Acta Botanica Brasilica - 30(4): 628-643. October-December 2016.
doi: 10.1590/0102-33062016abb0162

Rapateaceae in the state of Pará, Brazil

Talita de S. Praia[1*], André dos S. Bragança Gil[2] and Ricardo de S. Secco[2]

Received: May 10, 2016
Accepted: November 04, 2016

ABSTRACT

Rapateaceae comprises approximately 19 genera and 131 species distributed in the Neotropics, with the exception of *Maschalocephalus*, which is endemic to West Africa. In Brazil, there are nine genera and 38 species. The present paper is based on a taxonomic study of the species of Rapateaceae that occur in the state of Pará. Botanical specimens from seven herbaria were analyzed and the occurrence of five genera and eight species was confirmed for the state. An identification key to the genera and species, descriptions, illustrations and selected specimens are provided.

Keywords: Amazonian species, *Cephalostemon*, Neotropic, North Region, *Rapatea*

Introduction

Rapateaceae comprises approximately 19 genera and 131 species distributed in the Neotropics, with exception to the monotypic genus *Maschalocephalus* that is endemic to West Africa (Givnish *et al*. 2000). In Brazil, there are nine genera and 38 recorded species, which are distributed in every region except the South Region of the country (BFG 2015).

The first publication about Rapateaceae was made by Aublet (1775), which introduced *Rapatea paludosa* Aubl. However, this species was not treated as a member of Rapateaceae until 54 years later when Dumortier (1829) characterized the family as having flowers surrounded by large bivalvate spathes. Seubert (1847) published the first taxonomic treatment of Rapateaceae, which comprises detailed descriptions of the family, three genera and six species, as well as an identification key and illustrations. Following this, Körnicke (1873) published the first large study about Rapateaceae that described nine new species. Maguire (1958; 1962; 1965; 1979) refined the taxonomy of the family, and these studies remain the most important about the group. In addition, Givnish *et al*. (2000; 2004) published the first phylogeny of the family, based on molecular data and morphological characters, which confirmed the suprageneric taxa proposed by Maguire (1958; 1962; 1965; 1979).

Although the richness of Rapateaceae is well-documented for Brazil, there are few taxonomic studies about the family for the country (Maguire 1958; Forzza & Costa 2005; Rodrigues & Flores 2010; Romanini & Wanderley 2012; Monteiro 2016), and for some states, such as Pará (Poeppig & Endlicher 1838; Maguire 1958), the publications about this group are old. For this reason, taxonomic studies about Rapateaceae in Pará are needed to identify specimens in Amazonian herbaria and to improve what is known about the floras of Amazonia and Brazil.

Thus, the present work aims to carry out a taxonomic treatment of Rapateaceae species in the state of Pará, deposited in the main amazonian and extra-amazonian herbaria, and thus providing data to contribute to the knowledge expansion about this family in the Amazon.

Materials and methods

Pará State is located in the North Region of Brazil and comprises 1,248,042.515 km² divided into 144

[1] Programa de Pós-graduação em Ciências Biológicas, Universidade Federal Rural da Amazônia e Museu Paraense Emilio Goeldi, Av. Perimetral, 1901, Terra Firme, 66077-830, Belém, PA, Brazil
2 Museu Paraense Emilio Goeldi, Av. Perimetral, 1901, Terra Firme, 66077-830, Belém, PA, Brazil.

* Corresponding author: talitapraiabot@gmail.com

municipalities (IBGE 1990). The relief is predominantly flat and low; more than 80 % of the state is below 300 m elevation and approximately 50 % is below 200 m (IBGE 1990). Pará has little seasonal variation, an average temperature above 28º C, rain throughout the year, and no dry season (Pires & Prance 1985). There are various vegetation types in the state, such as *campinarana*, *campo rupestre*, *cerrado*, *caatinga*, *igapó* forest, *terra firme* forest, *várzea* forest, rain forest and Amazonian savanna (Pires & Prance 1985; IBGE 1990; BFG 2015), resulting in a highly diverse flora (Pires & Prance 1985).

All Rapateaceae specimens (from Pará) at the herbaria MG, IAN, INPA, RB, MO, NY and P were studied; images of specimens at MO, NY and P were studied online, and species determinations were made after consulting the literature (Maguire 1958; 1962; 1965; 1979; Berry 2004; Forzza & Costa 2005) and websites that have protologues and images of types Tropicos (2015), WCSP (2015) and Ithaka (2015). Some characters mentioned in protologues were not observed in the examined exsiccatae. These characters are included below the main description of the taxon as a "complimentary description." The terminology used to define the species is based on Maguire (1958; 1962; 1965; 1979) and Berry (2004).

The identification keys, detailed descriptions, illustrations of important aspects and information about the habitat of each species are based on the material deposited at the consulted herbaria. The descriptions of genera are based on the same material and the literature (Maguire 1958; 1962; 1965; 1979; Berry 2004; Forzza & Costa 2005). Accepted synonyms are found in Maguire (1958; 1962; 1965; 1979). Geographic distribution, phytogeographic domain and phenology data were obtained from specimens and the literature.

Results and discussion

Approximately 190 specimens of the family were analyzed and five genera and eight species were confirmed for Pará, including *Cephalostemon*, *Duckea*, *Saxofridericia* and *Spathanthus*, with one species each, and *Rapatea* with four species.

Rapateaceae Dumort., Anal. Fam. Pl.: 60 (1829).

Herbs, terrestrial in wetlands, or epiphytic (only *Epidryos* Maguire). Leaves subdistichous or rosulate to distichous; leaf blades green, margins unarmed or spinescent, petioles present or absent. Inflorescences capituliform, subglobose, spicate, glomerulate or secund; scapes green, cylindrical, compressed or flattened, glabrous or sparsely pubescent, sulcate or canaliculate; spathes bivalvate or univalvate, asymmetrical or symmetrical; spikelets numerous, sessile, pedunculate or shortly pedunculate; bracteoles heterogeneous or homogenous. Flowers sessile or pedicellate; sepals 3, coriaceous or papyraceous; petals yellow; stamens 6, anthers dehiscing by 1, 2 or 4 apical or subapical pores or apical slits; ovary superior, syncarpous or apocarpous, carpels 1–3, placentation axile or basal, ovules anatropous; style 1, terminal or basal, stigma simple. Fruits loculicidal capsules. Seeds 1–3 per fruit, endosperm abundant, possibly water dispersed. Mucilage is abundant at the leaf bases (rosettes) and in the young inflorescences (from Berry 2004; Forzza & Costa 2005).

Identification key to the Rapateaceae genera in the State of Pará

1. Leaves petiolate, margins spinescent; young inflorescences enveloped by involucrum formed by a membranous bivalvate spathe with entirely connate margins (fused region inconspicuous); seeds reniform ..... 4. *Saxofridericia*
1'. Leaves sessile, margins entire; young inflorescences not enveloped by involucrum formed by a spathe; seeds ellipsoid, ovoid, suboblong, oblong or subglobose 2
2. Inflorescence secund, spathe univalvate, navicular, base with auricles turned inward ..... 5. *Spathanthus*
2'. Inflorescences spicate, capituliform or glomerulate, spathes bivalvate, narrow-lanceolate, linear-lanceolate or lanceolate, base without auricles turned inward 3
3. Leaf blades 1.7–10 cm wide; spathes symmetrical, lanceolate to widely lanceolate, valves erect or ascending ..... 3. *Rapatea*
3'. Leaf blades 0.3–1.3 cm wide; spathes asymmetrical, linear to narrow-lanceolate, valves patent or reflexed 4
4. Spikelets with heterogeneous bracteoles, basal acuminate, apical long-aristate; seeds ellipsoid, reticulate, mitriform apical appendages present ..... 1. *Cephalostemon*
4´. Spikelets with homogeneous bracteoles; seeds ovoid, longitudinally striate, mitriform apical appendages absent ..... 2. *Duckea*

1. *Cephalostemon* R.H. Schomb., Die Rapatea Friderici Angusti 9. 1845.

Leaves distichous or subdistichous; leaf blades linear to lanceolate, glabrous, margins unarmed, marcescent, apices acute to attenuate, bases attenuate; petioles absent (rarely pseudopetiolate). Inflorescences capituliform,

globose or subglobose, young inflorescences enveloped by membranaceous involucrum formed by entirely connate spathes absent; scapes cylindrical, glabrous, sulcate; spathes bivalvate, asymmetrical, linear-lanceolate, valves reflexed, persistent, apices acute, bases cordiform; spikelets numerous or in numbers of 2 or 3, sessile; bracteoles 4–7 cm long, lanceolate, coriaceous, heterogeneous, apices clavate, acuminate, mucronate or long-aristate, imbricate or not imbricate. Flowers sessile; sepals lanceolate, coriaceous, margins membranaceous, apices apiculate. Capsules globose or elliptic to trigonous. Seeds 2, ellipsoid, longitudinally reticulate, with mitriform apical appendages, papilliform structures ovoid to subglobous, bases with hilar scars.

