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Triterpenes and flavonoids from the roots of *Mauritia flexuosa*

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Abstract: *Mauritia flexuosa* L. f., Arecaceae, is an endemic species of South America. This species was studied with the intent to isolate the constituents of its roots. After the fractionation of the *n*-hexane and methanolic extracts from the roots of *M. flexuosa*, six triterpenes were obtained: friedelin, taraxerone, lupenyl acetate, lupenone, betulin and betulinic acid, along with three flavonoids: rutin, quercitrin and quercetin. All the compounds were identified by analysis of NMR and MS data and comparison with the literature. All those compounds are been reported for the first time in *Mauritia*, and the chemosystematic significance of the flavonoids isolated in this genus is discussed.

Short Communication

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Introduction

The Arecaceae family is one of the biggest vegetal families of the world and by its morphological aspects is the most characteristic of the tropical flora (Galotta & Boaventura, 2005). This family comprises 1500 species distributed in 200 genera (Uhl & Dransfield, 1987). The chemical composition of the Arecaceae plants includes: diterpenes, triterpenes and their methyl esters, steroids (including brassinosteroids), proantocianidines, flavonoids (derived from kaempferol, quercetin, tricin and luteolin), saponins and rarely alkaloids (pirimidinics) (Piozzi et al., 1981; Harborne et al., 1994; Holdsworth et al., 1997; El Dib et al., 2004). The species *Mauritia flexuosa* L. f., popularly named buriti or miriti, is a large palm tree distributed throughout the Amazon region (Passos & Mendonça, 2006). While this palm is found in several vegetal formations, it is achieved more commonly growing up in flooded areas forming typical homogeneous groups (Ruiz & Alencar, 2004). This species has high economic potential, due mainly to its fruits that have valuable oil for the cosmetic industries (França et al., 1999). The oil extracted from the buriti fruits is popularly used against burns and as a potent vermifuge (Passos & Mendonça, 2006), and those activities are attributed principally to the carotenoids and the ascorbic acid, principal compounds in the oil (França et al., 1999). The buriti fruit showed also previously moderate antimicrobial activity against several bacteria (Silveira et al., 2005). No previous phytochemical studies were carried out with any species of the *Mauritia* genus.

Material and Methods

General

Melting points were measured on Buchi 545 B apparatus, ^{1}H-NMR spectra was recorded on a Bruker DRX-400 MHz spectrometer, MS spectra was obtained from a Thermo LCQ *Fleet* apparatus. TLC was performed using silica gel 60 PF_{254} (Merck). The fractionation was performed in chromatographic columns using normal phase silica 230-400 mesh (Merck) and Sephadex LH-20 (Merck) and spots were visualized under UV light and after sprayed vanillin-H_2SO_4 reagent followed by heating at 100 °C.

Plant material

The botanical material of *Mauritia flexuosa* L. f., Arecaceae, was collected in the green area of the Universidade Federal do Amazonas, Manaus (Brazil), and authenticated by the Herbarium of the Universidade Federal do Amazonas where a voucher specimen (no.

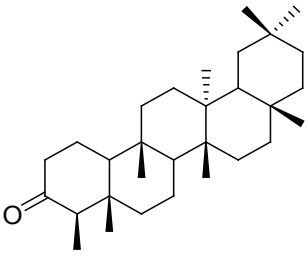
7282) is deposited.

Extraction and isolation

Roots were shade dried for a week and powered. The powder material (900 g) was extracted at room temperature with *n*-hexane and methanol for about 72 h for each solvent. Every extract was filtered and concentrated *in vacuum* using rotary flash evaporator. The hexane extract (5 g) was fractionated on an open normal silica column (h x Ø = 40 x 2 cm) eluted with hexane: CH_2Cl_2 (9:1, 8:2, 1:1, 3:7) and CH_2Cl_2:AcOEt (9:1, 8:2, 7:3, 1:1, 3:7, 1:9) affording friedelin **1** (21.0 mg), taraxerone **2** (17.4 mg), lupenyl acetate **3** (15.8 mg), lupenone **4** (13.2 mg), betulin **5** (23.0 mg) and betulinic acid **6** (26.6 mg). The methanolic extract (10 g) was separated on a Sephadex LH-20 column (h x Ø = 50 x 3.5 cm) using MeOH in isocratic mode yielding rutin **7** (10.6 mg), quercitrin **8** (4.6 mg) and quercetin **9** (21.9 mg).

Results and Discussion

The triterpenes **1-6** were identified by comparison of their NMR data with the literature (Fulgentius et al., 1990; Klass & Tinto, 1992; Silva et al., 2000; Souza et al., 2001; Saraiva et al., 2006). Biological activities were previously reported for the isolated triterpenes: anti-AIDS for betulinic acid, herbicid for lupenone and fibrinolytic for betulin (Connolly & Hill, 2010). The flavonoids **7-9** were identified based on NMR data (Hansen et al., 1999; Galotta et al., 2008) and typical fragmentation by CID experiments with ESI-MS (Fabre et al., 2001). Some biological activities reported for the isolated flavonoids are: antidepressant for rutin (Nolder & Schotz, 2002), anti-inflammatory for rutin and quercetin (Afanaseva et al., 2001) and antioxidant for all of them (Galotta et al., 2008). The flavonol quercetin is ubiquitous in monocotyledons, so it cannot be used as marker of the Arecaceae family (Silva, 2007). The chemosystematic of the Arecaceae family is very complex and by earlier studies it was suggested that the negatively charged flavones and tricin are possible markers for this family (Williams & Harbone, 1973). Although those authors investigated only leaves of the Arecaceae plants, the present research on *Mauritia flexuosa* roots revealed the flavonoids along to triterpenes as compound classes to be considered in future chemosystematic studies of Arecaceae. Flavonol *O*-glycosides are rarely reported in Arecaceae trees: rutin was previously isolated only from *Chamaeropsis* and *Phoenix* species (Harborne et al., 1974; Asami et al., 1991) while quercitrin was only isolated in the *Phoenix* genus (Hasan et al., 2010). This is the first phytochemical study of *Mauritia flexuosa*, a new source of all the compounds isolated. These are novelty in the genus and their taxonomic significance needs further investigation.



