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Artículo original

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Novelties in *Rapatea* (Rapateaceae) from Colombia

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Abstract

Rapatea isanae, from the upper Isana [Içana] river, Guianía Department, Colombia, is described and illustrated, and its morphological relationships with allied species are discussed. This taxon is remarkable for *Rapatea* in its small stature (15–30 cm tall) and leaves, and it is only the second species with white petals in a genus that otherwise has only yellow petals. It is most closely *R. spruceana*, with the base of the leaf blade gradually tapering from the intergrading into the petiole, and the bractlet of the spikelet and sepal shape. However, this new species differs from *R. spruceana* in its shorter size, sparse verrucose on the lower surface, the length of the attenuate portion of the involucral bracts, and the shape and color of the petals. It also has similarities to *R. longipes* and *R. modesta* in its ventricose sheath-leaf, inflorescence shape, and bractlets equal in length. A previously described species from Colombia is restablished (i.e., *R. modesta*), and one variety is elevated to the rank of species (i.e., *R. paludosa* var. *sessiliflora* to *R. sessiliflora*). An updated key to the all twenty five species of *Rapatea*, and an abstract in Kuripaco are also provided. © 2016. Acad. Colomb. Cienc. Ex. Fis. Nat.

Key words: *Rapatea;* sect. *Longipes;* Colombia; Isana [Içana] river; upper Rio Negro; Rapateaceae.

Novedades en *Rapatea* (Rapateaceae) para Colombia

Resumen

Rapatea isanae, una nueva especie del alto río Isana, Departamento del Guianía, Colombia, es descrita, ilustrada, y sus relaciones morfológicas con las especies afines son discutidas. Esta especie es notable en el género *Rapatea* por el tamaño de las plantas (entre 15 y 30 cm de altura), las hojas muy pequeñas, y los pétalos blancos, siendo la segunda especie con este carácter en un género en el cual predominan los pétalos amarillos. Por la base de las hojas transformándose gradualmente en un pecíolo, la morfología de las bractéolas de las espiguillas y los sépalos, *R. isanae* está relacionada con *R. spruceana*. Por las vainas basales de las hojas ventricosas, la forma convexa de las inflorescencias y las bractéolas del mismo tamaño con *R. longipes* y *R. modesta*, respectivamente. Sin embargo, esta nueva especie difiere de *R. spruceana* por ser plantas muy pequeñas, el envés esparcidamente verrugoso, el largo de la porción atenuada de las brácteas involúcrales y la forma y color de los pétalos. Se restablece una especie previamente descrita para Colombia (i.e., *R. modesta*), y una variedad es elevada al rango de especie (i.e., *R. paludosa* var. *sessiliflora* a *R. sessiliflora*). Adicionalmente se presenta una clave actualizada de las 25 especies aceptadas de *Rapatea* y un resumen en Kuripaco. © 2016. Acad. Colomb. Cienc. Ex. Fis. Nat.

Palabras clave: *Rapatea;* sect. *Longipes;* Río Isana [Içana]; Alto Río Negro; Colombia; Rapateaceae.

Abstract in Kuripaco. Supplementary information 1, http://www.raccefyn.co/index.php/raccefyn/article/downloadSuppFile/403/1749

Introduction

Rapatea Aubl. is the most widely distributed genus in the Rapateaceae (**Boom**, 1994). It currently comprises about 25 species of terrestrial herbs from 15 cm to 2 m tall, occurring in Panama, Colombia, Venezuela, Trinidad, Guyana, Suriname, French Guiana, Ecuador, Peru, Brazil and Bolivia (**Monteiro**, 2011). Species of *Rapatea* occur along streams, in the edges and shady understory of flooded (**Rangel-Ch.**, 2008) and terra firme forests, riparian granitic outcrops (**Giraldo-Cañas**, 2008), and in the oligotrophic, seasonal flooded white-sand savannas associated with black-water rivers (**Berry**, 2004; **Huber,** 2005; 2006). Like the rest of the family, most of the species of *Rapatea* have radiated successfully in the Amazon basin and on the Guiana Shield (**Ducke**, 1938; **Berry *et al.***, 1995; **Givnish *et al.***, 2000, 2004; **Bouchenak-Khelladi *et al.*,** 2014; **Fernández-L. *et al.*,** 2016). Few species are found outside of this region, such as *R. paludosa* Aubl., the most widespread species of

