Biological activities of triterpenoids from Poraqueiba sericea stems

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SHORT COMMUNICATION

Biological activities of triterpenoids from *Poraqueiba sericea* stems

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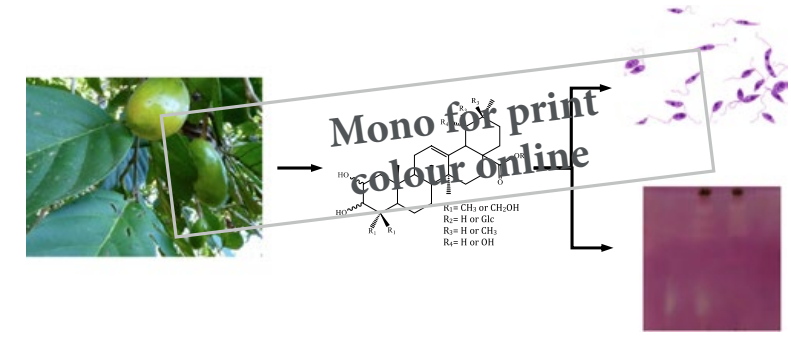
ABSTRACT

Eleven compounds were isolated from *Poraqueiba sericea* stems and identified as niga-ichigoside-F1 (**1**), trachelosperoside B1 (**2**), 4-epi-niga-ichigoside (**7**), 19α-hydroxyasiatic acid (**3**), myrianthic acid (**4**), hyptatic acid (**5**), trachelosperogenin B (**6**), arjunolic acid (**8**), and trachelosperogenin E (**9**), secologanoside (**10**) and secoxyloganin (**11**). Compounds **1**–**11** were tested for their antileishmanial activities against *Leishmania infantum* promastigotes, **1**–**6** and **8**–**11** were tested for their cytotoxic activities on fibroblasts, **1**–**3**, **5**–**6**, **8**–**11** were evaluated for their anti-elastase and anti-acetylcholinesterase assays activities by a spectrophotometric method and **1**–**2**, **5** and **7**–**10** were tested using bioautography for their β-glucosidase. No antileishmanial activity was detected; compounds **1**, **2** and **11** showed a moderate cytotoxic activity with IC_{50} 17.7, 20.5 and 10.9 µg/mL, respectively; compounds **2**, **8**, **9** and **10** gave a percentage of inhibition ranging from 13 to 16% (at 50 µg/mL) and compounds **1** and **2** showed an inhibition zone on β-glucosidase and anti-acetylcholinesterase assays.



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1. Introduction

The genus *Poraqueiba* (Icacinaceae) is composed of three species: *Poraqueiba sericea* Tulp., *Poraqueiba guianensis* Aubl. and *Poraqueiba paraensis* Ducke, large trees growing exclusively in the Amazon. A literature survey showed very few reports on *P. sericea* Tulp, a tree grown initially by Native Americans and propagated by them in Bolivia, Brazil and Peru. This tree is cultivated in Peru for its edible fruit (named Umari in Peru), with a pleasant and a characteristic taste, consumed as such, or accompanied by cassava. It is also an ingredient in the soft drink composition called 'Cahuana' with tapioca starch. The oil extracted industrially from the mesocarp is a raw material for this region (food and frying). In industry, the Umari flour replaces wheat flour in the production of adhesives for laminated wood. The only medicinal use concerns the leaves that are used by some tribes as infusion to treat themselves against dysentery (Huamán et al. 2001). Phytochemical investigation of Icacinaceae has resulted in the isolation of indolomonoterpenic alkaloids (Aiyama et al. 1988; Pirillo et al. 1995; Wu et al. 1995, 1996; Srinivas & Das 2003; Khan et al. 2013), flavonoids (Manga et al. 2013), diterpenes (On'okoko et al. 1985), pentacyclic triterpenes (Calderón et al. 2013) and monoterpene iridoids (Braga de Oliveira 1995). The phytochemical study of *P. guianensis* showed the presence of the triterpene icacinic acid, two emmotine derivatives (Braga de Oliveira 1995), one lignan (Goulart et al. 1994) and a secologanoside (Goulart 1983). Until now, there is no phytochemical or biological study reported for *Poraqueiba sericea* stems. Indeed, only the oil extracted from the fruit has been the subject of study for the characterisation of these fatty acids (Silva 1997).

