

# Generic additions to the Rapateaceae of Rondônia, Brazil

Rodrigo Schütz RODRIGUES<sup>1\*</sup>

<sup>1</sup> Universidade Federal de Roraima, Centro de Estudos da Biodiversidade, Av. Ene Garcez 2413, 69304-000, Boa Vista, RR, Brazil.

\* Corresponding author: [rodrigo.schutz@ufrr.br](mailto:rodrigo.schutz@ufrr.br)

## ABSTRACT

Rapateaceae is a monocot family centered in the Guiana Shield region of South America. This article reports four generic additions to the Rapateaceae of Rondônia, a state in northern Brazil. *Cephalostemon gracilis* (Poepp. & Endl.) R.H.Schomb., *Duckea cyperaceoidea* (Ducke) Maguire, *Monotrema xyridoides* Gleason, and *Schoenocephalum cucullatum* Maguire were recorded in lowland savannas and open white-sand ecosystems in the state. These findings extend significantly the known diversity of the Rapateaceae taxa occurring in Rondônia, and represent an extension of their geographical distribution to a Brazilian state with no part of its territory in the Guiana Shield.

**KEYWORDS:** Amazonia, floristics, Guiana Shield, new record

## Novos registros genéricos de Rapateaceae para Rondônia, Brasil

### RESUMO

Rapateaceae é uma família de monocotiledôneas centrada na região do Escudo das Guianas da América do Sul. Este artigo relata o registro de quatro gêneros de Rapateaceae para o estado de Rondônia, norte do Brasil. *Cephalostemon gracilis* (Poepp. & Endl.) R.H.Schomb., *Duckea cyperaceoidea* (Ducke) Maguire, *Monotrema xyridoides* Gleason e *Schoenocephalum cucullatum* Maguire são registrados em áreas de baixa altitude, ocorrendo em savanas e ecossistemas de campinas e campinaras no estado. Estas descobertas aumentam significativamente a diversidade conhecida de táxons de Rapateaceae para Rondônia, bem como representam uma extensão de sua distribuição geográfica para um estado que não tem nenhuma parte de seu território incluído no Escudo das Guianas.

**PALAVRAS-CHAVE:** Amazônia, Escudo das Guianas, florística, nova ocorrência

## INTRODUCTION

Rapateaceae Dumort. is a small angiosperm family belonging to the monocot Poales (APG IV 2016). The family comprises three subfamilies, Rapateoideae Maguire, Monotremoideae Givnish & P.E. Berry and Saxofridericioideae Maguire, established on the basis of the ovule number, inflorescence bract and seed morphology (Givnish *et al.* 2004). Rapateaceae possesses 17 genera and 100 species occurring exclusively in the Neotropics, with the exception of *Maschalocephalus dinklagei* Gilg & K.Schum., which is endemic of western Africa (Givnish *et al.* 2004; Berry 2004).

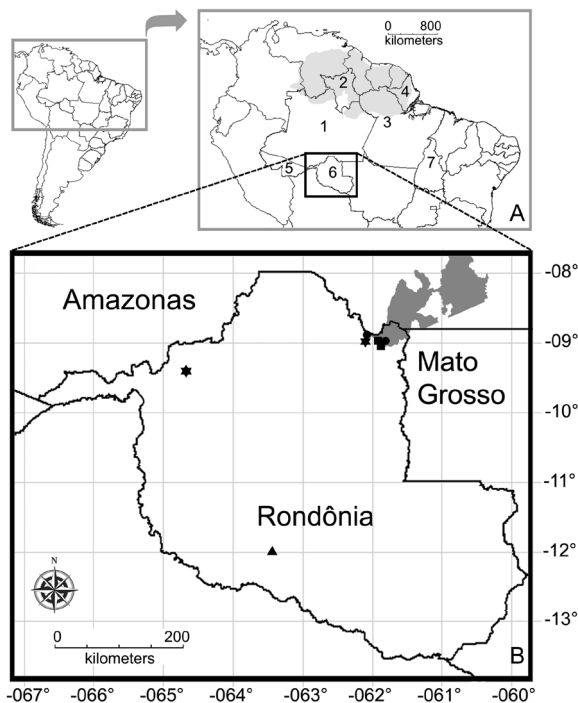
Rapateaceae probably arose in the Guiana Shield (Givnish *et al.* 2004), a northeastern region of South America between the Amazonas, Negro and Orinoco Rivers (Funk *et al.* 2007) markedly known by its high levels of plant endemism (Berry *et al.* 1995). In fact, with exception of six genera (*Cephalostemon* R.H.Schomb., *Epidryos* Maguire, Gilg & K.Schum., *Monotrema* Körn., *Rapatea* Aubl., *Spathanthus* Desv. and *Stegolepis* Klotzsch ex Körn.), all remaining Neotropical genera of Rapateaceae are restricted to the Guiana Shield areas (Givnish *et al.* 2004; Berry 2004).