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the genus (from Panama, Trinidad, and Venezuela to Bahia state in Brazil). Furthemore, *Rapatea pycnocephala* Seub. is known in central and southeastern Brazil (Mato Grosso do Sul: Xavantina; Bahia), and *R. spectabilis* Pilg. has been collected south to southern in Bolivia (Beni); *R. elongata* G. K. Schultze is common in northeastern of Colombia, an area that harbors some of the wettest forests in the world (**Arellano-Peña & Rangel-Ch.**, 2004). This region is known as the biogeographical Chocó or "Chocó biogeográfico", and it is a broad strip of land with the highest biodiversity found between the Pacific Ocean and the slopes of the Western Cordillera (**Cuatrecasas,** 1989; **Rangel-Ch.,** 2004). *Rapatea* is rare in the Andes, however two populations of *R. muaju* García-Barr. & L. E. Mora had been detected in Ecuador from collections made in the last 25 years in the foothills ("Piedemonte Andino"), the lower mountains (380–930 m) of Morona-Santiago Department, (see: http://www.tropicos.org/Name/27200122?tab=specimens), and in "Cerro Kaputna" in the Cordillera del Cóndor (**Neill, *et al.,*** 2007). This region forms part of the "sub-Andean cordillera" made up principally of Mesozoic and early Tertiary sediments of sandstones and limestones (**Rodríguez-R., *et al.,*** 2013) that form the border between Ecuador and Peru. The vegetation of these Cordillera have a phytogeographical connection with the Guayana Shield in northeastern South America (**Neill,** 2005). As a consequence, an important number of plant genera once thought to be endemic to the sandstone mountains (Tepuis) of the Guayana region have been found to occur disjunctly on the sandstone portions of the Andean cordilleras, but not elsewhere in the Andean region (**Berry & Riina**, 2005; **Aymard & Campbell**, 2008).

Rapatea is distinguished from other genera in the family by its laterally compressed inflorescences, which are subtended by two conspicuous involucral bracts that contain a capitate or elongate assemblage of flowers (**Stevenson, *et al.,*** 1998; **Stevenson**, 2004). The anthers are tipped with a cochleariform appendage (**Oriani & Scatena**, 2013), and the carpels are uniovulate with basal placentation, with seeds that are oblong and exappendiculate, with longitudinal striations. A revision of the genus was published by **Maguire** (1965), who recognized 18 species and placed them in three sections (*Elongata, Longipes,* and *Paludosa*). Maguire employed three characters to separate the species: the base of leaf blades, the length of the bractlets of the spikelets, and the shape of the inflorescence receptacle. Since then, four new species and two varieties have been described (**Maguire**, 1979; **Steyermark**, 1988, **Steyermark, *et al.***, 1989; **Boom**, 1994). The genus has also been treated for "Flora de Venezuela" (**Maguire**, 1982), Flora of Ecuador (**Berry**, 1999), Flora of the Venezuelan Guayana (**Berry**, 2004), the checklist of the plants of the Guiana Shield (**Berry**, 2007), and lately in the "Catálogo de Plantas y Líquenes de Colombia" (**Berry**, 2016).

This new species increases to 12 the number of *Rapatea* species known from Colombia, and 25 for the genus. Five of these species are restricted to the Río Negro basin in the Amazonian region of Brazil, Colombia and Venezuela (*R. angustifolia* Spruce ex Körn., *R. circasiana* García-Barr. & L. E. Mora, *R. isanae* Aymard & Arellano-Peña, *R. longipes* Spruce ex Körn., and *R. spruceana* Körn.). This region harbors an array of plant families species that tolerate the nutrient-poor soils habitats derived by sandstone substrates such as the white sand savannas surrounded by Amazonian Caatinga ("Campinarana florestada"), as well as open areas like the Bana ("Campinas" in Brazil) vegetation, most often found near black-water rivers (**Huber,** 1988**; Kubitzki,** 1989; 1990; **Berry & Riina,** 2005).

