinopse das Lauráceas nos estados de Goiás e Tocantins, Brasil. **Biota Neotrop** 5: 1 - 18.
- Moraes MM, Neves IA, Neves RCS, Botelho PS, Camara CAG. 2010. Composição química e Ação Repelente do óleo essencial *Ocotea gardneri* (Meisn) Mez. sobre o ácaro rajado *Tetranychus urticae* koch. **33ª Reunião Anual da Sociedade Brasileira de Química**, Águas de Lindóia, São Paulo, Brazil.
- Mossi AJ, Zanella CA, Kubiak G, Lerin LA, Cansian RL, Frandoloso FS, Prá VD, MAzutti MA, Costa AV, Treichel H. 2013. Essential oil of *Ocotea odorifera*: An alternative against *Sitophilus zeamais*. **Renew Agr Food Syst** 29: 161 - 166.
- Olivero-Verbel J, Gonzalez CT, Guette FJ, Jaramillo CB, Stashenko E. 2010. Chemical composition and antioxidant activity of essential oils isolated from Colombian plants. **Rev Bras Farmacogn** 20: 568 - 574.
- Oltramari AC, da Silva JMOD, Pedrotti EL, Maraschin M. 2001. Canela sassafrás (*Ocotea odorifera* (Vell.) Rohwer): Análise histórica e de mercado da atividade extrativista da biomassa lignocelulósica e do óleo essencial no Estado de Santa Catarina. **Rev Árvore** 26: 99 - 106.
- Quinet A, Baitello JB, Moraes PLR. 2010. Lauraceae. In: Forzza RC, Costa A, Siqueira Filho JA, Martinelli G, Monteiro RF, Santos-Silva F, Saraiva DP, Paixão-Souza B, Louzada RB. (Ed.) **Lista de espécies da flora do Brasil**. Jardim Botânico do Rio de Janeiro. Rio de Janeiro, Brazil.
- Ribeiro RA, Carmo LG, Vladimirova I, Jurkiewicz NH, Jurkiewicz A. 2003. Nantenine blocks muscle contraction and Ca<sup>2+</sup> transient induced by noradrenaline and K<sup>+</sup> in rat vas deferens. **Eur J Pharmacol** 470: 37 - 43.
- Rohwer JG. 1993. Lauraceae. In: Verlag, Kubitzki K, Rohwer JG, Bittrich V: **The families and**



- genera of vascular plants.** Springer, Berlin, Germany.
- Sacchetti G, Guerrini A, Noriega P, Bianchi A, Bruni R. 2006. Essential oil of wild *Ocotea quixos* (Lam.) Kosterm. (Lauraceae) leaves from Amazonian Ecuador. **Flavour Frag J** 21: 674 - 676.
- Scora RW, Scora PE. 2001. Essential leaf oil of *Persea* subgenus *Eriodaphne* and closely related *Perseoid* genera. **J Essent Oil Res** 13: 37 - 42.
- Takaku S, Haber WA, Setzer WN. 2007. Leaf essential oil composition of 10 species of *Ocotea* (Lauraceae) from Monteverde, Costa Rica. **Biochem Syst Ecol** 35: 525 - 532.
- Yamaguchi KKL, Alcantara JM, Lima ES, Veiga-Junior VF. 2013. Chemical Composition and Platelet Aggregation Activity of Essential Oils of Two Species of the Genus *Ocotea* (Lauraceae) **TEOP** 16(4): 518 - 523.
- Van den Dool H, Kratz PD. 1963. A generalization of the retention index system including linear temperature programmed gas liquid partition chromatography. **J Chromatogr A** 11: 463-471.
- Wright BS, Bansal A, Moriarity DM, Takaku S, Setzer WN. 2007. Cytotoxic leaf essential oils from neotropical Lauraceae: synergistic effects of essential oil components. **Nat Prod Commun** 2: 1241 - 1244.