However, even though floristic works for Rapateaceae are available for Venezuela, Colombia and the Guianas (Maguire 1958; 1965; 1982; Boom 1997; Berry 2004; 2008; Funk *et al.* 2007; Aymard and Arellano-Peña 2016; Rodrigues and Flores 2017), studies in adjacent areas in Brazil are relatively scarce (Maguire 1979; Forzza and Costa 2005; Rodrigues and Flores 2010; Rodrigues 2015; Barbosa-Silva *et al.* 2016; Praia *et al.* 2016). The knowledge about the biodiversity of the state of Rondônia is still incomplete (Carleial and Bigio 2014), including its rapateacean flora. Only four species of *Rapatea* have been reported in the literature for Rondônia (BFG 2015), which places Rondônia as the northern Brazilian state with the lowest richness of genera and species of Rapateaceae, after the state of Acre (BFG 2015).

This article reports generic additions of Rapateaceae to Rondônia, providing a description and information on the previously known geographical distribution for each taxon. An updated inventory of Rapateaceae of Rondônia is discussed on a regional scale, taking into consideration the limits of the Guiana Shield in northern Brazil.

## MATERIALS AND METHODS

I primarily analyzed specimens of Rapateaceae from Rondônia state included in the UFRR herbarium (acronym according to Thiers 2017), with emphasis on duplicates collected in 2013 and 2014 in the Campos Amazônicos National Park (CANP) and adjacent areas. The CANP has an area of 809,158ha and is located between the coordinates of 7°30'S to 9°15'S, and 61°30'W to 62°30'W (Figure 1),



**Figure 1.** Geographical distribution of novel occurrences of Rapateaceae in Rondônia state, Brazil. A. Maps of South America and adjacent Central America, numbering the states of northern Brazil: 1 (Amazonas), 2 (Roraima), 3 (Pará), 4 (Amapá), 5 (Acre), 6 (Rondônia) and 7 (Tocantins); the shaded area corresponds to the Guiana Shield limits according to Funk *et al.* (2007). B. *Cephalostemon gracilis* (Poepp. & Endl.) R.H.Schomb. (triangle), *Duckea cyperaceoidea* (Ducke) Maguire (stars), *Monotrema xyridoides* Gleason (circles) and *Schoenocephalum cucullatum* Maguire (squares) occurrences in and around the Campos Amazônicos National Park (shaded area) and other areas in Rondônia.

extending mainly over lowland areas (ca. 100–250 m altitude) in the states of Rondônia, Amazonas, and Mato Grosso (D'Amico and Coutinho 2011). The CANP is biologically important, for it protects a part of the largest area of the savanna-like Cerrado in southern Amazonia along its contact with white-sand forests (campinaranas) and other forest formations, and also an important river system (D'Amico and Coutinho 2011).

Additionally, available images of specimens from Rondônia in CEN, HUEFS, INPA, NY, RB, RON and UEC herbaria (acronyms according to Thiers 2017) were consulted, mainly by means of the *speciesLink* network (2017) and Reflora Virtual Herbarium (2017) online resources. When available, selected specimens from neighbor states were also analyzed, but descriptions were based only on the material examined from Rondônia. Specimens were identified using specialized literature (Gleason 1931; Maguire 1958; 1965; 1982; Berry 2004). Maps were produced using DIVA-GIS

software (Hijmans *et al.* 2012). The limits of the Guiana Shield (Figure 1A) were extracted from Funk *et al.* (2007).