There are four species of *Cephalostemon* in Brazil (BFG 2015). Only *C. gracilis* was recorded for State of Pará. The genus is characterized mainly by having a spathe with two erect, reflexed valves, and seeds with mitriform apical appendages.

1.1. *Cephalostemon gracilis* (Poepp. & Endl.) R.H. Schomb., Rapatea 9. 1845.
Fig. 1

Herbs 35–68 cm tall. Leaves subdistichous, sheaths 5.0–10 × 4.0–1.0 cm, coriaceous, margins membranaceous, bases marcescent; leaf blades 26–54 × 1.3–1.3 cm, linear, both sides (pseudofaces) with prominent lateral veins, one side with conspicuous prominent central vein, apices acute. Inflorescences 1.0–1.5 × 2.0–2.5 cm, subglobose; scapes 25–37 cm long, costae conspicuously discolored; spathes: smaller 1.4–3.6 × 3.0–5.0 cm, larger 3.5–5.5 × 4.0–8.0 cm; spikelets ca. 15 per inflorescence; bracteoles 47–56 per spikelet, basal ca. 0.4 cm long, apical acuminate, ca. 1.0 cm long, long-aristate, imbricate. Flowers with sepals ca. 1.0 cm long; other flower parts not seen. Capsules ca. 4.0 × 5.0 mm, ellipsoid to trigonous. Seeds ca. 2.0 × 3.0 mm, mitriform apical appendages 2.0–4.0 × 1.0–2.0 mm.

Complementary description: Flowers with petals narrowing towards the base; filaments smooth, connate to corolla tube; anthers appendiculate; ovaries round; styles triangular; stigmas papillose (Poeppig & Endlicher 1838; Schomburgk 1845; Körnicke 1873).

Selected material: BRAZIL. PARÁ: Breves, 14/IV/1923, fr., A. Ducke s.n. (RB). Óbidos, 20/VII/1912, fr., A. Ducke s.n (MG). Serra do Cachimbo, 10/VII/1973, fr., N. T. Silva 3704 (IAN). Vigia, 26/IV/1927, fr., A. Ducke, s.n. (RB). See S1 in supplementary material.

Schomburgk (1845) described *C. gracilis* based on the grass-like, linear leaf blades and inflorescence spikelets with bracteoles that have acuminate basal and long-aristate apical, confirmed these characteristics in all materials analyzed. *Cephalostemon gracilis* is very similar to *C. affinis*. The characters used to distinguish them (form of the base and apex of the bracteoles) were highly variable in the exsiccatae examined, including the types, and it was not possible to separate them. However, before synonymizing *C. affinis*, a more detailed taxonomic analysis of both taxa needs to be made that includes additional fertile material.

This species is endemic to Brazil, has been recorded for the states of Amapá, Amazonas, Mato Grosso and Pará, and occurs in *campinas* where it grows in inundated fields of white sand.

2. *Duckea* Maguire, Mem. New York Bot. Gard. 10(1): 41. 1958.

Leaves subdistichous or distichous; leaf blades narrow-lanceolate, plane or linear, glabrous, margins unarmed; petioles absent (rarely pseudopetiolate). Inflorescences capituliform, subglobose or globose, young inflorescences enveloped by membranaceous involucrum formed by entirely connate spathes absent, smaller or larger than 2.0 cm diam.; scapes cylindrical, glabrous, sulcate; spathes bivalvate, asymmetrical, linear-lanceolate or lanceolate, valves patent, persistent, apices acute, bases cordiform; spikelets numerous, subsessile; bracteoles acuminate or obtuse, coriaceous, homogeneous, bases with revolute margins, apices attenuate, imbricate. Flowers sessile; sepals lanceolate, coriaceous, margins membranaceous, apices acuminate, larger or smaller than the sepals. Capsules ellipsoid or trigonous. Seeds 2, ovoid or elliptic, longitudinal striations conspicuous, mitriform apical appendages absent.

Duckea is represented by three species in Brazil (BFG 2015). In the state of Pará, only *D. cyperaceoidea* (Ducke) Maguire has been recorded. *Duckea* can be distinguished from the other genera in the family mainly by its leaf width (< 4 cm wide) and seeds that are strongly longitudinally striated. *Duckea* is easily confused with *Cephalostemon*, but differs by the absence of seeds with apical appendages.

2.1. *Duckea cyperaceoidea* (Ducke) Maguire, Mem. New York Bot. Gard. 10(1): 42. 1958.
Fig. 2

Herbs 44.0–65.0 cm tall. Leaves subdistichous, sheathes 7.0–9.0 cm, coriaceous, margins membranaceous, bases marcescent; leaf blades 36.0–52.0 × 3.0–4.0 cm, narrow-lanceolate, both sides (pseudofaces) with prominent lateral veins, one side with conspicuous prominent central vein, apices acute, bases attenuate. Inflorescences 2.0–2.3 × 1.1–1.6 cm, subglobose; scapes 28.0–39.0 cm long, costae concolor; spathes: smaller 6.0–7.7 × 3.0–5.0 cm, larger 8.0–16.6 × 4.0–6.0 cm, linear-lanceolate; spikelets ca. 12 per inflorescence; bracteoles 17–20 per spikelet, 5.0–8.0 mm long, obtuse. Flowers with sepals 0.4–0.8 cm long; other flower parts not seen. Capsules ca. 4.0 × 3.0 mm. Seeds 2 per fruit, ca. 2.0 × 2.0 mm, ovoid, longitudinal striations conspicuous.

Complementary description: Flower petals ca. 0.1 × 0.2 cm, apices obtuse-acuminate; anthers lanceolate; styles longer than sepals; ovary 3-locular, ovules 1 per locule, oval (Ducke 1915). There is no information in the literature about the filaments and stigmas.

Material examined: BRAZIL. PARÁ: Bela Vista, 24/

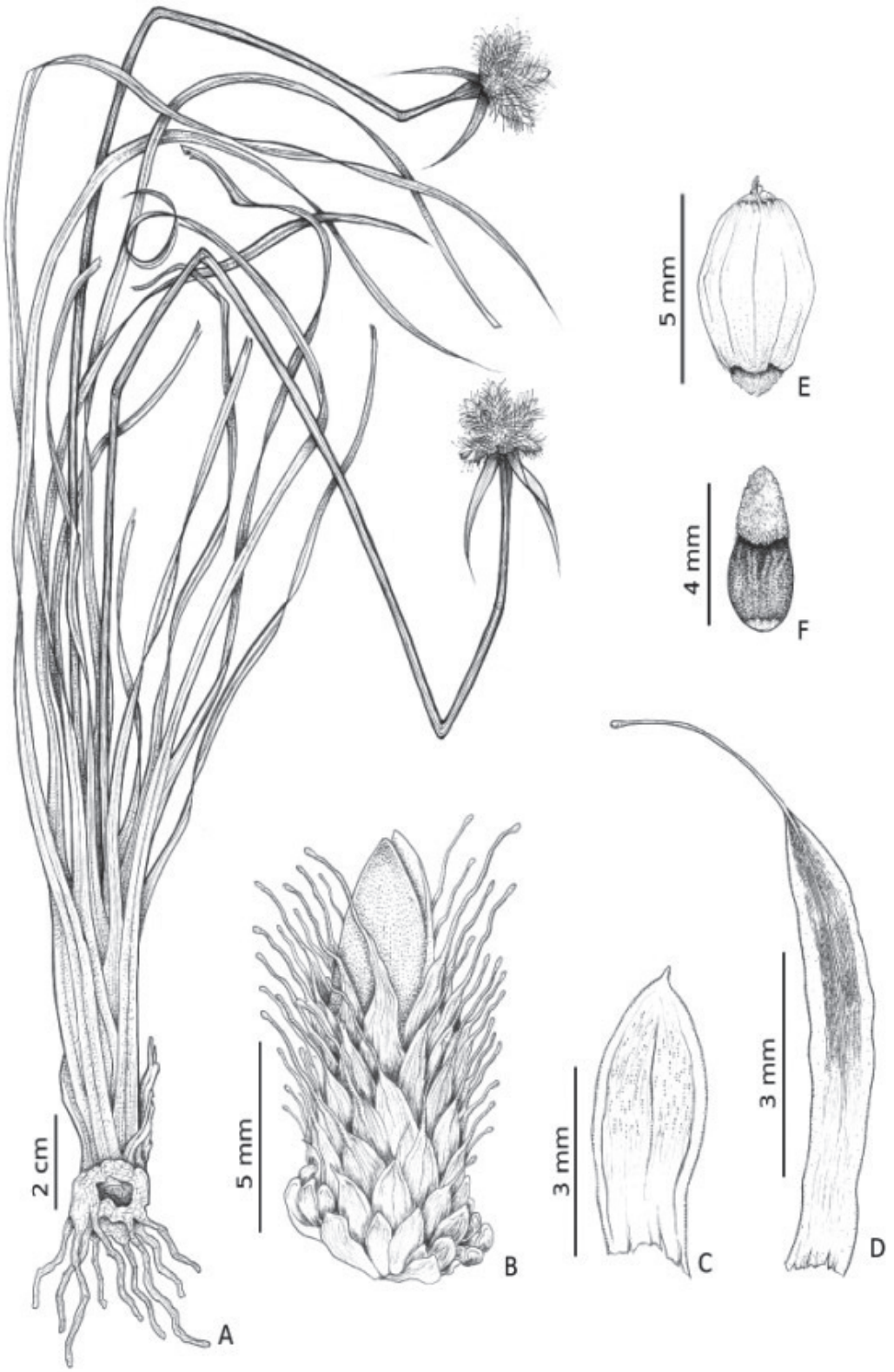

Figure 1. *Cephalostemon gracilis* (A. *Ducke, sn* - MG). A. Habit. B. Spikelet. C. Bracteole basal (adaxial face). D. Bracteole apical (adaxial face). E. Fruit. F. Seed. Illustrations: Pedro Machado (2015).

