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Original Article

Chemical constituents from *Sidastrum paniculatum* and evaluation of their leishmanicidal activity

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ABSTRACT

Sidastrum paniculatum (L.) Fryxell, Malvaceae, is popularly known in Brazil as "malva-roxa" or "malvavisco". The species is found mainly in Northeast region where it is used by locals to treat spider bites and bee stings. Aiming to identify the chemical compounds from *S. paniculatum* secondary metabolism and to contribute to the chemotaxonomic knowledge of Malvaceae family, a phytochemical study of *S. paniculatum* was carried out. Besides that, the isolated compounds were evaluated for antileishmanial activity against promastigotes of *Leishmania braziliensis*. By using chromatographic techniques the study resulted the isolation of eight compounds: 3-oxo-21β-*H*-hop-22(29)-ene; sebiferic acid; sitosterol 3-*O*-β-D-glucopyranoside/stigmasterol 3-*O*-β-D-glucopyranoside; phaeophytin a; $13^2(S)$-hydroxyphaeophytin a; $13^2(S)$-hydroxy-(17^3)-ethoxyphaeophorbide a and 7,4′-di-*O*-methylisoescutellarein. The structure of all isolated compounds was elucidated by spectroscopic analysis, including two-dimensional NMR techniques. In addition, the isolated compounds phaeophytin a; $13^2(S)$-hydroxyphaeophytin a; $13^2(S)$-hydroxy-(17^3)-ethoxyphaeophorbide a and 7,4′-di-*O*-methylisoescutellarein exhibited antileishmanial activity against promastigotes of *L. braziliensis*.

Introduction

Sidastrum paniculatum (L.) Fryxell, Malvaceae, is popularly known in Brazil as "malva roxa" or "malvavisco". The species is wide spread in Northeast region, especially in Paraiba and Pernambuco states (Baracho, 1995). The *Sidastrum* genus comprises eight species with neotropical distribution, occurring from Mexico to Argentina. Previous phytochemical studies on *Sidastrum* species have reported the presence of steroids, phenolic acids, flavonoids and phaeophytins (Gomes et al., 2011a). From *S. paniculatum* were previously isolated steroids, a feruloyl derivative and a glycosil flavonoid (Cavalcante et al., 2010). Many species from Malvaceae family are used in folk medicine to treat diseases, *S. paniculatum* leaves are traditionally used as topical treatment to spider bites and bee stings. *Sidastrum micranthum* leaves are used to prepare a tea to treat asthma and bronchitis (Gomes et al., 2011b). *Sida rhombifolia* is used in Indian folk medicine against hypertension, diabetes and gout (Chaves et al., 2013). *Hibiscus esculentus* and *Malva neglecta* are used in popular medicine to treat ulcer and stomachache. In fact, these plants have showed to possess an effective gastroprotective effect against ulcers induced by ethanol in rats (Gürbüs et al., 2003, 2005). The methanol extract of *Herissantia crispa*, species rich in phenolic compounds, showed antidiarrhoeal and antiulcerogenic activity on the HCl/ethanol-induced gastric lesions (Lima et al., 2009). Other relevant pharmacological activities of Malvaceae species are well reported such as anti-inflammatory, antioxidant and antibacterial activities (Silva et al., 2006; Falcão-Silva et al., 2009; Costa et al., 2009; Silva et al., 2005; Karou et al., 2005; Ghosal et al., 1975; Oliveira et al., 2012).

Leishmanicidal activity against *Leishmania major* has also been reported for Malvaceae species (Rocha et al., 2005). The

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leishmaniasis is caused by more than 20 species of protozoan parasite that belongs to *Leishmania* genus and has great epidemiological and clinical diversity (Kamhawi, 2006; Mishra et al., 2009). *Leishmania* (*Viannia*) *braziliensis* is endemic in Latin America and is the causative agent of mucocutaneous disease in the Américas (Brelaz et al., 2012). The current chemotherapeutic arsenal consists of pentavalent antimony, pentamidine, various formulations of the antibiotic amphotericin B, and recently miltefosine (Croft and Olliaro, 2011). These drugs are widely prescribed despite their toxicity, high cost and difficult administration (Croft et al., 2006). All these facts show the urgent need for the research and development of new leishmanicidal compounds, including from natural sources (Santos et al., 2008).