## RESULTS

The analysis of Rapateaceae specimens at UFRR and additional herbaria revealed the occurrence of *Cephalostemon gracilis* (Poepp. & Endl.) R.H.Schomb., *Duckea cyperaceoidea* (Ducke) Maguire, *Monotrema xyridoides* Gleason, and *Schoenocephalum cucullatum* Maguire in the state of Rondônia (Figures 1 and 2). Below I present a brief account on the examined material from Rondônia.

***Cephalostemon gracilis*** (Poepp. & Endl.) R.H.Schomb. (Schomburgk 1845). Figures 1B and 2A-B.

Description: Terrestrial herbs. Leaf sheaths 9.5-11 x 0.9-1.1 cm, blades 50-62 x 0.3-0.4 cm, linear, 9-11-veined, abaxially with the midvein conspicuously prominent. Inflorescence peduncle erect, 50-60 cm long, 1.5-1.8 mm wide, widening to 3 mm at the top. Inflorescence subglobose, 20-27 mm in diameter; bracts 2, 30-40 x 1.5-3 mm, linear-lanceolate. Spikelets 8-10, 10-12 mm long; external bracteoles 4-5 mm long, nerved, acuminate, the internal ones 10-11 mm long, setose and clavate at apex. Sepals 9.5-11 mm long; petals and anthers not seen.

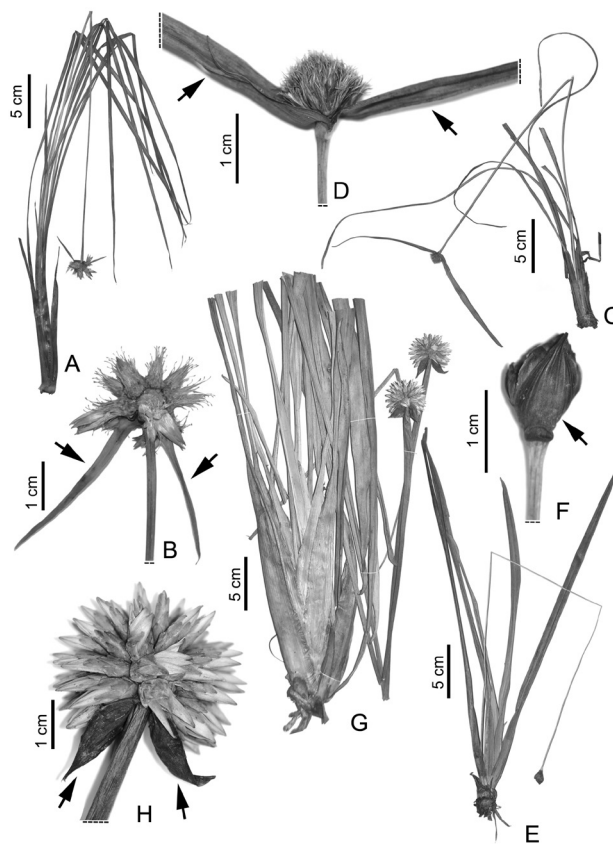
Distribution: Brazil (Amazonas, Amapá, Pará, Mato Grosso) (Maguire 1958; BFG 2015; Praia *et al.* 2016).

Material examined: Brazil. Rondônia: Costa Marques, W of river Cautarinho, 6 km, N of highway BR 429, 12°01'S, 63°27'W, 25/III/1987, *M.H. Nee 34487* (INPA, UFRR).

Additional material examined: Brazil. Amazonas: Manicoré, BR-230, Transamazônica highway, 243 km from Humaitá, 24/IV/1985, *C.A.C. Ferreira et al. 5794* (INPA, NY). Aripuanã, BR-230, Transamazônica highway between Km 350 and 400 east from Humaitá, Ferreira, 30/IV/1985, *C.A.C. Ferreira et al. 5911* (INPA, NY).