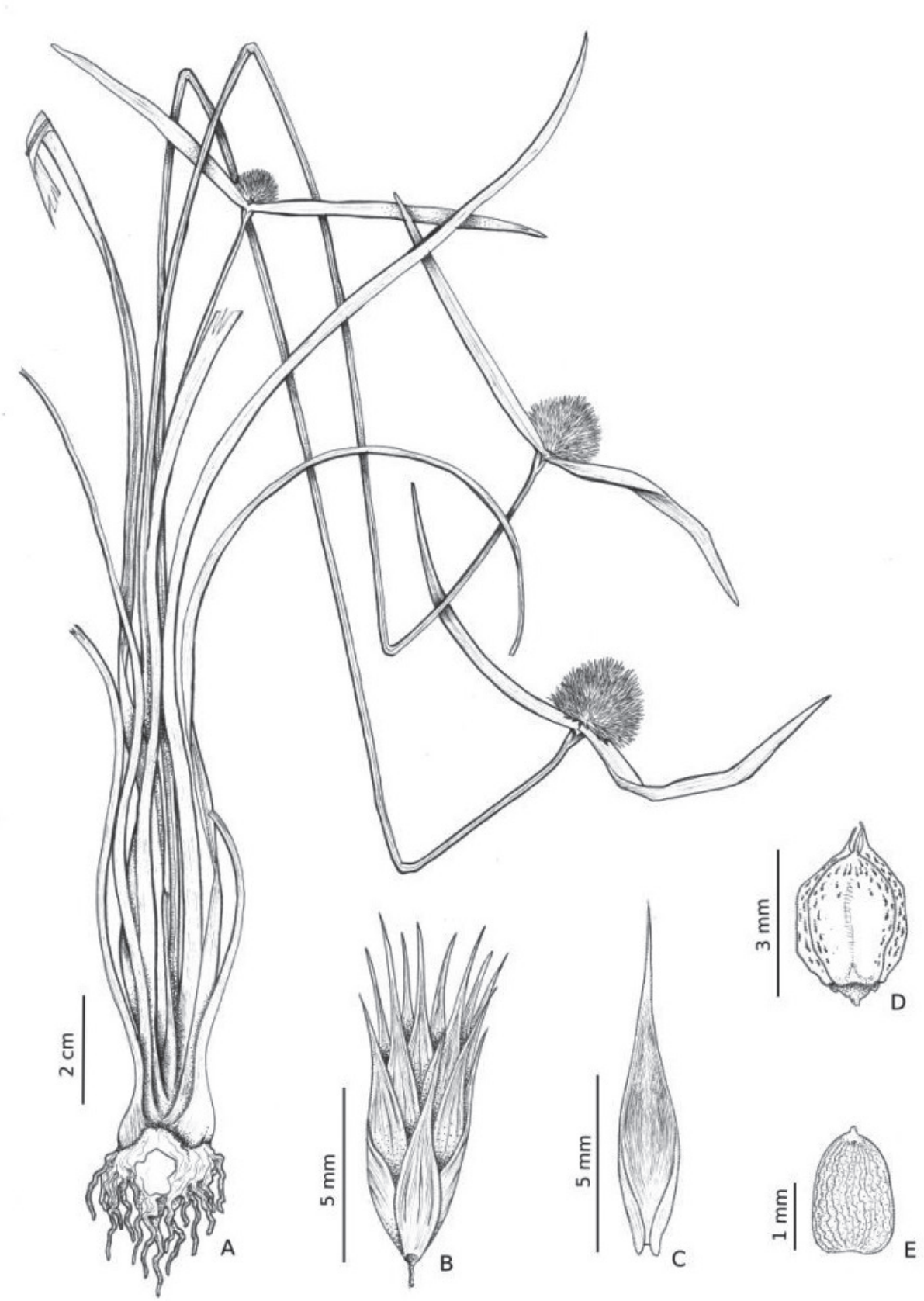

Figure 2. *Duckea cyperaceoidea* (*A. Ducke, sn* - RB). A. Habit. B. Spikelet. C. Bracteole with revolute margin (adaxial face). D. Fruit. E. Seed. Illustrations: Pedro Machado (2015).

IX/1922, A. Ducke sn (RB). Jamaracarú, 5/VI/1957, fr., W. A. Engler 476 (MG). Óbidos, 7/XII/1987, fr., C. Farney & E. F. Bastista 2114 (INPA, RB). See S1 in supplementary material.

Duckea cyperaceoidea resembles *Cephalostesmon gracilis*, mainly by its leaves and inflorescences. However, in *D. cyperaceoidea* the bracteoles are homogenous and long-aristate, and the seeds are appendiculate, whereas in *C. gracilis* the bracteoles are heterogeneous, basally clavate-acuminate and apically long-aristate, and the seeds have mitriform apical appendages. In addition, the leaf blades of *D. cyperaceoidea* are very narrow (rarely more than 0.4 cm wide) compared to the blades of *C. gracilis* (to 1.2 cm wide).

In Brazil, *Duckea cyperaceoide* has been recorded for the states of Amazonas, Pará and Roraima, where it occurs in *campinaranas* in flooded areas. It is also found in Venezuela in flooded areas. *Duckea cyperaceoide* flowers from July to December.

3. *Rapatea* Aubl., Hist. Pl. Guiane 1: 305, pl. 118. 1775.

Leaves with coriaceous sheaths, margins marcescent, unarmed, bases membranaceous; leaf blades 1.7–10.0 cm wide, lanceolate, wide-lanceolate, narrow-lanceolate or linear-lanceolate, glabrous, bases attenuate, asymmetrical, symmetrical, or asymmetrically subcordate, both sides with prominent central veins, lateral veins prominent or slightly inconspicuous, rugosity inconspicuous, absent or prominent, one side with prominent rugosity with lateral nerves slightly inconspicuous, the other side not rugose; petioles absent or present. Inflorescences spicate, capituliform or glomerulate young inflorescences enveloped by membranaceous involucrum formed by entirely connate spathes absent; scapes compressed or flattened, glabrous or sparsely pubescent, sulcate or canaliculate; spathes bivalvate, symmetrical (rarely asymmetrical), lanceolate or wide-lanceolate, distinct or adnate to the central axis of inflorescence, valves erect or ascending, persistent or caducous, apices acute or attenuate, bases attenuate, subcordate or cordate; spikelets numerous sessile or pedunculate; bracteoles navicular or lanceolate, coriaceous, homogenous or heterogeneous, apices mucronate, long-aristate, acute or apiculate, bases attenuate or rounded, sometimes imbricate. Flowers sessile or pedicellate; sepals lanceolate, chartaceous or coriaceous, apices apiculate; other flower parts not seen (except for *R. paludosa*). Capsules ellipsoid, oblong or ovoid. Seeds 3 per fruit, ellipsoid, subglobose or oblong, longitudinally and transversely rugose (sometimes inconspicuous), mitriform apical appendages absent.

Rapatea has 12 species in Brazil (BFG 2015), of which *Rapatea elongata*, *R. paludosa*, *R. pycnocephala*and *R. ulei* occur in Pará. The main diagnostic characters that separate *Rapatea* from the other genera of Rapateaceae are the spathe with two opposite valves that are erect or ascending, the presence of appendages on the anthers and solitary seeds (Maguire 1965; Berry 2004).

Key to the species of **Rapatea** *in the State of Pará*

1. Spathes adnate to the central axis of the inflorescence, bases attenuate; inflorescences spicate, axis elongate, 5.0–7.0 cm long ..... 3.1. *Rapatea elongata*
1'. Spathes distinct from the central axis of the inflorescence, bases cordate or subcordate (not visible in *R. pycnocephala* when mature); inflorescences capituliform or glomerulate, axis plane to convex, to 1.7 cm long 2
2. Leaf blades with subcordate, asymmetrical bases; spikelets with homogeneous bracteoles ..... 3.4. *Rapatea ulei*
2´. Leaf blades with attenuate, symmetrical bases; spikelets with heterogeneous bracteoles 3
3. Inflorescences glomerulate, enveloping the base of the spathe at maturity; bracteoles with clear brown spots, apices apiculate ..... 3.3. *Rapatea pycnocephala*
3'. Inflorescences capituliform, not enveloping the base of the spathe at maturity; bracteoles tinged with brown, apices long-aristate ..... 3.2. *Rapatea paludosa*

3.1. *Rapatea elongata* G. K., Schultze., Notizbl. Bot. Gart. Berlin, 12: 230. 1934.

