SHORT COMMUNICATION

Chemical composition and evaluation of the antimicrobial activity of the essential oil from leaves of *Eugenia platysema*

Adrielli Tenfena, Diogo Alexandre Sieberta, Celina Noriko Yamanakaa, Caio Maurício Mendes de Córdovaa, Dílamara Riva Scharfb, Edésio Luiz Simionattool and Michele Debiasi Albertonb

aDepartamento de Ciências Farmacêuticas, Universidade Regional de Blumenau, Blumenau, Brazil; bInstituto de Pesquisas Tecnológicas, Universidade Regional de Blumenau, Blumenau, Brazil

**ABSTRACT**

This study describes the qualitative and quantitative chemical composition and evaluates the antibacterial activity of essential oil from *Eugenia platysema* leaves. Analysis by GC–FID and GC–MS allowed the identification of 22 compounds. Different from the other species of the *Eugenia* genus, the major compound found in the essential oil was the diterpene phytol (66.05%), being this the first report of the presence of this compound in the essential oils from *Eugenia* genus. The sesquiterpene elixene was the second most concentrated compound in the studied essential oil (9.16%). The essential oil from *E. platysema* was tested for its antibacterial activity against cell-walled bacteria and mollicute strains of clinical interest using the microdilution broth assay. The results showed that the essential oil of *E. platysema* was inactive until 1000 μg mL⁻¹ against tested bacteria.

**KEYWORDS**

Eugenia platysema; essential oil; antibacterial activity; phytol

**ARTICLE HISTORY**

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1. Introduction

Essential oils are complex natural products produced from secondary metabolism, which are commonly concentrated in leaves, bark or the fruit of aromatic plants. The composition of essential oils varies from 20 to 60 compounds at different concentrations, primarily made up of molecules with low molecular weight, such as terpenes. Since they are responsible

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CONTACT Michele Debiasi Alberton  michele@furb.br

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for a wide range of biological activities, such as antimicrobial, antioxidant, anti-inflammatory and antiviral, among others, they are extensively studied by the scientific community (Bakkali et al. 2008).

The *Eugenia* genus is known for its numerous therapeutic properties and it has been used for a long time in popular medicine as hypotensive, antigout, diuretic, antimicrobial, hypoglycemic and anti-inflammatory agent (Schapoval et al. 1994; Auricchio and Bacchi 2003; Garmus et al. 2014). According to the literature, several species of *Eugenia* genus are rich in essential oils, such as *Eugenia uniflora* (Maia et al. 1997), *Eugenia punctifolia* (Oliveira et al. 2005), *Eugenia brasiliensis* (Siebert et al. 2015) and *Eugenia pyriformis* (Stieven et al. 2009). Many biological activities have been described following the use of essential oil from the *Eugenia* genus, which have demonstrated antifungal (Gayoso et al. 2005), antileukemic (Yoo et al. 2005), cytotoxic (Ogunwande et al. 2005), antioxidant, antimicrobial (Magina et al. 2009; Kloucek et al. 2012; Victoria et al. 2012; Garmus et al. 2014), antidiarrhoeic (Galheigo et al. 2015) and antileishmanial activity (Rodrigues et al. 2013). Euglobal-like compounds, derived from monoterpenes and found in *Elaeagnus multiflora*, also have shown chemoprotective and antimalarial activity (Faqueti et al. 2013).

*Eugenia platysema*, known as ‘guamirim’, is a perennial tree of the Myrtaceae family native to South America (Legrand & Klein 1978). Since there are few studies of this species in the literature, and observing the interesting chemical and biological potential for *Eugenia* genus, the aim of this study was to evaluate the chemical composition and the antibacterial activity of the essential oil from *E. platysema*.

**2. Results and discussion**

After the extraction, 0.039% (w.w⁻¹) of the essential oil was yielded. After chromatographic analysis by GC–MS and GC–FID, a total of 22 compounds were identified, accounting for 99.0% of the constituents detected. The qualitative and quantitative chemical composition of essential oil is presented in Table S1 (Supplementary material – Table S1).