In order to increase the knowledge about *S. paniculatum* phytoconstituents and aiming to contribute to the chemotaxonomic knowledge of Malvaceae family, the species *S. paniculatum* was submitted to a phytochemical study. In addition, isolated compounds were evaluated for antileishmanial activity against promastigotes of *L. braziliensis*.

Materials and methods

General experimental procedures

The isolation of chemical constituents was performed on glass chromatographic columns using Silica (ASTM, 230–400 mesh, Merck) or Sephadex LH-20 as stationary phase. TLC were performed on silica gel PF_{254} plates and the spots were visualized under UV light (254 and 366 nm) and by exposure to iodine vapor and vanillin–sulphuric acid reagent. Isolated compounds were identified by Infrared (IR), Perkin-Elmer FT-IR-1750 and Shimadzu – Prestige 21 model using KBr discs; and 1D and 2D NMR analysis (^{1}H 500 MHz, ^{13}C 125 MHz – Varian and ^{1}H 400 MHz, ^{13}C 100 MHz – Bruker) using deuterated chloroform, DMSO or pyridine. Melting points were measured in a MQAPF-302 apparatus (Microquimica Equipamentos Ltda).

Plant material

The aerial parts of *Sidastrum paniculatum* (L.) Fryxell, Malvaceae, were collected in Pedra da Boca Park, located in Araruna city, Paraiba/Brazil, in June 2008 (SISBIO Authorization Number 46923-2). The plant was identified by Prof. Dr. Maria de Fátima Agra, and a voucher specimen (JPB 6051) was authenticated and deposited at Lauro Pires Xavier Herbarium (CCEN/UFPB).

Extraction and isolation

The plant material was dried in an oven at 40 °C for 72 h. After that, it was grounded in a mechanical mill, yielding 3.7 kg of a powder which was submitted to maceration with ethanol during three consecutive days. This process was repeated in order to maximize the extraction of chemical constituents. A rotary evaporator was used to concentrate the extract resulting 250 g of crude ethanol extract (CEE). The CEE was partitioned with *n*-hexane, chloroform ($CHCl_3$), ethyl acetate (EtOAc) and *n*-butanol. From this process were obtained 82 g of *n*-hexane phase (HP), 32 g of $CHCl_3$ phase (CP), 3 g of EtOAc phase (EAP), 10 g of *n*-butanol phase (BP) and 110 g of hydroalcohol phase (HAP).

HP (7 g) was subjected to column chromatography with silica gel (210 g of silica gel packed in a glass column with 4 cm of diameter) and eluted with hexane, dichloromethane and methanol resulting 25 fractions which were analyzed and combined by analytical TLC. The 05/06 fraction yielded a precipitate that was washed with hexane to yield 20 mg of colorless crystals (**1**). The 10/12 fraction, a colorless solid, was pure when analyzed by TLC, being labeled as compound **2** (12 mg). The fraction 20/22 showed a white powder soluble in pyridine, the powder was washed with hexane resulting the mixture of the compounds **3** and **4** (30 mg). The fractions 13/18 (900 mg) were rechromatographed in silica column (27 g of silica gel in glass column with 2 cm of diameter) resulting the isolation of the compounds **5** (50 mg), **6** (15 mg) and **7** (19 mg).

An aliquot (2 g) of EAP was chromatographed in Sephadex column (Sephadex gel length of 30 cm) using methanol as solvent. The fractions were analyzed by TLC, joined, and the chromatography was repeated to isolate the compound **8** (20 mg).

In vitro *activity against* L. braziliensis

Promastigotes of *L. braziliensis* (MHOM/BR/87/BA125) were obtained from Dr. Valéria de Matos Borges (Centro de Pesquisa Gonçalo Moniz/FIOCRUZ/BA). The parasites were maintained *in vitro* in Schneider's medium, supplemented with 10% FBS and 2% human urine. Stock solutions of compounds and pentamidine (reference leishmanicidal drug) were prepared in DMSO immediately before use. The cytotoxicity of compounds isolated from *S. paniculatum* and pentamidine against promastigotes was determined. Stationary phase *L. braziliensis* promastigotes were plated in 96-well vessels (Nunc) at 1×10^5 cells per well, in Schneider's medium, supplemented with 10% FBS and 2% human urine. Each compound solution was added at the following concentrations: 0.01 μM, 0.1 μM, 1 μM, 10 μM and 100 μM.