2. Results and discussion

The structures of the isolated compounds were determined mainly by means of extensive spectroscopic methods including 1D (^{1}H and ^{13}C NMR), 2D NMR (COSY, ROESY, HSQC, and HMBC) and HR-ESIMS, and by comparison with reported data in the related literature. They are identified as: niga-ichigoside-F1 (**1**) (Bowen-Forbes et al. 2009), trachelosperoside B1 (**2**) (Bowen-Forbes et al. 2009), 19α-hydroxyasiatic acid (**3**) (Bowen-Forbes et al. 2009), myrianthic acid (**4**) (Hirai et al. 2000), hyptatic acid (**5**) (Bowen-Forbes et al. 2009), trachelosperogenin B (**6**) (Abe & Yamauchi 1987), 4-epi-niga-ichigoside (**7**) and arjunolic acid (**8**) (Bowen-Forbes et al. 2009), trachelosperogenin E (**9**) (Nasser et al. 2006), secologanoside (**10**) and secoxyloganin (**11**) (Calis & Sticher 1984) (Figure 1). Compounds **1**–**11** were tested for their antileishmanial activity against *Leishmania infantum* promastigotes but no activity was detected (at 100, 10, 1 and 0.1 µg/mL) (Sosa et al. 2016). Compounds **1**–**6** and **8**–**11** were also tested (concentration range of 10, 7.5, 5, 2.5 and 1 µg/mL) for their cytotoxicity against human dermal fibroblasts using a MTT assay. Compounds **1**, **2** and **11** showed a very moderate activity with 19.5, 24.6 and 22.4% cell death, respectively, at 10 mg/mL (Table 1) and IC_{50} values of 17.7, 20.5 and 10.9 µg/mL, respectively. The positive control, α-hederin, possessedg 71.3% cell death at the same concentration and an IC_{50} of 3.5 µg/mL. Compounds **1**–**3**, **5**–**6**, **8**–**11** were evaluated for their anti-elastase activity and four compounds (**2**, **8**–**10**) gave a low inhibition percentage ranging from 13 to 16% at 50 µg/mL (Table 1), twofold less active than ursolic acid used as a standard (31% inhibition) corresponding to IC_{50} values of 24.5, 35.9, 31.0 and 42.0 µM, respectively (10.5 µM for ursolic acid). These compounds should be tested on other elastases because the activities of these enzymes deferred based on their

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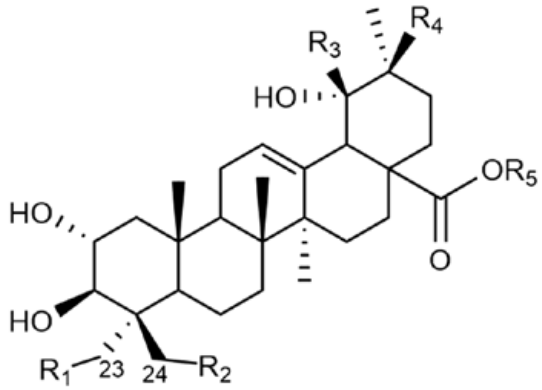
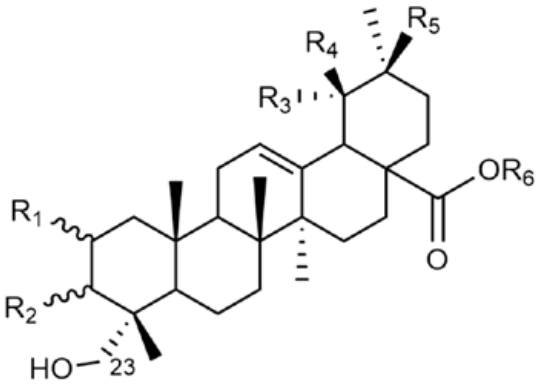
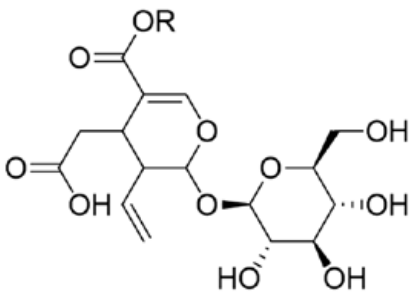


	R_1	R_2	R_3	R_4	R_5
2	OH	OH	CH_3	H	β-D-Glc
6	OH	OH	CH_3	H	H
5	H	OH	CH_3	H	H
7	H	OH	CH_3	H	β-D-Glc
9	OH	OH	H	CH_3	H



	R_1	R_2	R_3	R_4	R_5	R_6
1	αOH	βOH	OH	CH_3	H	β-D-Glc
3	αOH	βOH	OH	CH_3	H	H
4	αOH	αOH	OH	CH_3	H	H
8	αOH	αOH	H	H	CH_3	H



	R_1
10	H
11	CH_3

Figure 1. Chemical structures of compounds **1**–**11**.

