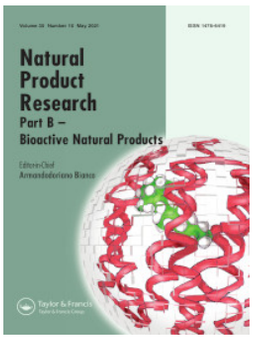

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SHORT COMMUNICATION

Flavonoids, antioxidant potential and antimicrobial activity of *Myrcia rufipila* mcvaugh leaves (myrtaceae)

Márcia M. Cascaes[a,b], Giselle M. S. P. Guilhon[b], Maria das Graças Zoghbi[c], Eloisa Helena A. Andrade[b,c], Lourivaldo S. Santos[b], Joyce Kelly R. da Silva[b,d], Ana Paula Trovatti Uetanabaro[e] and Isabella S. Araújo[e]

[a]Programa de Capacitação Institucional, Museu Paraense Emílio Goeldi, Belém, Brazil; [b]Programa de Pós-Graduação em Química, Universidade Federal do Pará, Belém, Brazil; [c]Museu Paraense Emílio Goeldi, Coordenação de Botânica, Belém, Brazil; [d]Programa de Pós-Graduação em Biotecnologia, Universidade Federal do Pará, Belém, PA, Brazil; [e]Universidade Estadual de Santa Cruz, Ilhéus-Itabuna, Brasil

ABSTRACT

This paper reports the first chemical study of the non-volatile compounds, antioxidant capacity and antimicrobial effect of the methanol extract of the leaves of *Myrcia rufipila* McVaugh. Samples of the leaves were collected in Maracanã Municipality, Pará, Brazil. The chemical investigation led to the identification of the triterpenoids β- and α-amyrin, the flavonoids 4′-*O*-galloyldihydromyricetin, myricetin, myricitrin, desmantin-I, myricetin-3-*O*-(3"-*O*-galloyl)-α-L-rhamnopyranoside and isovitexin, in addition to gallic acid. The methanol extract showed antioxidant capacity (>90%) against DPPH radical (IC_{50} 356.3 ± 3.1 μg.mL^{-1}) and was active only at high concentrations against the tested microorganisms, including the chloramphenicol resistant *E. coli* CCMB261 and *S. aureus* CCMB285 and a nystatin resistant *C. parapsilosis* CCMB 288. This study shows that *M. rufipila,* like other *Myrcia* species, is another source of flavonoids such as desmantin-I and myricitrin which have shown hypoglycemic potential, besides triterpenes and phenolic acids.

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CONTACT Giselle M. S. P. Guilhon giselle@ufpa.br

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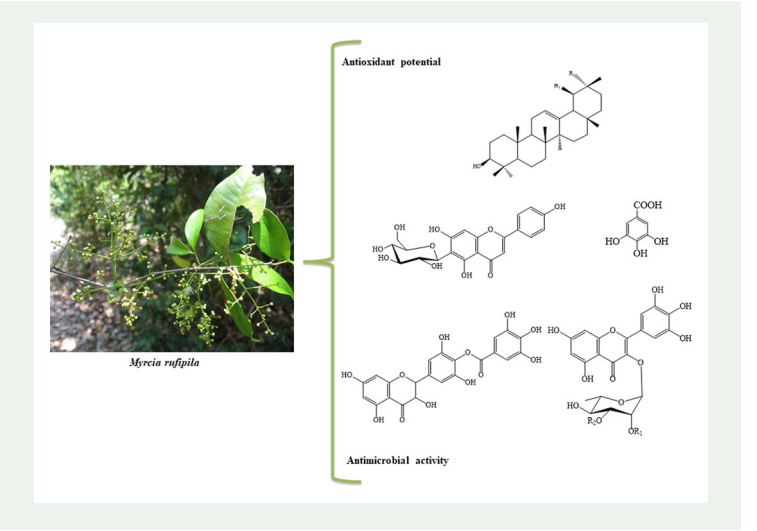

1. Introduction

Myrcia DC. is an important genus, with more than 280 species, occurring in different biomes and in all regions of Brazil (Sobral et al. 2015). Based on recent molecular findings, some authors now include *Myrcia* in a new genus named *Myrcia sensu lato* or *Myrcia* s.l. (Lucas et al. 2011) that comprises, besides *Myrcia*, three other traditional Myrtaceae genera (*Marlierea* Cambess, *Calyptranthes* Sw. and *Gomidesia* O.Berg). *Myrcia* species are used to treat several diseases in folk medicine, including diabetes, gastric illness, diarrhea, aphtha and to neutralize snake venoms. Several studies have demonstrated the hypoglycemic action of extracts and isolated substances from *M. multiflora* and other study has showed that extracts of *M. salicifolia, M. sphaerocarpa* DC. and *M. speciosa* may be used in pharmaceutical formulations to suppress hyperglycemia (Cascaes et al. 2015 and references therein).