Cells were also cultured in a medium free of compounds or vehicle (basal growth control) or with DMSO 0.1% (vehicle control). After 48 h, extracellular load of *L. braziliensis* promastigotes was estimated by counting the promastigotes in Schneider's medium in a CELM automatic cell counter (model CC530) (Rangel et al., 1996).

Results and discussion

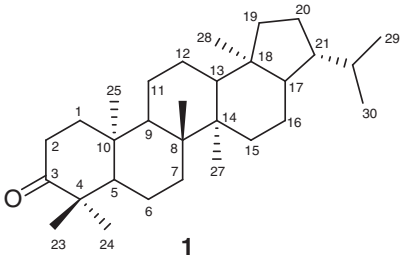
Structure elucidation of isolated compounds

By using typical chromatographic procedures the compounds **1**–**8** were isolated from the aerial parts of *S. paniculatum*.

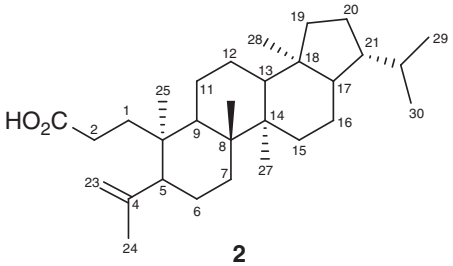
The IR spectra of **1** suggested the presence of olefinic, methyl, methylene, methynic hydrogens and carbonyl by showing bands at 3050; 2943–2862 and 1708 cm^{-1}, respectively. The ^{1}H NMR showed seven methyl singlets, one of those presenting characteristic chemical shift of proton bonded to sp^2 carbon (δ_H 1.72). Olefinic protons were found as a broad singlet at δ_H 4.76 indicating the presence of isopropenyl group. The ^{13}C NMR showed 30 carbons and the isopropenyl group and the carbonyl were confirmed by the signals at δ_C 148.64, δ_C 110.06 and δ_C 220.51. HMQC and HMBC correlations showed that the carbons are consistent with a hopane-type skeleton with a carbonyl at position C-3. Comparisons with the literature led to identify the compound **1** as 3-oxo-21β-*H*-hop-22(29)-ene (David et al., 2004; Sousa et al., 2012).

Compound **2** showed IR bands at 1708, 2943, 2862 and 3435 cm^{-1} suggesting presence of hydroxyl, double bond and carbonyl groups in the molecule. The ^{1}H NMR spectra showed a triterpenoid profile and the presence of two isopropenyl groups was indicated by the presence of vinyl methyls (δ_H 1.77 and δ_H 1.73) and exomethylenes protons at δ_H 4.76 (2H), δ_H 4.80 (1H) and δ_H 4.87 (1H). The ^{13}C NMR of compound **2** confirmed the triterpenoid skeleton and the two terminal double bonds were confirmed by the presence of the signals δ_C 148.65, δ_C 147.83, δ_C

113.00 and δ_C 110.09. The 2D correlations were carefully analyzed thus the compound **2** was identified as sebiferic acid, a 3,4-*seco*-hopane-type triterpene (Sousa et al., 2012; Pradhan et al., 1984). Triterpenes were isolated from some Malvaceae species, such as *S. micranthum*, *Herissantia tiubae*, *Sida acuta* and *Abutilon pakistanicum* (Gomes et al., 2011b; Silva et al., 2009b; Chen et al., 2007; Ahmed et al., 1990). Hopane triterpenes and 3,4-*seco*-triterpenes have been recently reported from *Wissadula periplocifolia* (Teles et al., 2014).