Fig. 3

Herbs 72.0–97.0 cm tall. Leaves with sheaths ca. 11.0 × 1.3 cm; leaf blades 67.0–82.0 × 2.0–4.5 cm, lanceolate, both sides (pseudofaces) with prominent lateral veins, one side prominently rugose, rugosity absent on other side, apices long-acute, bases asymmetrically attenuate; petioles absent. Inflorescences spicate, axis elongate, 5.0–7.0 cm long; scapes 25.0–30.0 × 1.2–1.5 cm, flattened, glabrous, canaliculate; spathes 24.0–30.0 × 2.9–4.5 cm, lanceolate, adnate to the central axis of the inflorescence, valves erect, persistent, apices long-acute, bases attenuate; spikelets ca. 20 per inflorescence, sessile, laterally exceeding the spathe; bracteoles 10–13 per spikelet, homogeneous, ca. 1.0 cm long, navicular, apices brown, mucronate, not imbricate. Flowers sessile; sepals 0.6–1.0 × 0.3–0.5 cm, chartaceous, other flower parts not seen. Capsules not seen. Seeds not seen.

Complementary description: Flowers with flattened filaments; anthers ca. 5.0 mm long, linear, apical appendages ca. 2 mm long; ovaries rounded, locules monospermic; styles 10.0–12.0 cm long, apically contorted (Schultze 1934).

Figure 3. *Rapatea elongata* (*N. A. Rosa & M. R. Santos 1905* - MG). A. Habit. B. Spikelet. C. Bracteole (adaxial face). Illustrations: Pedro Machado (2015).

There is no data about the petals, stigmas fruits and seeds in the literature.

Material examined: BRAZIL. PARÁ: Alto Tapajós, 12/V/1977, N. A. Rosa & M. R. Santos, 1905 (MG, IAN). See S1 in supplementary material.

The main character that distinguishes *Rapatea elongata* from the other species in the genus is the elongate inflorescence, which was easily observed in the specimens studied.

In Brazil, *R. elongata* occurs in the states of Amazonas, Pará and Roraima, in *campinarana*, *várzea* fields, *igapó* forests and *várzea* forests, where it grows on the swampy margins of rivers and waterways. This species also occurs in Colombia, where is grows on the margins of rivers. *Rapatea elongata* flowers from February to July.

3.2 *Rapatea paludosa* Aubl., Hist. Pl. Guiane 1: 305, tb 118. 1775.

Fig. 4

Herbs 70.0–130.0 cm tall. Leaves with sheaths 16.0–25.5 × 1.2–2.4 cm; leaf blades 50.0–102.0 × 3.5–7.9 cm, wide-lanceolate, sides (pseudofaces) inconspicuously rugose, lateral veins prominent, apices acute, bases attenuate, symmetrical; petioles absent. Inflorescences capituliform, not surround the base of the spathes at maturity, axis plane to convex, ca. 1.0 cm long; scapes 25.0–30.0 × 1.2–1.5 cm, flattened, sparsely pubescent, sulcate; spathes 11.0–18.0 × 1.3–4.3 cm, lanceolate to wide-lanceolate, distinct from the central axis of the inflorescence, valves erect, persistent, apices attenuate, bases subcordate; spikelets ca. 40 per inflorescence, pedunculate, peduncles 1.0–2.2 cm long; bracteoles 12–14 per spikelet, heterogeneous, lanceolate, basal 1.1–8.0 mm long, apical 1.0–1.4 cm long, tinged brown, long-aristate, imbricate. Flowers pedicellate, pedicels 1.1–2.3 cm long; sepals ca. 1.4 × 0.3 cm, coriaceous; petals 1.4–1.6 × 0.4 cm, coriaceous, connate into a tube, tube hyaline-membranous, trilobed, lobes obovate; filaments ca. 1.3 cm long, tomentose; anthers 2.0–7.0 mm long, yellow, lanceolate, 4-locular, sulcate, with apical appendages; ovaries 0.3–0.5 cm long, rounded, apocarpous, carpels 3, unilocular; styles ca. 1.2 mm long, central, apically recurved, bases whitish; stigmas ca. 2 mm, apical. Capsules ca. 5.0 × 2.0 mm, ellipsoid, yellowish. Seeds 3.0–5.0 mm, ellipsoid, longitudinally and transversely rugose.

Material selected : BRAZIL. PARÁ: Breves, 5/XI/1958, fr., T. N.Guedes 662 (IAN). Maracanã, 6/IV/1980, fr., G. Davidse *et al*. 17966 (MG). Tucuruí, 18/III/1980, fr., T. Plowman *et al*. 9708 (MG). See S1 in supplementary material.

Rapatea paludosa is the type species of the genus and was the first to be described for the family. The species is mainly distinguished by its bivalvate spathes and mucilage at the base of the leaves, characteristics easily identified in the material studied.

Rapatea paludosa is common throughout Pará and is well represented in Brazilian herbaria. The morphology of the specimens of *R. paludosa* analyzed was highly variable, mainly in relation to the size of the leaf blades (50.0–102.0 cm long). In addition, the spathes usually envelop all of the spikelets but in some specimens from Mosqueiro Island (in the district of Belém) the spikelets pass beyond the spathes (laterally).

In general, the description in this paper is in accordance with the description proposed by Aublet (1775). However, Aublet described the scapes of *R. paludosa* as glabrous, and in the samples analyzed in the present study the scapes were sparsely pubescent.

This species is widely distributed in the Neotropics. In Brazil, *R. paludosa* occurs in the states of Acre, Amapá, Amazonas, Bahia, Mato Grosso, Pará, Rondônia and Tocantins, in *campinarana*, *terra firme* forest, várzea *forest* and rain forest, where it grows on the margins of rivers and waterways, and inundated areas. This species also occurs in Panama, Colombia, Venezuela, Suriname, French Guiana and Peru, where it grows in inundated areas. *Rapatea paludosa* flowers from January to October.

3.3. *Rapatea pycnocephala* Seub., Fl. bras., 3(1): 128. 1847.

Fig. 5

Herbs 80.0–110.0 cm tall. Leaves with sheaths ca. 20.0 × 1.0 cm; leaf blades 57.0–98.0 × 1.7–2.7 cm, narrow-lanceolate, both sides (pseudofaces) not rugose, lateral veins prominent on one side and inconspicuous on other, apices attenuate, bases attenuate, symmetrical; petioles absent. Inflorescences 2.0–3.0 × 2.0 cm, 2.0–3.0 cm diam., glomerulate, enveloping the base of the spathe at maturity, axis plane, ca. 5.0 cm long; scapes 25.0–30.0 × 1.5–1.2 cm, flattened, glabrous, sulcate; spathes 11.0–15.0 × 1.5–4.4 cm, lanceolate, distinct from the central axis of the inflorescence, valves erect, caducous, apices attenuate, bases subcordate; spikelets ca. 20 per inflorescence, sessile; bracteoles 24–27 per spikelet, heterogeneous, lanceolate, veins present on both faces, basal 3.0–5.0 mm long, apical 7.0–8.0 mm long, apiculate, with clear brown spots, imbricate. Flowers sessile; sepals 3.8–9.0 mm long, coriaceous; other flower parts not seen. Capsules ca. 3 × 2 mm, oblong. Seeds ca. 3.0 × 3.0 mm, ellipsoid to subglobose, longitudinally rugose (inconspicuous).

Complementary description: Flowers with whitish corolla, lobes obovate; anthers lanceolate; ovaries rounded; styles trigonous, apically swollen; stigmas apically papillose (Seubert 1847; Körnicke 1873). Data about the filaments was not found in the literature.

Material examined: BRAZIL. PARÁ: Altamira, 16/XII/2010, fr., D. Amaral 392 (MG). Serra do Cachimbo, 6/IX/1997, fr., G. T. Prance *et al*. 24960 (MG). Serra do Cachimbo, 15/X/1906, J. M. Pires *et al*. 6307 (IAN). See S1 in supplementary material.