Diterpenes were the major class of compounds identified in the essential oil (66.05%), followed by sesquiterpenes (32.95%). Among the sesquiterpenes, the non-oxygenated ones were more abundant (16.60%) when compared to the oxygenated ones (16.35%). Monoterpenes were not found in the essential oil, different from other species of *Eugenia* genus.

The major compound identified in the essential oil was diterpene phytol (66.05%). This compound is not commonly found in essential oils because it has a higher molecular weight; however, it was previously reported in the essential oil of other species, like *Citrus* species (Hamdan & El-Shazly 2014). Although there are no reports of this compound in the essential oils extracted from *Eugenia* genus, phytol has been isolated from the leaves of other species of the Myrtaceae family, as *Syzygium formosanum* (Chang et al. 1999). The second major compound found in the studied essential oil was elixene (9.16%), a non-oxygenated sesquiterpene. This compound was found at lower concentrations in the essential oil of buds of other *Eugenia* species, such as *Eugenia caryophyllata* (Bhuiyan et al. 2010). Other sesquiterpenes characteristic of *Eugenia* genus, such as δ and β-elemene, allo-aromadendrene, spatulenol, globulol and viridiflorol (Cole et al. 2007; Nakamura et al. 2010) were found in our study.

In a previous report performed by Apel et al. (2002) with the essential oil from *E. platysema* collected in South Brazil, sesquiterpenes were the major class identified, making up
81.7% of the total compounds. In that study, the monoterpenes represent the 0.2% of the total compounds, confirming the low concentration of these compounds in *E. platysema*. The major sesquiterpenes identified were aromadendrene (12.6%), which was also present at lower concentrations in our sample, and β-selinene (17.9%), which was not found in our study. Phytol and elixene, the two most concentrated compounds in our study, were not found in the sample studied by Apel et al. (2002).

In fact, there are often large differences in the qualitative and quantitative composition of oils from the same plant species. The reasons for this variability may be the different geographical sources, the season it was harvested in, the genotype, the climate, the drying procedure and the part of the plant distilled. These variables influence the relative concentration of each constituent in the oil (Oussalah et al. 2007).

The essential oil extracted from *E. platysema* was tested against bacteria of clinical interest to evaluate its potential antibacterial activity. For this assay, a criterion established by Machado et al. (2005) was used. Samples with MIC values lower than 10 μg mL\(^{-1}\) were considered to have an excellent antibacterial activity; values between 10 and 100 μg mL\(^{-1}\) were considered to have a good antibacterial activity; values between 100 and 500 μg mL\(^{-1}\) were considered to have a moderate activity; values between 500 and 1000 μg mL\(^{-1}\) to have a low activity, and for MIC values above 1000 μg mL\(^{-1}\), samples were considered inactive. Results for the MIC value of all the essential oil samples are shown in Table S2. For cell-walled bacteria and for mollicutes, none of the samples tested were active, showing MIC values above 1000 μg mL\(^{-1}\).

Some antimicrobial activities have been attributed to phytol, such as antituberculosis activity against *Mycobacterium tuberculosis* (Rajab et al. 1998; Saikia et al. 2010) and anti-growth activity against *Staphylococcus aureus* (Inoue et al. 2005). However, despite the existence of phytol in the essential oil, the antibacterial activity has not been observed.

3. Conclusions

The results presented in this work show that, different from most essential oils of *Eugenia* genus, the essential oil of *E. platysema* has high concentration of diterpene phytol (66.05%), followed by sesquiterpenes (33.95%). However, studies with samples collected in all seasons of the year are necessary to verify if the qualitative and quantitative chemical profile and biological activity presented by the essential oil of this species keep the pattern described in this study. Although phytol was the major compound in the analysed essential oil, antibacterial activity was not observed.

Supplementary material

Experimental details relating to this paper are available online, alongside with Tables S1–S2.

Disclosure statement

No potential conflict of interest was reported by the authors.
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