***Duckea cyperaceoidea*** (Ducke) Maguire (Maguire 1958). Figures 1B, 2C-D.

Description: Terrestrial herbs. Leaf sheaths 6-12 x 0.5-0.6 cm, blades 30-100 x 0.4-0.5 cm, linear, 9-veined, with the midvein conspicuously abaxially prominent. Inflorescence peduncle erect, 30-75 cm long, 1.5-2 mm wide, widening to 4 mm at the top. Inflorescence globose, 12-19 mm in diameter; bracts 2, 90-150 x 4-5 mm, linear-lanceolate. Spikelets 35-45, 6.8-7.5 mm long; external bracteoles 4-5 mm long, inconspicuously nerved, the internal ones 5-6 mm long, long acuminate at apex (acumen >3 mm long). Sepals 5-6 mm long; petals 3-3.5 mm long; anthers 2.5-2.7 mm long, without apical appendices.



**Figure 2.** Novel occurrences of Rapateaceae in Rondônia state, Brazil. A-B. *Cephalostemon gracilis* (Poepp. & Endl.) R.H.Schomb. A. Habit. B. Distal part of the peduncle and the two adjacent bracts (arrows) subtending a subglobose inflorescence. C-D. *Duckea cyperaceoidea* (Ducke) Maguire. C. Habit. D. Distal part of the peduncle and the two adjacent bracts (arrows) subtending a globose inflorescence. E-F. *Monotrema xyridoides* Gleason. E. Habit. F. Distal part of the peduncle of an inflorescence with numerous spikelets, indicating the outermost inflorescence bract (arrow). G-H. *Schoenocephalum cucullatum* Maguire. G. Habit. H. Distal part of the peduncle and the two adjacent bracts (arrows) of an inflorescence with numerous spikelets. (A-B: *Nee 34487*; C-D: *Sandrini & Resende s.n.*, UFRR 8642; E-F: *Capistrano et al. 115*; G-H: *Capistrano et al. 44*).

Distribution: Venezuela (Amazonas), Colombia (Guainía), and Brazil (Amazonas, Pará, Roraima) (Maguire 1958; 1982; Berry 2004; 2008; BFG 2015, Praia *et al.* 2016).

Material examined: Brazil. Rondônia: Machadinho d'Oeste, left margin of the Ji-Paraná River, near the District of Tabajara, 8°55'38"S, 62°05'06"W, 17/III/2014, *M. Sandrini & T. Resende s.n.* (UFRR 8641). *Ib.*, *M. Sandrini & T. Resende s.n.* (UFRR 8642). Porto Velho, south of Mutum Paraná, 9°22'42"S, 64°40'41"W, 24/X/2010, *G. Pereira-Silva et al. 15756* (CEN, HUEFS, INPA, RB, RON).

Additional material examined: Brazil. Amazonas: Apuí, Nova Prainha, ca. 13 km on road to Prainha N. of Transamazônica highway, 25/VI/1979, *C.E. Calderón et al.*

2670 (INPA). Humaitá, Estanho road, between Km 795 and 790 of Transamazônica highway, 26/04/1979, G. Vieira et al. 182 (INPA).

*Monotrema xyridoides* Gleason (Gleason 1931). Figures 1B, 2E-F.

Description: Terrestrial herbs. Leaf sheaths 7-8 x 0.8-1 cm, blades 18-25 x 0.6-1 cm, linear, 11-15-veined, with the midvein conspicuously abaxially prominent. Inflorescence peduncle erect, 45-48 cm long, 1.2-1.5 mm wide, widening to 4 mm at the top. Inflorescence globose, 9-10 mm in diameter; bracts numerous, the outermost 10-12 x 7-8 mm, widely lanceolate. Spikelets 15-20, 7.8-8.3 mm long; external bracteoles 5.8-6.5 mm long, 3-5-nerved, the internal ones 5-6 mm long, obtuse at apex. Sepals 6.8-7.5 mm long; petals 7-7.5 mm long; anthers 2.4-2.7 mm long, without apical appendices.

Distribution: Venezuela (Amazonas), Colombia (Caquetá, Guainía, Vaupés), and Brazil (Amazonas, Roraima) (Maguire 1958; 1982; Berry 2004; 2008; BFG 2015).

Material examined: Brazil. Rondônia: Machadinho d'Oeste, Tabajara village, 8°50'45"S, 62°04'52"W, fl., VIII/2013, T.R.C. Capistrano et al. 35 (UFRR 8583); *Ib.*, 8°58'47"S, 61°53'44"W, fl., II/2014, T.R.C. Capistrano et al. 115 (UFRR 8643).