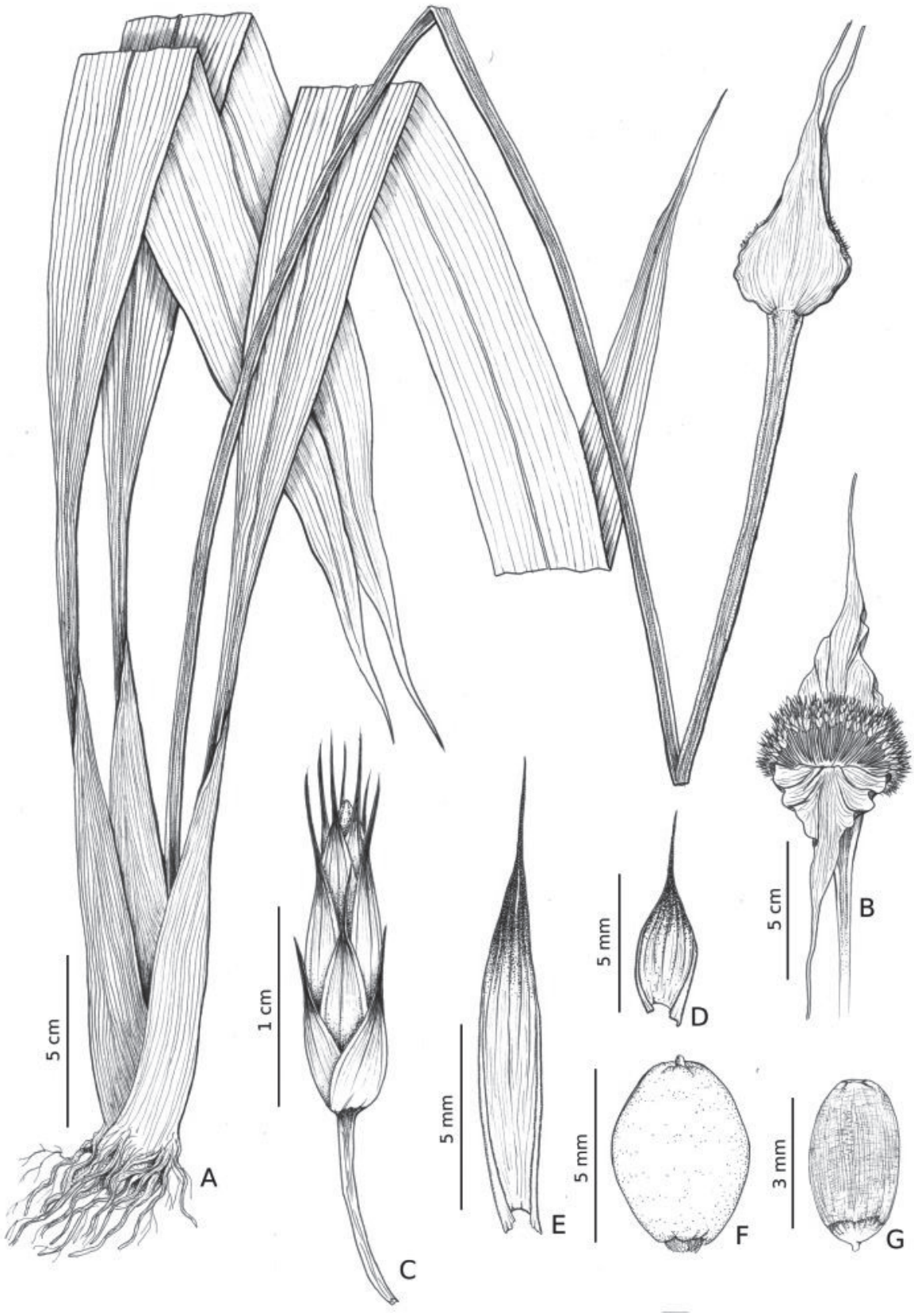

Figure 4. *Rapatea paludosa* (*G. Davidse et al. 17966* - MG). A. Habit. B. Inflorescence (highlighted). C. Spikelet. D. Bracteole basal (adaxial face). E. Bracteole apical (adaxial face). F. Fruit. G. Seed. Illustrations: Pedro Machado (2015).

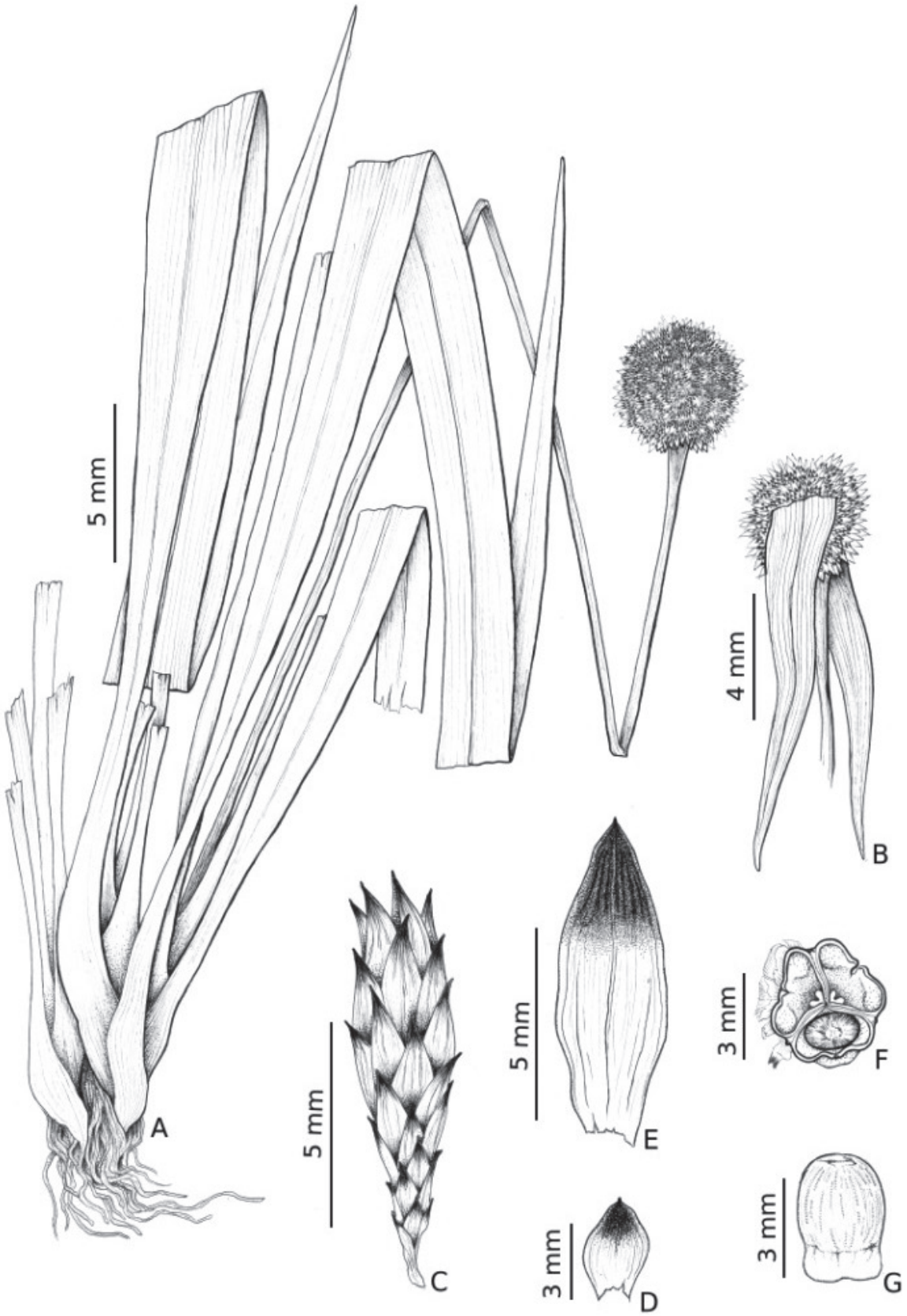

Figure 5. *Rapatea pycnocephala* (A-C-D-E-F-G *G.T. Prance et al* 24960, B D. *Amaral 392* - MG). A. Habit. B. Young inflorescence with spathe (highlighted). C. Spikelet. D. Bracteole basal (abaxial face). E. Bracteole apical (abaxial face). F. Open fruit. G. Seed. Illustrations: Pedro Machado (2015).

Characters that can be used to identify *Rapatea pycnocephala* are glomerulate inflorescences and bracteoles with brown spots. *R. pycnocephala* can be distinguished from other species of the genus by its non-persistent spathes, which are lost at in the maturity. In addition, this species also has very characteristic leaf blades compared to the other species; *R. pycnocephala* has narrower leaf blades that are rarely more than 2.7 cm wide.

This species is endemic to Brazil and occurs in the states of Bahia, Goiás, Maranhão, Mato Grosso, Mato Grosso do Sul, Pará, Piauí, Rondônia and Tocantins, as well as the Distrito Federal, where it is found in cerrado, at the headwaters of rivers and in inundated areas. *Rapatea pycnocephala* flowers from August to December.

3.4. *Rapatea ulei* Pilg., Notizbl. Bot. Gart. Berlin-Dahlem 6: 119. 1914.
Fig. 6

Herbs 119.0–125.0 cm tall. Leaves with sheaths 18.0–24.0 × 2.0–2.2 cm; leaf blades 74.0–99.0 × 9.0–10.0 cm, one side (pseudoface) green and the other side glaucous, wide-lanceolate, both sides prominently rugose, lateral nerves inconspicuous, apices attenuate, bases subcordate, asymmetrical; petioles absent. Inflorescences capituliform, axis convex, ca. 1.7 cm long; scapes 25.0–30.0 × 1.5–12.0 cm, flattened, glabrous, sulcate; spathes 8.0–13.0 × 3.0–5.0 cm, lanceolate, distinct from the central axis of the inflorescence, valves ascending, persistent, apices attenuate, bases cordate; spikelets ca. 30 per inflorescence, pedunculate, peduncles ca. 0.5 cm long; bracteoles 10–11 per spikelet, homogeneous, ca. 1.0 cm long, lanceolate, veins on both surfaces, apices brown, acute to apiculate, imbricate. Flowers sessile; sepals ca. 1.0 × 0.3 cm, coriaceous; other flower parts not seen. Capsules ca. 5.0 × 3.0 mm, ovoid. Seeds ca. 4.0 × 1.0 mm, ellipsoid to oblong, longitudinally rugose (inconspicuous).