Taxonomy. *Rapatea isanae* Aymard & Arellano-Peña, *sp. nov.* (Figures 1-4).

Type: COLOMBIA. Guianía: Panapaná, Corregimiento de Venado, alto río Isana, alrededores de la Comunidad Punta Tigre, 1° 4´ 25.5048´´ N; 69° 43´ 58.0296´´ W, 185 m, 7 de

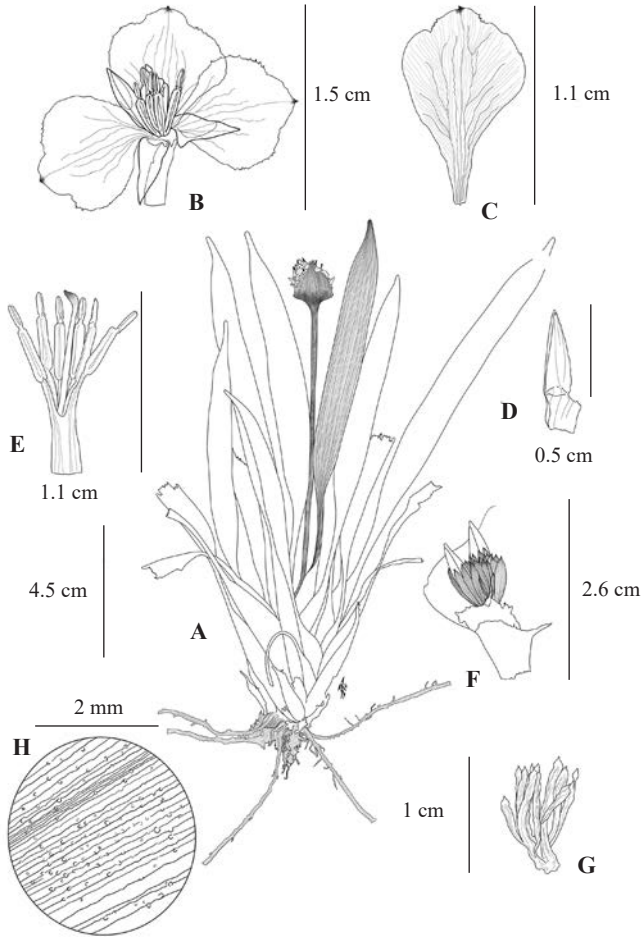

Figure 1. *Rapatea isanae*. **A.** Habit **B.** Flower showing sepals, petals and stamens. **C.** Detail of a petal. **D.** Detail of a sepal. **E.** Detail of staminal tube showing stamens surrounding the style. **F.** Detail of spikelet showing the bracteoles. **G.** Detail bracteoles without spikelet. **H.** Detail of lower surface showing the verrucosities. A and H drawn from *Castro, et al. 18324* (COL), B, C, D, E, F and G drawn from material preserved in 70% alcohol solution by G. Aymard. Drawing by Henry Arellano-Peña.

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Figure 2. *Rapatea isanae.* Habitat (Castro-Lima *et al.* 18324 COL). Photograph by Gerardo A. Aymard C. taken at 0600 AM, 8 May 2014.

Figure 3. *Rapatea isanae.* Close-up of the inflorescences showing the petals (Castro-Lima *et al.* 18324 COL). Photograph by Gerardo A. Aymard C. taken 11 AM, 8 May 2014.

Mayo 2014, *F. Castro-Lima, G. Aymard C., V. Minorta-C., H. Arellano-P., L. Niño, A. Lozano, M. González & C. Villegas 18324* (holotype: COL; isotype: COAH).