Additional material examined: Brazil. Amazonas: Humaitá, BR-230 Transamazônica highway, 150 Km from Humaitá on Estanho road, 40 Km on this road, 21/IV/1985, A.J. Henderson et al. 294 (INPA). *Ib.*, 32 km S of Transamazon highway (150 km E of Humaitá), Estanho road, 27/IX/1979, J.L. Zarucchi et al. 2599 (INPA, UEC).

*Schoenocephalium cucullatum* Maguire (Maguire 1958). Figures 1B, 2G-H.

Description: Terrestrial herbs. Leaf sheaths 15-18 x 1.9-2.5 cm, blades 25-35 x 1.5-2 cm, linear, 8-10-veined, with midvein inconspicuous. Inflorescence peduncle erect, 95-100 cm long, 4.8-5.3 mm wide, widening to 10 mm at the top. Inflorescence globose, 34-37 mm in diameter; bracts 2, 15-20 x 13-16 mm, widely lanceolate, reflexed. Spikelets 28-45, 15.2-16.3 mm long; external bracteoles 2.7-4.5 mm long, 3-5-nerved, the internal ones 8-14.3 mm long, obtuse and cucullate. Sepals 14-15 mm long; petals 10-12 mm long; anthers 3-4.5 mm long, without apical appendices.

Distribution: Venezuela (Amazonas), Colombia (Guainía), and Brazil (Amazonas) (Maguire 1958; 1982; Berry 2004; 2008; BFG 2015).

Material examined: Brazil. Rondônia: Machadinho d'Oeste, left margin of the Ji-Paraná River, 8°58'44"S, 61°53'41"W, fl., 17/II/2014, M. Sandrini & T. Resende s.n. (UFRR 8644). *Ib.*, Tabajara village, 8°58'39"S, 61°53'46"W, fl., II/2014, T.R.C. Capistrano et al. 44 (UFRR 8582).

Additional material examined: Brazil. Amazonas: Apuí, Nova Prainha, Project RADAM/ BRASIL, SB-20-ZB-Pto. O7, 22/VII/1976, C.D.A Mota & O.P. Monteiro s.n. (INPA 60659). Manicoré: Igarapé Preto, 60 Km SE from Transamazônica highway, 02/VII/1979, C.E. Calderón et al. 2747 (NY).

## DISCUSSION

Literature data (Maguire 1958; Berry 2004; BFG 2015) coupled with the present report show that an updated inventory of Rapateaceae of Rondônia contains five genera and eight species (Table 1). The results indicate that Rondônia is, together with Pará state, now the third state in northern Brazil with the highest number of genera and species of Rapateaceae, only behind the states of Amazonas and Roraima (Table 1). *Rapatea*, with four recorded species, can be distinguished from the four genera here added to Rondônia's flora by presenting two relatively large bracts subtending the inflorescence and anthers with an apical hooded appendage (Berry 2004).

*Cephalostemon* possesses five species distributed from northern South America to southeastern Brazil and Bolivia (Berry 2004). All species of *Cephalostemon* have been recorded in Brazil, in the states of Amazonas, Amapá, Goiás, Mato Grosso, Mato Grosso do Sul, Minas Gerais, Pará and Tocantins (Berry 2004; BFG 2015). The specimen analyzed from Rondônia has inflorescences with numerous spikelets, whose external bracteoles are acuminate and the internal ones setose and clavate at the apex. This description agrees with the traits observed in *Cephalostemon gracilis* (Maguire 1958; Praia et al. 2016). In Rondônia, this species occurred in sandy and periodically wet savannas with scattered palms and shrubs, but it has been found elsewhere in seasonally flooded white-sand savannas (Praia et al. 2016).

*Duckea* has four species distributed in northern South America (Berry 2004). In Brazil, three species have been recorded, in the states of Amazonas, Pará and Roraima (BFG 2015). *Duckea cyperaceoidea* is most similar to *D. squarrosa*, but it differs by having inflorescences up to 20 mm in diameter (vs. inflorescences 20 > mm in diameter), bracteoles with long acuminate apex (vs. acute or acuminate apex), the external ones inconspicuously veined (vs. strongly nerved) (Maguire 1982; Berry 2004). In Rondônia, *D. cyperaceoidea* occurred in shrubby white-sand savannas, but elsewhere it has been recorded on forest edges, open white-sand savannas, and edges of rocky outcrops (Berry 2004).