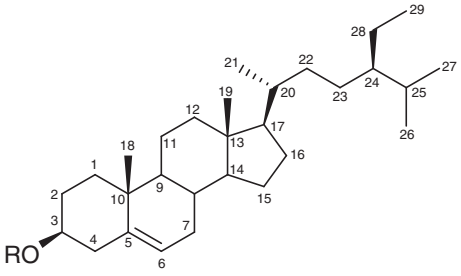


1



2

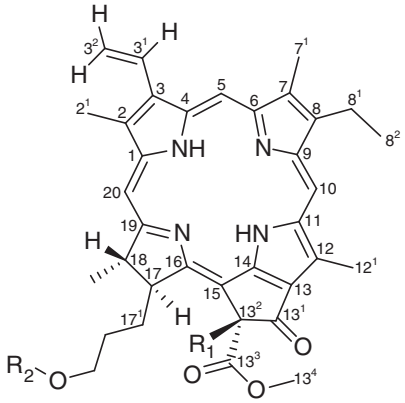
The structural assignment of the mixture of compounds **3** and **4** was performed based on spectral analysis and comparisons with the literature (Kojima et al., 1990; Rashed et al., 2014). The data are in good agreement with those reported and the structures were identified as the mixture of glucosyl steroids: sitosterol 3-*O*-β-D-glucopyranoside (**3**) and stigmasterol 3-*O*-β-D-glucopyranoside (**4**). These steroids are widely spread in plants, being important component of vegetable cell wall and membrane. They have been previously reported from many Malvaceae, such as *W. periplocifolia*, *S. rhombifolia*, *Sida galheirensis*, *H. crispa* and *Bakeridesia pickelli* (Teles et al., 2014; Chaves et al., 2013; Silva et al., 2006; Costa et al., 2007, 2009).



3 R=β-D-glucopyranosyl

4 R=β-D-glucopyranosyl; $\Delta^{22,23}$

The substances **5**, **6** and **7** were isolated as dark green amorphous solid, and showed quite similar IR spectra. The ^{1}H and ^{13}C NMR indicated that the compounds are chlorophyll derivatives. Comparisons with the literature data led to identify the compounds as phaeophytin a (**5**), 13^2-hydroxy-phaeophytin a (**6**) (Nogueira et al., 2013) and 13^2(*S*)-hydroxy-17^3-ethoxyphaeophorbide a (**7**) (Silva et al., 2009a), previously reported from Malvaceae species *W. periplocifolia*, *S. rhombifolia* and *S. galheirensis* (Teles et al., 2014; Chaves et al., 2013; Silva et al., 2006). These compounds are formed from chlorophyll degradation by action of enzymes such as Mg-dechelatase and chlorophyllase. Additional structural modifications can occur and recently new structures of chlorophyll derivatives are being reported (Silva et al., 2010). Researchers are interested in understanding if they belong to the secondary metabolism of plants once they have showed to possess many biological activities (Teles et al., 2014).

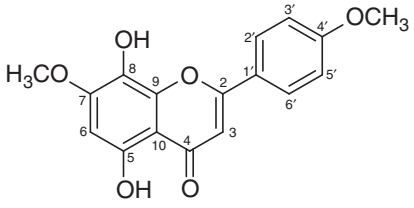


5 R_1=H; R_2=phytol

6 R_1=OH; R_2=phytol

7 R_1=OH; R_2=CH_2CH_3

The compound **8** was isolated as yellow powder. By analyzing its ^{1}H and ^{13}C NMR, besides bidimensional NMR spectra, it was possible identify the compound **8** as 5,8-dihydroxy-7,4′-dimethoxy-flavone (7,4′-di-*O*-methylisoescutellarein), previously isolated from *Sidastrum micrathum* (Gomes et al., 2011b). Flavonoids are considered a characteristic group of constituents from family. Flavones, flavonols, their methyl and sulphur derivatives, and glucosyl flavonoids, have been reported from Malvaceae species (Chaves et al., 2013; Gomes et al., 2011a; Silva et al., 2006; Cavalcante et al., 2010; Costa et al., 2007, 2009; Silva et al., 2005; Nawwar and Buddrus, 1981).