Complementary description: Flowers with petals 0.6–0.7 mm long, apices mucronate, veined, base villous; filaments tomentose, ca. 1.0 cm long; anthers ca. 4.5 mm long, linear, apical appendages ca. 0.2 mm long; ovaries rounded with monospermic locules; styles ca. 1.0 cm long, apically contorted (Pilger 1914).

Material examined: BRAZIL. PARÁ: Oriximiná, 31/VIII/1980, fr., C. A. C. Ferreira 1975 (INPA, NY). Oriximiná, 16/I/2010, fr., J. B. F. de Silva 3388 (MG). See S1 in supplementary material.

Rapatea ulei resembles *R. paludosa* by the capituliform inflorescence and the bivalvate, persistent spathes, but differs by its leaf blades with deeply cordate, asymmetrical leaf bases, rugose surfaces, prominent lateral veins on one side and spikelets with homogeneous bracteoles. *Rapatea paludosa* has leaf blades with attenuate, symmetrical bases, inconspicuously rugose surfaces, prominent lateral veins and spikelets with heterogeneous bracteoles.

In Brazil, this species occurs in the states of Amapá, Amazonas, Mato Grosso and Pará, where it grows in streams near shady areas and in swamp forest along waterways. *Rapatea ulei* flowers from January to August.

4. *Saxofridericia* R.H. Schomb., Rapatea 13. 1845.

Leaves rosulate or distichous, sheathes 1.5–7.0 cm long, invaginated, sometimes spongy; leaf blades lanceolate, margins spinescent or entire; petioles present or absent. Inflorescences 1.0–8.0 cm long, globose or subglobose, young inflorescences completely enveloped by membranaceous involucrum formed by a bivalvate spathe, margins entirely connate (area of fusion inconspicuous); scapes cylindrical, flattened-trigonous or flattened; spathes bivalvate, symmetrical, margins connate, forming an involucrum over the immature flowers, valves caducous; spikelets 50.0–100.0 per inflorescence, sessile or shortly pedicellate; bracteoles numerous, coriaceous or chartaceous, lanceolate or navicular, homogeneous or heterogeneous, larger or smaller than sepals, sometimes imbricate. Flowers sessile, congested; sepals acuminate or navicular, coriaceous. Capsules obovoid to oblong or ellipsoid to trigonous, trilocular. Seeds 2 or 3, compressed or reniform, transversally striate and sulcate.

Saxofridericia is represented by five species in Brazil (BFG 2015). Only *S. aculeata* occurs in the state of Pará. Maguire (1958) defined *Saxofrideiricia* mainly by the presence of rugose, reniform, transversely striate seeds and differentiated its species by the leaf blade width and margin (spinescent or entire).

4.1. *Saxofridericia aculeata* Körn., Linnaea 37: 457. 1872.
Fig. 7

Herbs 96.0–114.0 cm tall. Leaves rosulate, sheaths 24.0–39.0 × 1.9–3.0 cm, not spongy, coriaceous, margins membranaceous, bases membranaceous; leaf blades ca. 72.0–76 × 5.0–8.0 cm, narrow-lanceolate, sides (pseudofaces) with prominent rugosity and central veins, lateral veins not conspicuous, margins spinescent, apices attenuate, bases attenuate; petioles ca. 21.0 × 7.0 cm, margins spinescent. Inflorescences 3.0–5.0 × 2.0–3.5 cm, glomerulate; scapes 34.0–51.0 cm long, flattened, glabrous, canaliculate; spathes 9.0–13.0 × 1.0–3.0 cm, navicular, membranaceous, distinct from the central axis of the inflorescence, valves ascending, apices attenuate, bases subcordate; spikelets ca. 85 per inflorescence, shortly pedunculate, peduncles, ca. 0.2 cm long; bracteoles 50–55 per spikelet, coriaceous, navicular, homogeneous, ca. 0.5–0.7 × 0.1 mm, brown, smaller than sepals, apices brown, acuminate, not imbricate. Flowers with sepals ca. 1.0–1.2 × 0.2 cm, navicular, apices apiculate, other flower parts not seen. Capsules ca. 3.0–5.0 × 5.0 cm, ellipsoid to trigonous. Seeds 2 per fruit, ca. 5.0 × 2.0 mm, reniform, transversely reticulate and sulcate.

Complementary description: Flower petals 1.3–1.5 × 0.4–0.6 cm; anthers ca. 0.5 cm long, oblong, papillose, rugose, apices acuminate, maculate; ovaries rounded; styles ca. 1.1 cm long, the same size as anthers, triangular,

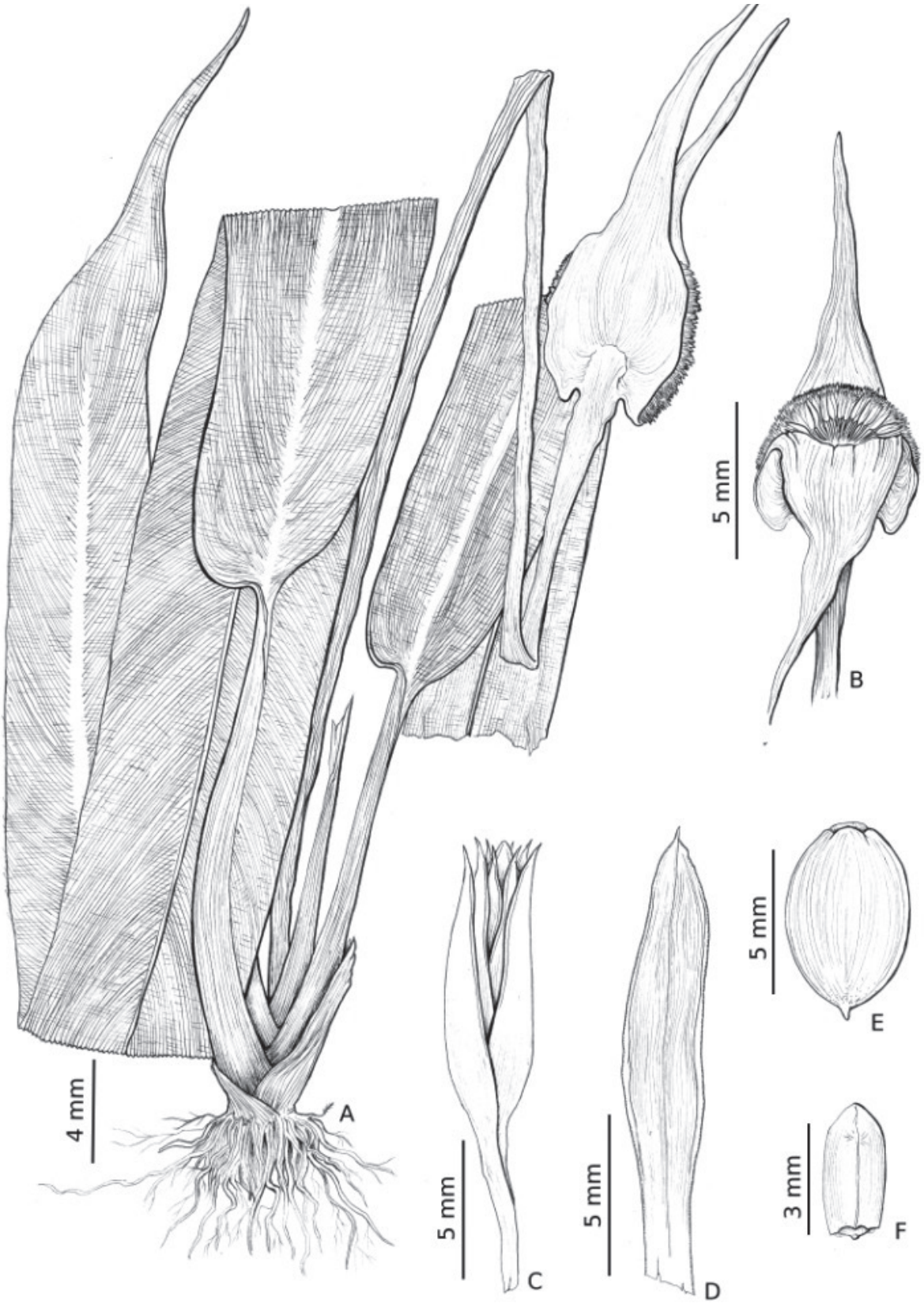

Figure 6. *Rapatea ulei* (*J.B.F de Silva 3388* - MG). A. Habit. B. Inflorescence (highlighted). C. Spikelet. D. Bracteole (adaxial face). E. Fruit. F. Seed. Illustrations: Pedro Machado (2015). Illustrations: Pedro Machado (2015).