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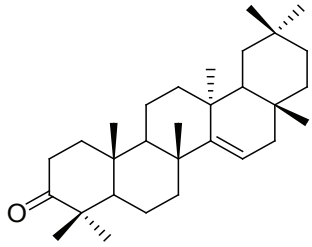

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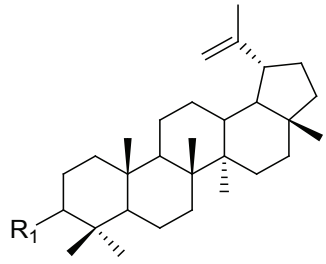
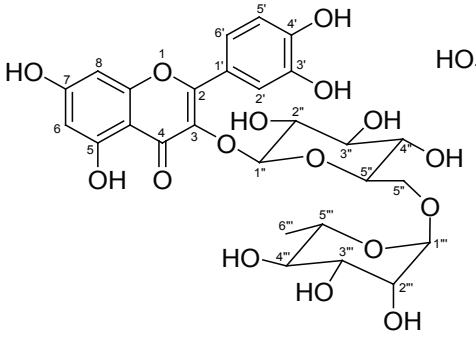


3 R_1=$OCOCH_3$; R_2=CH_3
4 R_1=O; R_2=CH_3
5 R_1=OH; R_2=CH_2OH
6 R_1=OH; R_2=CO_2H



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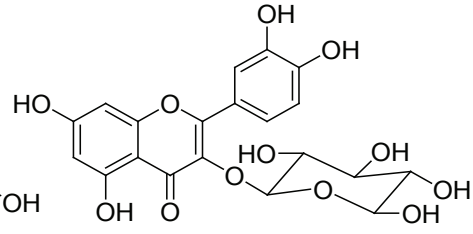

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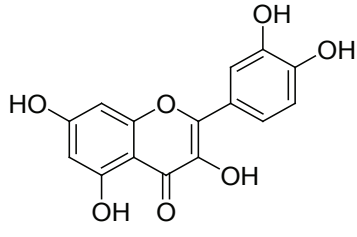

9

Rutin (**7**): ^{1}H NMR (400 MHz, CD_3OD) δ_H 1,00 (*d*, *J* = 6,2 Hz, H-6’’’); 3,04-3,11 (*m*, H-4’’, H-4’’’); 3,22-3,38 (*m*, H-2’’, H-3’’, H-5’’, H-2’’’, H-5’’’); 3,29 (*m*, H-6’’); 3,71 (*m*, H-6’’); 4,39 (*s*, H-1’’’); 5.09 (*d, J* = 7.1 Hz, H-1”) 6.19 (*d, J* = 2.1 Hz, H-6); 6.38 (*d, J* = 2.1 Hz, H-8); 6.86 (*d, J* = 8.5 Hz, H-5’); 7.64 (*dd, J* = 2.1 and 8.5 Hz, H-6’); 7.67 (*d, J* = 2.1 Hz, H-2’). ESI-MS (product ions, 15 eV) *m/z*: 609 [M-H]-, 301 [M-H-Glu-Rha]-, 179, 151. mp: 197-199 °C.

Quercitrin (**8**): ^{1}H NMR (400 MHz, CD_3OD) δ_H 1,18 (*d, J* = 1,2 Hz, H-6’’); 3,31 (*m*, H-4’’); 3,55 (*m*, H-2’’); 3,66 (*m*, H-3’’); 4,08 (*d, J* = 1,2 Hz, H-1’’); 4,23 (*m*, H-5’’); 6,20 (*d, J* = 1,8 Hz, H-6); 6,42 (*d, J* = 1,8 Hz, H-8); 6,81 (*d, J* = 8,2 Hz, H-5’); 7,55 (*dd, J* = 2,1 e 8,5 Hz, H-6’); 7,68 (*d, J* = 2,1 Hz, H-2’). ESI-MS (product ions, 15 eV) *m/z*: 447 [M-H]-, 301 [M-H-Rha]-, 179, 151, 121. mp: 193-195 °C.

Quercetin (**9**): ^{1}H NMR (400 MHz, CD_3OD) δ_H 6,20 (*d, J* = 1,8 Hz, H-6); 6,42 (*d, J* = 1,8 Hz, H-8); 6,81 (*d, J* = 8,2 Hz, H-5’); 7,55 (*dd, J* = 2,1 e 8,5 Hz, H-6’); 7,68 (*d, J* = 2,1 Hz, H-2’). ESI-MS (product ions, 15 eV) *m/z*: 301 [M-H]-, 179, 151, 121, 107. mp: 315-318 °C.

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