8

3-oxo-21β-*H*-hop-22(29)-ene (**1**): mp 168–170 °C; IR: 2943, 2862, 1708 cm^{-1}. ^{1}H NMR (500 MHz, $CDCl_3$, δ ppm): 2.08 (m, H-1), 2.24 (m, H-2), 1.95 (m, H-5), 1.10 (m, H-6), 1.10 and 2.01 (m, H-7), 1.42 (m, H-9), 1.10 (m, H-11), 1.42 (m, H-12), 1.32 (m, H-13), 1.32 (m, H-15), 1.62 (m, H-16), 1.39 (m, H-17), 1.60 (m, H-19), 1.81 (m, H-20), 2.66 (m, H-21), 1.02 (s, H-23), 1.00 (s, H-24), 0.73 (s, H-25), 1.14 (s, H-26), 0.86 (s, H-27), 0.68 (s, H-28), 4.76 (bs, 2H-29), 1.72 (s, H-30). ^{13}C NMR (125 MHz, $CDCl_3$, δ): 31.59 (C-1), 33.78 (C-2), 220.51 (C-3), 46.82 (C-4), 47.32 (C-5), 20.57 (C-6), 34.17 (C-7), 41.65 (C-8), 43.30 (C-9), 36.17 (C-10), 21.96 (C-11), 24.27 (C-12), 49.72 (C-13), 42.66 (C-14), 33.55 (C-15), 21.37 (C-16), 55.14 (C-17), 44.82 (C-18), 41.53 (C-19), 27.30 (C-20), 46.24 (C-21), 148.64 (C-22), 29.36 (C-23), 19.57 (C-24), 23.29 (C-25), 22.08 (C-26), 17.06 (C-27), 15.96 (C-28), 110.06 (29), 25.04 (C-30) (David et al., 2004; Sousa et al., 2012).

3,4-seco-21β-*H*-hop-22(29)-en-3-oic acid (sebiferic acid) (**2**): mp 178–180 °C; IR: 1708 cm^{-1}; 2941 cm^{-1}, 3435 cm^{-1}. ^{1}H NMR (500 MHz, $CDCl_3$, δ): 2.25 (m, H-1), 1.85–2.44 (m, H-2), 2.04 (m, H-5), 1.39 (m, H-6), 1.00 (m, H-7), 1.72 (m, H-9), 1.48 (m, H-11), 1.43 (m, H-12), 1.40 (m, H-13), 1.41 (m, H-15), 1.51 (m, H-16), 1.43 (m,

Table 1
Leishmanicidal effect of compounds isolated from *S. paniculatum* against promastigotes of *L. braziliensis*.

Treatment	IC_{50} [a] (μM ± S.E.M.)	Maximum effect[b] (% ± S.E.M.)
Pentamidine	1.3 ± 0.4	94.8 ± 0.2**
3/4	>100	NA
5	77.2 ± 3.9	59.5 ± 0.3**
6	72.7 ± 6.3	70.8 ± 5.7**
7	89.0 ± 1.9	56.5 ± 1.4*
8	78.1 ± 9.5	55.6 ± 3.3*

H-17), 1.60 (m, H-19), 1.78 (m, H-20), 2.67 (m, H-21), 4.87 (s, H-23), 1.77 (s, H-24), 0.82 (s, H-25), 1.03 (s, H-26), 0.97 (s, H-27), 0.71 (s, H-28), 4.76 (bs, H-29), 1.73 (s, H-30). ^{13}C NMR (125 MHz, $CDCl_3$, δ): 30.14 (C-1), 30.07 (C-2), 180.07 (C-3), 147.83 (C-4), 46.88 (C-5), 22.83 (C-6), 26.70 (C-7), 41.35 (C-8), 43.21 (C-9), 37.94 (C-10), 22.49 (C-11), 24.30 (C-12), 49.72 (C-13), 42.99 (C-14), 33.49 (C-15), 21.60 (C-16), 55.86 (C-17), 44.76 (C-18), 42.01 (C-19), 27.31 (C-20), 46.41 (C-21), 148.65 (C-22), 113.00 (C-23), 26.78 (C-24), 25.20 (C-25), 17.02 (C-26), 16.39 (C-27), 16.21 (C-28), 110.09 (29), 25.01 (C-30) (Sousa et al., 2012; Pradhan et al., 1984).