*Monotrema* has four species and an interspecific hybrid, distributed in southern Venezuela and adjacent regions of Colombia and Brazil (Berry 2004). In Brazil, BFG (2015) recorded two species, *M. aemulans* Körn. and *M. xyridoides*, from the states of Amazonas, Mato Grosso and Roraima. However, Rodrigues (2015) additionally confirmed the

**Table 1.** Taxa of Rapateaceae recorded for northern Brazil states based on (a) Rodrigues and Flores (2010); (b) Rodrigues (2015); (c) BFG (2015); (d) Costa *et al.* (2016); (e) Barbosa-Silva *et al.* (2016); (f) Praia *et al.* (2016); (g) present work. Acronyms for Brazilian states: (AC) Acre; (AM) Amazonas; (AP) Amapá; (PA) Pará; (RO) Rondônia; (RR) Roraima; (TO) Tocantins. Bold: present data. Guianan and extra-Guianan respectively refer to those northern Brazil states included or not in the Guiana Shield limits according to Funk *et al.* (2007).

Taxa/number of species	Guianan				Extra-Guianan			Source
	AM	RR	PA	AP	AC	RO	TO	
<b>Subfam. Rapateoideae</b>								
<i>Cephalostemon</i>	3	1	1	1	-	<b>1</b>	3	c, f
<i>Duckea</i>	3	2	1	-	-	<b>1</b>	-	c, d, f, g
<i>Rapatea</i>	10	1	4	2	3	4	2	a, c, f
<i>Spathanthus</i>	2	1	1	2	-	-	-	c, f
<b>Subfam. Monotremoideae</b>								
<i>Monotrema</i>	2	3	-	-	-	<b>1</b>	-	b, c, d, g
<b>Subfam. Saxofridericioideae</b>								
<i>Epidryos</i>	-	1	-	-	-	-	-	a, c
<i>Saxofridericia</i>	5	2	1	1	-	-	-	c, f
<i>Schoenocephalium</i>	1	-	-	-	-	<b>1</b>	-	c, g
<i>Stegolepis</i>	3	4	-	-	-	-	-	a, c, e
<b>Total: genera (species)</b>	<b>8(29)</b>	<b>8(15)</b>	<b>5(8)</b>	<b>4(6)</b>	<b>1(3)</b>	<b>5(8)</b>	<b>2(5)</b>	

occurrence of *M. bracteatum* Maguire in Brazil, for the state of Roraima. *Monotrema xyridoides* is similar to *M. aemulans*, as both have the outermost bracts shorter to slightly longer than the inflorescences (Maguire 1982; Berry 2004). The ovoid inflorescences, with up to 25 spikelets and obtuse bracteoles observed in Rondonian specimens agree with *M. xyridoides*, in opposition to the nearly hemispheric inflorescences, with 40 to 75 spikelets, and subacute and apiculate bracteoles found in *M. aemulans* (Maguire 1982; Berry 2004). In Rondônia, *M. xyridoides* occurred in open or shrubby savannas, but it has been found elsewhere in open moist white-sand savannas (Berry 2004).

*Schoenocephalium* comprises four species, distributed in Colombia, Venezuela, and Brazil (Berry 2004). BFG (2015) recorded two species for Brazil in the states of Amazonas and Mato Grosso. The examined material of *Schoenocephalium* from Rondônia possesses sepals exceeding the tips of the upper bracteoles 1-3 mm and plane leaf blades. This character set is shared by two close species, *S. cucullatum* and *S. schultesii* Maguire. As the analyzed specimens have the upper bracteoles cucullate, inflorescences with up to 45 spikelets, and 2(-3) ovules per locule, they correspond to *S. cucullatum* (Maguire 1958; 1982; Berry 2004). On the other hand, *S. schultesii* differs by having the upper bracteoles not cucullate, inflorescences with 60 to 80 spikelets, and 4 ovules per locule (Maguire 1958; 1982). In Rondônia, *S. cucullatum* occurred in shrubby savannas, but has been found elsewhere in seasonally flooded white-sand savannas (Berry 2004).