The major classes of non-volatile secondary metabolites from *Myrcia* species are flavonol glucosides and terpenoids (Cascaes et al. 2015 and references therein). A survey of the literature revealed that no studies on the non-volatile compounds of *Myrcia rufipila* McVaugh has been published to date, moreover the leaves essential oil of this species has been studied showing a high content on sesquiterpenes (Pereira et al. 2010). The aim of this study was to characterize the chemical composition of the non-volatile compounds of *M. rufipila* leaves and to test the methanol extract against a diverse range of microorganisms and to evaluate its antioxidant potential.

2. Results and discussion

2.1. Chemical composition

Chemical investigation of the methanol extract of *M. rufipila* leaves resulted in the identification of a mixture of the triterpenoids β- and α-amyrin (**1** and **2**) (Mahato and

Kundu 1994) and the isolation of the flavonoids dihydromyricetin-4′-*O*-gallate (**4**) (Yin et al. 2010; Chaturvedula and Huang 2013), myricetin (**5**) (Yang et al. 2011), desmantin-I (**8**) (Kim et al. 2013) in a mixture with myricetin-3-*O*-(3"-*O*-galloyl)-α-L-rhamnopyranoside (**9**) (Cavalheiro et al. 2011), myricitrin (**6**) (Madikizela et al. 2013) and isovitexin (**7**) (Ersoz et al. 2002), in addition to gallic acid (**3**) (Sidana et al. 2013). Among the isolated flavonoids, desmantin-I and myricitrin have a high hypoglycemic potential (Yoshikawa et al. 1998). These results show that although *M. rufipila* is not included in the group of species known as "pedra-ume-caá", which are used to treat diabetes in folk medicine, it is another source of secondary metabolites with this potential. This is the first time that the NMR data in CD_3OD of compound **11** are being published; the key HMBC correlations of **11** is also shown (Suplementary Material).

2.2. Antimicrobial activity

The antimicrobial activity of the methanol extract of *M. rufipila* leaves using the well diffusion test showed that the methanol extract was active against all tested microorganisms (Table S1). The methanol extract was active only at high concentrations against the tested microorganisms, including activity against two chloramphenicol resistant microorganisms, *E. coli* CCMB261 (MIC = 5.00 and MCC = 5.00 $mg.mL^{-1}$) and *S. aureus* CCMB285 (MIC = 1.25 and MCC = 2.50 $mg.mL^{-1}$) and a nystatin resistant *C. parapsilosis* CCMB 288 (MIC = 2.50 and MCC = 2.50 $mg.mL^{-1}$). According to MIC and MCC, the highest inhibition effect was observed against the bacteria *S. aureus* CCMB 263 (MIC = 1.25 and MCC = 2.50 $mg.mL^{-1}$) and *S. aureus* CCMB 285 and against the yeast *C. albicans* CCMB 266 (MIC = 1.25 and MCC = 2.50 $mg.mL^{-1}$) (Table S2).

2.3. Antioxidant potential

The DPPH radical scavenger assay results varied from 27.1 to 91.9% and the IC_{50} values were 356.3 ± 3.1 and 4.9 ± 0.06 $\mu g.mL^{-1}$ for the methanol extract and Trolox, respectively. Although the IC_{50} value of extract is not significant, flavonoids are known to have high antioxidant potential. Desmantin-I showed IC_{50} 3210 μM and myricetin-3-*O*-(3"-*O*-galloyl)-α-L-rhamnopyranoside IC_{50} 1389 μM (Lee et al. 2006), as well as other isolated phenolic compounds. The low free radical scavenging effect of the methanol extract can be explained by the fact that the methanol extract is a complex mixture of substances and not all of them have this activity.

3. Conclusions

The chemical study of *M. rufipila* leaves led to identification of flavonoids, triterpenoids, organic acids and derivatives. This composition is in accordance to other *Myrcia* species. The extract is a source of substances with hypoglycemic action and also is a rich source of antioxidant substances, although the methanol extract results of the DPPH scavenging assay was not significant. The experiment using well diffusion test

showed that the methanol extract was active against all tested microorganisms, but the effect on the tested microorganisms was observed at high concentrations.

Disclosure statement

The authors declare that they have no conflicts of interest.

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