Sitosterol 3-*O*-β-D-glucopyranoside (3)/Stigmasterol 3-*O*-β-D-glucopyranoside (4): The ^1H and ^{13}C NMR spectral data are consistent with published data (Kojima et al., 1990; Rashed et al., 2014).

Phaeophytin a (5): The ^1H and ^{13}C NMR spectral data are consistent with published data (Nogueira et al., 2013).

13^2(*S*)-hydroxy-phaeophytin a (6): The ^1H and ^{13}C NMR spectral data are consistent with published data (Nogueira et al., 2013).

13^2(*S*)-hydroxy-(17^3)-ethoxyphaeophorbide a (7): The ^1H and ^{13}C NMR spectral data are consistent with published data (Silva et al., 2009a).

5,8-dihydroxy-7,4′-dimethoxy-flavone (7,4′-Di-*O*-Methylisoescutelarein) (8): ^1H NMR (500 MHz, DMSO-d_6, δ): 6.87 (s, H-3), 6.56 (s, H-6), 8.12 (d, *J* = 8.6 Hz, H-2′), 7.13(d, *J* = 8.6 Hz, H-3′), 7.13 (d, *J* = 8.6 Hz, H-5′), 8.12 (d, *J* = 8.6 Hz, H-6′), 3.90 (s, OCH_3-7), 3.86 (s, OCH_3-4′), 12.44 (s, OH-5). ^{13}C NMR (125 MHz, DMSO-d_6, δ): 164.0 (C-2), 103.6 (C-3), 182.9 (C-4), 153.6 (C-5), 96.2 (C-6), 154.8 (C-7), 126.8 (C-8), 145.0 (C-9), 104.4 (C-10), 123.5 (C-1′), 129.0 (C-2′), 115.1 (C-3′), 162.9 (C-4′), 162.9 (C-5′), 129.0 (C-6′), 56.9 (OCH_3-7), 56.1 (OCH_3-4′) (Gomes et al., 2011a).

Leishmanicidal activity

The protozoan parasite *L. braziliensis* is the causative organism for the clinically important disease cutaneous and mucocutaneous leishmaniasis (Gonzalez et al., 2009). The current drugs for *Leishmania* infections are inadequate due to low efficacy and high toxicity, and the problem is further compounded by the increasing prevalence of drug-resistant parasites. Current biomedical research always has its focus on the search for newer intervention strategies and natural compounds have been used as novel treatments for parasitic diseases (Amato et al., 2008; Ndjonka et al., 2013).

The antileishmanial activity of compounds **3**–**8** was assessed against extracellular promastigotes of *L. braziliensis* as causative agent of cutaneous leishmaniasis. As a parameter for antileishmanial activity, the maximum leishmanicidal effect and IC_{50} value were used.

The obtained results showed that the mixture of phytosterols **3**/**4** was inactive against promastigote forms of *L. braziliensis* (Table 1). The obtained result is in agreement with previous reports which demonstrated that stigmasterol and sitosterol 3-*O*-β-D-glucoside were inactive against *Leishmania donovani* (Graziose et al., 2012; Kirmizibekmez et al., 2011; Camacho et al., 2002). Moreover, Torres-Santos et al. verified that stigmasterol and sitosterol were not active against promastigotes and intracellular amastigotes of *Leishmania amazonensis* (Torres-Santos et al., 2004).

Data are reported as means ± S.E.M. Differences with $^{**}p < 0.01$, $^{*}p < 0.05$ were considered significant in relation to DMSO 0.1% group. NA: When the compound is not active until 100 μM. (a) IC_{50} is the concentration required to give 50% inhibition, calculated by linear regression analysis from the K_c values at employed concentrations (100, 10, 1, 0.1 and 0.01 μM). (b) EM is the maximum effect of treatment.