An analysis of available specimens in both *speciesLink* network (2017) and *Reflora Virtual Herbarium* (2017) indicated that a previously putative record of *Cephalostemon* in Rondônia (Pereira-Silva *et al.* 15756) corresponds indeed to *Duckea cyperaceoidea*. However, in these two online databases there are Rondonian specimens of *Cephalostemon* (e.g., *G.T. Prance et al.* 5833; *C.D. Mota & D. Coêlho* 190) whose identifications need to be further confirmed. Species delimitation in *Cephalostemon* is intricate, as four species are morphologically very similar and possibly diagnosed by variable characters (Pirani and Giulietti 1989; Berry 2004; Praia *et al.* 2016). *Cephalostemon gracilis* is the older name in the genus and is probably conspecific with *C. affinis* Körn. (Praia *et al.* 2016), also forming a species complex with *C. angustatus* Malme and *C. riedelianus* Körn (Berry 2004).

On a regional scale, only four states in northern Brazil have variable proportions of their territory in the Guiana Shield area: Amazonas, Roraima, Pará, and Amapá (Figure 1A). The rapateacean flora of these four states is relatively rich, possessing all the nine genera and 36 from the 40 species recorded for Brazil (Rodrigues and Flores 2010; BFG 2015; Rodrigues 2015; Barbosa-Silva *et al.* 2016). On the other hand, for the entirely extra-Guianan states of northern Brazil (Acre, Rondônia, and Tocantins; Fig. 1B) only eight species of *Cephalostemon* and *Rapatea* had been recorded so far (BFG 2015).

With the records reported herein, the rapateacean flora of northern Brazilian extra-Guianan states currently comprises five genera and 12 species of the three subfamilies (Table 1). It is interesting to note that, with exception of *Schoenocephalium*, all these taxa belong to distinct, predominantly lowland lineages of Rapateaceae subfamilies Rapateoideae (*Duckea*, *Rapatea*, *Cephalostemon*) and Monotremoideae (*Monotrema*) (Givnish *et al.* 2004). On the other hand, *Schoenocephalium*, though belonging to a preponderantly upland or highland subfamily (Saxofridericioideae), is a lowland genus which is included in a small lineage that probably shifted back to low altitudes (Givnish *et al.* 2004).

In this respect, the occurrence of *Cephalostemon gracilis*, *Duckea cyperaceoidea*, *Monotrema xyridoides* and *Schoenocephalium cucullatum* in lowland savannas and open white-sand ecosystems at the CANP agrees with the similar altitudinal and habitat preferences previously documented for these species in Guiana Shield areas (Berry 2004) and in some municipalities of the Amazonas state close to the border with Rondônia. These results suggest that the four species may be more widespread in other extra-Guianan areas in northern Brazil, since García-Villacorta *et al.* (2016) observed that long-distance dispersal events are important to link white-sand floras from Guiana Shield and Amazonian areas. A better understanding of the biogeography of Rapateaceae in Amazonia still depends on the expansion of collections at sites still unexplored. In this regard, Milliken *et al.* (2010) and Zappi *et al.* (2016) have already emphasized that the poor knowledge of species distribution patterns, especially in northern Brazil, is a result of the pronounced incompleteness of floristic knowledge in this region. Since other recent additions to Rapateaceae from northern Brazil were from both lowland (Rodrigues 2015; Costa *et al.* 2016) and mountain areas (Rodrigues and Flores 2010; Barbosa-Silva *et al.* 2016), additional collection efforts must consider the distinct elevation preferences of taxa within this family.

## CONCLUSIONS

As reported herein, *Cephalostemon gracilis*, *Duckea cyperaceoidea*, *Monotrema xyridoides* and *Schoenocephalium cucullatum* Maguire are new records for the state of Rondônia. The documented occurrence of species of *Duckea*, *Cephalostemon*, *Monotrema* and *Schoenocephalium* extends significantly the known diversity of the Rapateaceae taxa occurring in this state, that has no part of its territory in the Guiana Shield.

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