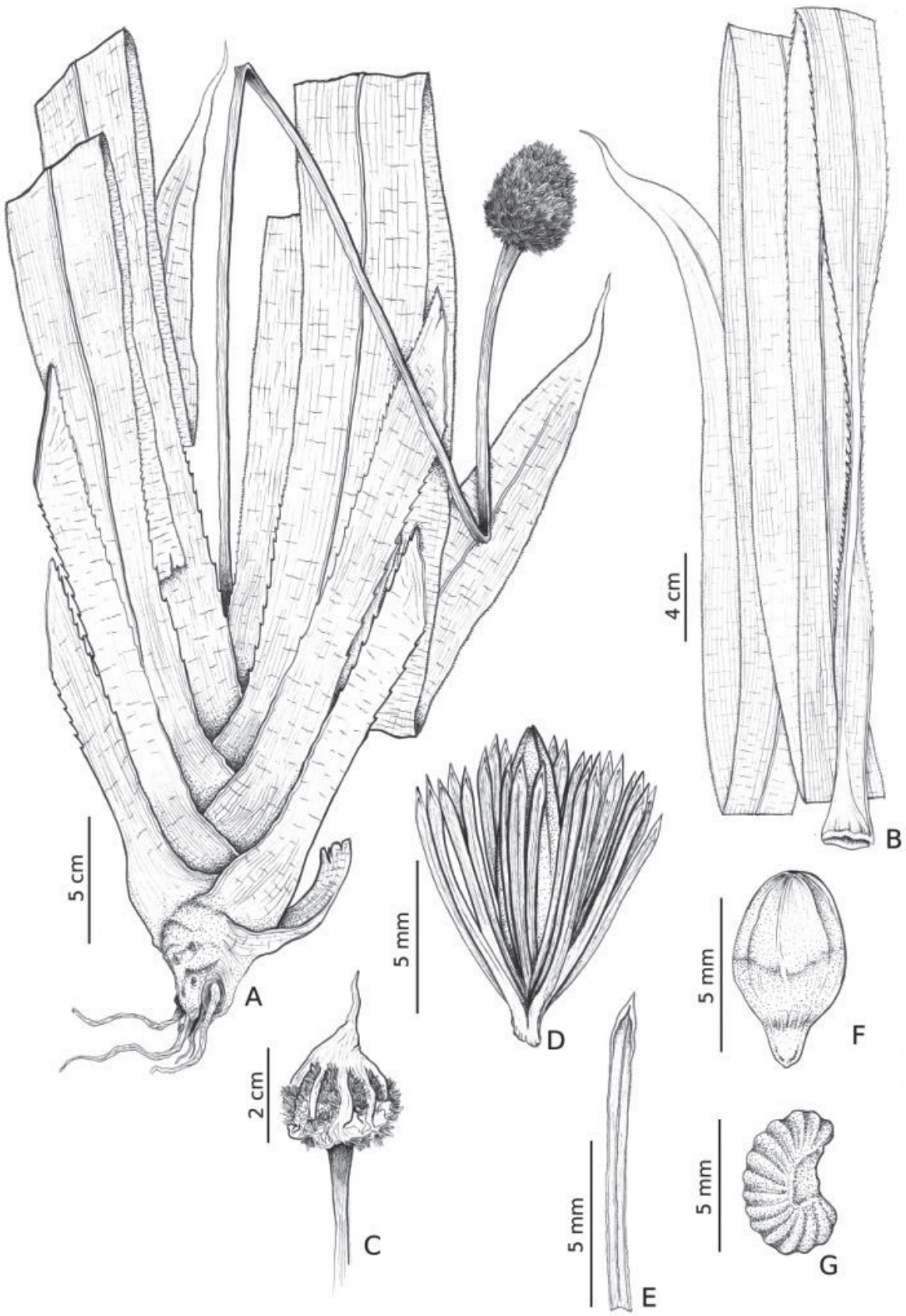

Figure 7. *Saxofridericia aculeata* (A-C-D-E-G *C. A. Cid.* & *J. Ramos 1069*- MG; B *P. Calvacante* & *M. Silva 2886* - MG). A. Habit. B. Highlight for the petiole. C. Young inflorescence (with spathe). D. Spikelet. E. Bracteole (abaxial face). F. Fruit. G. Seed. Illustrations: Pedro Machado (2015).

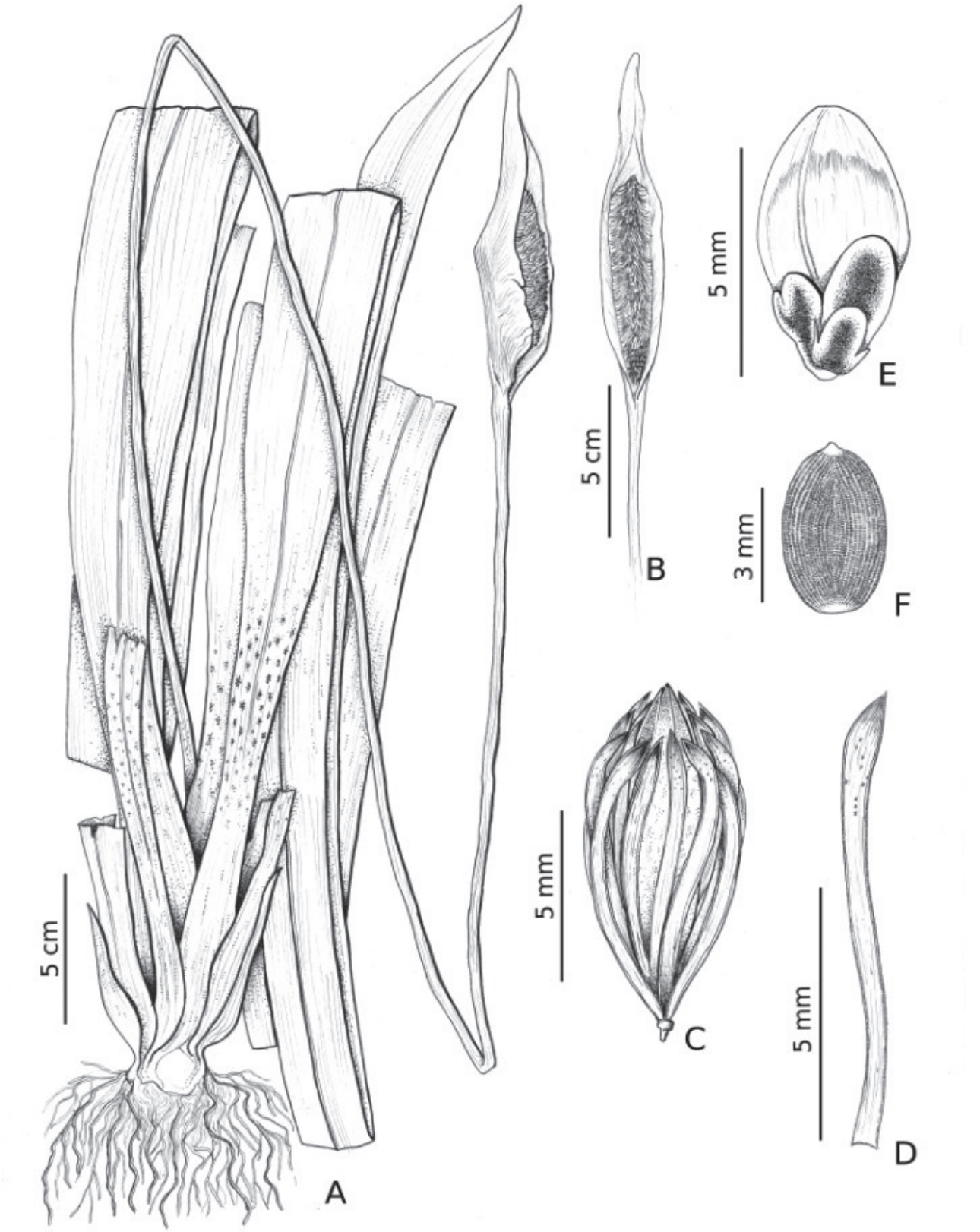

Figure 8. *Spathanthus unilateralis* (A-C-D-E-F *A. Ducke sn*- MG; B *T. Praia 13* - MG). A. Habit. B. Front view of inflorescence. C. Spikelet. D. Bracteole (abaxial face). E. Fruit. F. Seed. Illustrations: Pedro Machado (2015).

contorted at base; stigmas papillose (Körnicke 1873). There is no information about the filaments in the literature.

Material selected: BRAZIL. PARÁ: Altamira, 11/VII/1971, fr., P. Cavalcante & M. Silva 2886 (INPA). Oriximiná, 19/06/1980, fr., C. A. Cid & J. Ramos 1069 (INPA). Oriximiná, 09/VIII/1989, fr., C. A. Ferreira *et al*. 7620 (MG). See S1 in supplementary material.