On the other hand, it has been reported the use of porphyrin compounds for their ability to inhibit *Leishmania* (Hörtensteiner et al., 1998; Sakata et al., 1990). Previous works revealed that phaeophytins possess potent cytotoxic activities (Cheng et al., 2001). In this study, the three phaeophytin-related compounds phaeophytin a (**5**), 13^2-hydroxy-(13^2-S)-phaeophytin a (**6**) and 13^2 (*S*)-hydroxy-17^3-ethoxyphaeophorbide a (**7**) exhibited leishmanicidal activity against promastigotes of *L. braziliensis*, especially 13^2-hydroxy-(13^2-S)-phaeophytin a (**6**), showing that the addition of hydroxyl group in 13^2-position increased efficacy, but not potency. In addition, the importance of heme in *Leishmania* sp. metabolisms justifies considering the potential of porphyrins and their precursors and derivatives as potential antiparasitic agents by interfering with heme metabolism (Abada et al., 2013). Heme is one of many indispensable nutrients that must be scavenged from the phagolysosomal compartment by *Leishmania* (Naderer and McConville, 2008). In metazoa, heme biosynthesis occurs through 8 highly conserved chemical reactions, resulting in the insertion of ferrous iron into the protoporphyrin IX ring (Hamza and Dailey, 2012). However, several unicellular organisms, such as *Leishmania* lack several of the enzymes necessary for a complete heme-biosynthetic pathway (Korený et al., 2013). Heme not only is a crucial component of cytochromes in the respiratory chain, but also functions as an essential cofactor for hemoproteins, such as the ones involved in the biosynthesis of polyunsaturated fatty acids and sterols (Tripodi et al., 2011).

The flavone 5,8-dihydroxy-7,4′-dimethoxyflavone (**8**) showed activity against *L. braziliensis*. The structure antileishmanial activity relationship of flavones has been described and it has been shown that this class of flavonoids, consists of potential antiprotozoal agents. The presence of OH groups on the flavone benzochromone skeleton enhances the leishmanicidal potential. Particularly important positions are C-5, C-7, and C-8 (Silva-Filho et al., 2009). On the other hand, the replacement of the OH groups, either on A or B rings, by methoxyl groups was demonstrated to decrease the antiprotozoal activity (Tasdemir et al., 2006). Numerous natural compound screens have successfully identified novel treatments for parasitic diseases (Ndjonka et al., 2013). Extracts obtained from plants and pure compounds, such as certain types of flavonoids, have been reported to possess significant antiprotozoal activity with no side effects (Muzitano et al., 2006; Fonseca-Silva et al., 2011). While the mechanism of action of the 5,8-dihydroxy-7,4′-dimethoxyflavone to kill these parasites is not yet known, biochemical experiments with other flavones provide initial insights. Among naturally occurring flavonoids, the flavones quercetin, luteolin and baicalein are reported as topoisomerase II inhibitor (Austin et al., 1992; Mittra et al., 2000). Therefore, we will continue this study to evaluate the inhibitory effects of theses analogs on topoisomerase of *Leishmania* as well as other validated chemotherapeutic target.

Conclusion

The phytochemical investigation of *S. paniculatum* led to isolation of eight compounds, being two triterpenes: 3-oxo-21β-*H*-hop-22(29)-ene (**1**) and sebiferic acid (**2**); a mixture of steroids: sitosterol 3-*O*-β-D-glucopyranoside/stigmasterol

3-*O*-β-D-glucopyranoside (**3/4**); three chlorophyll derivatives: phaeophytin a (**5**); 13^2-hydroxy-(13^2-*S*)-phaeophytin a (**6**); 13^2-hydroxy-(13^2-*S*)-phaeophorbide a (**7**); and a flavone: 7,4′-di-*O*-methylisoescutelarein (**8**).

The studied species *S. paniculatum* has demonstrated quite similar group of chemical constituents to *S. micranthum*, *S. galheirensis*, *H. tiubae* and *W. periplocifolia*, showing a related chemotaxonomic profile of these species.

The antileishmanial activity against promastigotes of *L. braziliensis* of compounds **5**–**8** is being here reported for the first time.

Conflicts of interest

The authors declare no conflicts of interest.

Authors' contribution

YCFT, OSC and MFVS carried out the chromatography isolation and identification of compounds. MFA contributed in collecting plant sample plant, identification and herbarium deposit. RB-F and LMB contributed on analyses and discussion data. ACQ, MVA and MSAM carried out the biological study. All the authors have read the final manuscript and approved the submission.

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