origin. Therefore, we could have a greater activity on other elastase types. Compounds **1**–**2**, **5** and **7**–**10** were tested using bioautography (Camag, Switzerland) for their β-glucosidase and anti-acetylcholinesterase activities at 1 mg/mL (application of 2 µL in 8 mm band length). Only compounds **1** and **2** showed an inhibition zone on the β-glucosidase assay (Substrate: 2-naphthyl-β-glucopyranoside) with an inhibition zone of 11 and 7 mm respectively whereas the positive control, acarbose, showed an inhibition zone of 5 mm only. To verify the detected activity, we used other β and α-glucosidase (0.013 U/mL) tests *in vitro* for compounds **1** and **2** at 500 µg/mL but no activity was revealed by a spectrometrical quantification of the released *p*-nitrophenolate at 410 nm. This suggests that the activity detected on bioautography may be due to an excessive concentration and/or to a reaction of the two saponins with the substrate. The anti-acetylcholinesterase (6.66 U/mL) assay was performed using Fast Blue B salt as reagent, 1-naphthyl acetate as substrate and convallatoxin as positive control. Compounds **1** and **2** showed also an inhibition zone of 0.8 and 0.5 mm, respectively, and 0.4 mm for convallatoxin. Till then we could not verify this activity by *in vitro* tests because we did not have all the required elements.

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1 October 2016
Initial
CE: ER QA: XX
Coll:XX QC:XX

Table 1. IC_{50} values and cell (Fibroblasts) death (%) at 10 µg/mL of compounds **1**–**6** and **8**–**11** and Elastase inhibition (%, IC_{50}) by compounds **1**–**4**, **6** and **8**–**11**.

Compounds	Elastase inhibition (%)						Cytoxicity assay		
µg/mL	5	10	25	50	IC_{50} (µg/mL)	IC_{50} (µM)	% of cell death	IC_{50} (µg/mL)	IC_{50} (µM)
Niga-ishigoside F1 (**1**)	0.9	1.7	0	0	318.87	47.9	19.5	17.7	26.5
Trachelosperoside B1 (**2**)	0	4.0	9.2	13.2	167.40	24.5	24.6	20.5	30.0
19α-hydroxyasiatic acid (**3**)	3.0	2.8	2.2	0.0	773.22	153.3	5.4	28.6	56.5
Myrianthic acid (**4**)	0.8	0.5	0.9	0.3	>1000	>500	6.9	>100	>200
Hyptatic acid (**5**)							12.9	>100	>200
Trachelosperogenin B (**6**)	3.1	4.9	7.0	0.8	336.31	64.6	4.9	65.5	125.8
Arjunolique acid (**8**)	4.9	9.8	10.1	16.9	175.47	35.9	11.9	32.7	49.0
Trachelosperogenin E (**9**)	0	5.5	5.6	14.5	161.34	31.0	1.1	90.2	66.9
Secologanoside (**10**)	2.6	5.7	9.7	16.2	164.04	42.0	9.5	30.5	173.3
Secoxyloganine (**11**)	1.6	0.8	7.1	5.6	272.43	67.4	22.4	10.9	78.1
Ursolic acid	6.4	5.9	17.0	32.3	78.60	10.5			
α-hederin							71.3	3.5	4.6

3. Experimental

See Supplementary material.

4. Conclusion

In this study, three triterpenoids saponins (**1**, **2**, **7**), six triterpenes (**3**–**6**, **8**–**9**), and two secoiridoids (**10**–**11**) were isolated and identified from *P. sericea*. Except for the two secologanosides (**10**–**11**) (Braga de Oliveira 1995), this is the first report of these triterpenoids in the genus *Poraqueiba* and the Icacinaceae family. Compounds **10** and **11** were considered as chemotaxonomic markers of Icacinaceae species. The isolated compounds was evaluated for several biological activities to valorise our phytochemical study. Compound **1**, **2** and **10** showed moderate cytotoxicity on fibroblasts (IC_{50}: 17.7, 20.5 and 10.9 µg/mL respectively) and compounds **2**, **8**, **9** and **10** showed low antielastase activity with IC_{50} of 24.5, 35.9, 31.0 and 42.0 µM, respectively. On bioautography, compounds **1** and **2** showed significant inhibition zones for anti-β-glucosidase and anti-acetylcholinesterase activities. Compounds **1**–**11** did not show any antileishmanial activity. This phytochemical and biological investigation helps us to extend the knowledge about the constituents of the unstudied *Poraqueiba sericea* plant.

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Disclosure statement

No potential conflict of interest was reported by the authors. AQ5

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