Saxofridericia aculeata is mainly characterized by having spinescent leaf margins, which markedly distinguishes it from the other species in the family. This character was easily seen in all of the material studied.

In Brazil, this species occurs only in the states of Amapá, Amazonas and Pará, in *campinarana*, *igapó* forest, *terra firme* forest, *várzea* forest and rain forest, where it grows on the shady margins of waterways and river mouths. The species also occurs in Colombia, French Guiana and Suriname, where it grows in wetland environments. *Saxofridericia aculeata* flowers from May to October.

5. *Spathanthus* Desv., Ann. Sci. Nat. (Paris) 13: 45 1828.

Leaves 5.0–180.0 × 1.5–3.0 cm, distichous; leaf blades linear, glabrous, margins unarmed; petioles absent. Inflorescences secund, adnate to spathe, young inflorescences enveloped by membranaceous involucrum formed by entirely connate spathes absent; scapes compressed, glabrous or sparsely pubescent; spathes univalvate, navicular, acuminate, valves erect, persistent, light pink and lilac, apices acute, slightly pungent, bases attenuate; spikelets numerous, pedunculate; bracteoles navicular or obtuse, apices pungent or acute, homogeneous, not imbricate. Flowers sessile; sepals navicular, papyraceous; petals yellow, lanceolate, ephemeral; filaments short; anthers oblong-linear, 4-locular, poricidal; ovaries apocarpous; styles basal; stigmas apical, small or absent. Capsules ellipsoid, sessile. Seeds 3 per fruit, oblong-elliptical, strongly striate.

Spathanthus is represented in Brazil by two species (BFG 2015). Only *S. unilateralis* occurs in Pará. The genus is characterized mainly by the presence of a univalvate spathe (Maguire 1958; Stevenson *et al*. 1989), which is peculiar and was easily seen in the analyzed material.

5.1. *Spathanthus unilateralis* (Rudge) Desv., Ann. Sci. Nat. (Paris) 13: 45, tb 4, f. 1. 1828.

Fig. 8

Herbs 100.0–180.0 cm long. Leaves with sheaths 24.5–45 × 2.3–3.0 cm, coriaceous, marcescent, margins and bases membranaceous; leaf blades 74.0–134.0 × 5.0–8.0 cm, sides (pesudofaces) with prominent central and lateral veins, apices attenuate, bases acute, symmetrical, dark spots present on the inferior parts of the leaves. Inflorescences 5.5–7.7 cm; scapes 40.0–54.0 cm long; spathes 7.0–14.0 × 3.0–5.0 cm, auricles lilac, turned inward, adnate to the axis of the inflorescence, valves light pink and lilac, apices acute, slightly pungent, bases attenuate; spikelets ca. 70 per inflorescence, peduncles ca. 0.5 cm long; bracteoles 25–30 per spikelet, ca. 1.0 × 0.2 cm, navicular, congested, connate to spathe, apices pungent. Flowers with sepals ca. 1.0 × 0.3 cm, triveined, veins prominent, apices mucronate; petals 0.9–1.0 × 0.3 cm; filaments ca. 0.3 cm long; anthers ca. 4.0 mm long, papillose, sulcate; ovaries 0.3–0.4 cm long, ovule 1; styles 0.8–1.0 cm, apices yellowish; stigmas not seen. Capsules 3.0–5.0× 3.0 mm. Seeds 3.0–4.0 × 2.0 mm.

Material selected: BRAZIL. PARÁ: Almerim, 01/VI/2010, fr., E. S. Leal & R. C. Forzza 191 (RB). Benevides, 23/IV/2015, fr., fl., T. S. Praia 13 (MG). Gurupá, 5/IX/1919, A. Ducke s.n. (RB). See S1 in supplementary material.

Spathanthus unilateralis is characterized by univalvate spathes and young leaves with dark visible spots (mostly on inferior parts). The latter characteristic is not mentioned in any description related to *S. unilateralis*, but was observed on specimens during the present study.

In Brazil, this species only occurs in the states of Amapá, Amazonas and Pará, in *campinarana*, *várzea* fields, *igapó* forest and *terra firme* forest, where it grows in wetlands and affluents of waterways, rocky soils in humid areas, and around waterfalls. The species also occurs in French Guiana, Venezuela and Suriname, in swamp forests. *Spathanthus unilaterais* flowers from June to October.

Acknowledgements

The authors thank CNPq for awarding the scholarship to the first author, the curators and staff of the herbaria consulted for the specimens loaned to Museu Paraense Emilio Goeldi, and the Universidade Rural do Pará for making their infrastructure available; to reviewers for comments to improve the manuscript.

References

Aublet JBCF. 1775. Histoire des plantes de la Guiane Françoise. London/Paris, Pierre-François Didot.

Berry PE. 2004. Rapateaceae. In: Berry PE, Yatskievych K, Holst BK. (eds.) Flora of the Venezuelan Guayana- Poaceae-Rubiaceae. St Louis, Missouri Botanical Garden Press. p. 413-472.

BFG – The Brazil Flora Group. 2015. Growing knowledge: an overview of Seed Plant diversity in Brazil. Rodriguésia 66: 1085-1113.

Ducke WA. 1915. Plantes nouvelles ou peu connues de la région amazonienne. Archivos do Jardim Botânico do Rio de Janeiro 1: 10.

Dumortier BCJ. 1829. Analyse des Familles des Plantes. Tournay: Imprimière de J. Casterman, Ainé: 62.

Forzza RC, Costa MAS. 2005. Flora da Reserva Ducke, Amazonas, Brasil: Rapateaceae. Rodriguésia 56: 177-181.

Givnish TJ, Evans TM, Zihra ML, *et al*. 2000. Molecular evolution, adaptive radiation, and geographic diversification in the amphiatlantic family Rapateaceae: evidence from ndhF sequences and morphology. Evolution 54: 1915-1937.

Givnish TJ, Millam KC, Evans TM, *et al*. 2004. Ancient vicariance or recent long–distance dispersal? Inferences about phylogeny and South American-African disjunctions in Rapateaceae and Bromeliaceae based on ndhF sequence data. International Journal of Plant Sciences 165: S35-S54.

IBGE – Instituto Brasileiro de Geografia e Estatística. 1990. Divisão regional do Brasil em mesorregiões e microrregiões geográficas. Brasília, IBGE.
Ithaka. 2015. JSTOR Global Plants. http://plants.jstor.org/ 6 May 2015.
Körnicke FA. 1873. Monographie der Rapateaceae. Linnaea 37: 418.
Maguire B. 1958. Rapateaceae. The botany of the Guayana Highland. Part III. Memoirs of the New York Botanical Garden, v.10: 19.
Maguire B.1962. Epidryos. Taxon, v. 11, n.2: 57.
Maguire B. 1965. Rapateaceae. The botany of the Guayana Highland Part VI. Memoirs of the New York Botanical Garden, v.12: 69.
Maguire B. 1979. Additions to the Rapateaceae. Acta Amazonica, n.9: 267.
Monteiro RF, 2016. Rapateaceae in Lista de Espécies da Flora do Brasil. Rio de Janeiro, Jardim Botânico do Rio de Janeiro. http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB32493. 18 Jan. 2016.
Pilger R. 1914. Rapateaceae. Die Natürlichen Pflanzenfamilien: 56.
Pires JM, Prance GT. 1985. The vegetation types of the Brazilian Amazon. In: Prance GT, Lovejoy TE. (eds.) Key Environments: Amazonia. Oxford, Pergamon Press. p. 109-145.
Poeppig EF, Endlicher SFL. 1838. Nova Genera ac Species Plantarum. Sumptibos Friderich Hofmeister 2: 51: 168.
Rodrigues RS, Flores AS. 2010. Novas ocorrências de Rapateaceae para o Brasil. Acta Botanica Brasilica 24: 1096-1099.
Romanini RP, Wanderley MGL. 2012. Rapateaceae. In: Wanderley MGL, Martins SE, Romanini RP, *et al*., Flora fanerogâmica do Estado de São Paulo. Vol. 7. São Paulo, Instituto de Botânica. p. 321-327.
Schomburgk RH. 1845. Die Rapatea Friderici Angusti. 418.
Schultze GK. 1934. Uber einige Rapateacea aeus dem Mattogrosso Gebiet. Notizblatt des Botanischen Gartens und Museums zu Berlin-Dahlem 12: 230.
Seubert MA. 1847. Rapateaceae. Flora Brasiliensis 3: 125-132.
Stevenson DW, Colella M, Boom B. 1989. Rapateaceae. In: Kubitzki K. (ed.) The families and genera of vascular plants - IV Monocotyledons. Berlin, Springer. p. 415-424.
TROPICOS. ORG. Missouri Botanical Garden. http://www.tropicos.org. 6 May 2015.
WCSP – World Checklist of Selected Plant Families. 2015. Kew, The Royal Botanic http://apps.kew.org/wcsp/home.do 01 Jan. 2015.