Diagnosis: *Rapatea isanae* differs from the morphologically most similar species *R. spruceana* Spruce ex Körn. in its shorter stature (15–30 cm tall), leaf of the lamina is shorter (8–13 cm long), the lower surface of the leaf sparse verrucose, the involucral bracts covered by shorter glandular trichomes in the basal portion outside, the attenuate portion 1–5 mm long, spikelets shortly pedicellate, bractlets not ciliate at the margins, petals white, broadly obovate, and the apical appendage of anthers brown.

Herb acaulescent, perennial, erect, 15–30 cm tall. **Leaves** 3 to 15 per plant, leaf sheaths reddish, glabrous, conduplicate, equitant and distichous, subcoriaceous to chartaceous, elongate, with about 50 distinct nerves, 5–9 cm long x 0.8–10 cm wide; base of leaf blades gradually passing into the petiole, petioles slender, 1.5–10 cm long, glabrous, narrowled toward the apex; ***leaf blades*** subcoriaceous, lanceolate, 5–13 cm long x 1–1.3 cm wide, glabrous on both sides, sparsely verrucose along the veins on the lower surface, with 12–15 secondary veins, the base attenuate, the apex long-acuminate, acumen ca. 1 cm long. **Inflorescence** 1–3 per plant, peduncle 10–15 cm long, 1–1.5 mm thick, glabrous, canaliculate, somewhat broadened and medially compressed at the summit below the head, head compressed, broadly ovate, subtended by 2 involucral bracts red ca. 1.5 x ca. 1.5 cm, coriaceous, covered by short glandular trichomes on the basal portion outside, glabrous inside, multinerved (ca. 100 nerves), receptacle convex, ca. 5 mm x 5 mm, the attenuate apex of the involucral bracts 1–5 mm long, ***spikelets*** 12–15 per inflorescence, pedicels ca. 1 mm long, ***bractlets*** 18–20 per spikelet, linear-oblanceolate, 7–10 mm x ca. 1 mm, 3-nerved, membranaceous, glabrous on both sides, shortly acuminate. **Flower:** ***sepals*** coriaceous, lanceolate-acuminate, 3 or 4-veined, 4–6 mm x ca. 2 mm, glabrous on both sides, bases membranous and basally connate into a tube 4–5 mm long, upper halves free; ***petals*** white, blade widely-obovate, membranous, 8–11 mm x 5–6, shortly apiculate at the apex, margins erose, 7–10-veined, the basal claws ca. 3 mm long, connate for 1–2 mm at the base, glabrous on both sides; ***stamens*** 6, the filaments 1.5–2.4 mm long, inserted near the base of the corolla tube, staminal tube ca. 3.5 mm long, anthers extrorse, white, 3–3.4 mm long with a brownish apical cochleariform linear-oblong appendage ca. 1.5 mm long, attached by a short, sigmoid base; ***ovary*** conical to subcapitate, ca. 2 mm x ca. 2 mm, style equaling the stamens**,** 9–10 mm long, the stigma curved, acute. **Fruits** and ***seeds*** not seen.

Figure 4. *Rapatea isanae.* Plant showing the petiole shorter than the blade, the base of leaf blades gradually into the petiole, and the apex not abruptly narrowed. Photograph by Francisco Castro-Lima C. taken 6 pm, 8 May 2014. Based on *F.* Castro-Lima *et al. 18324* (COL).

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Distribution and habitat. In the edges and in shaded places of oligotrophic, flooded white-sand savannas from the upper Isana [Içana] river, Guianía Department, Colombia, at elevations of 185 m.

Taxonomic notes. Because of the spikelets bractlets of the of equal length and the inflorescence receptacle convex or hemispheric, *Rapatea isanae* belongs to *Rapatea* sect. *Longipes* Maguire (**Maguire**, 1965). By its base of leaf blades gradually passing into the petiole, apex of leaf blades not abruptly narrowed, the petiole shorter than the blade, the attenuate portion of the involucral bracts short (< twice as long as the expanded broader basal portion), and bractlets linear-oblong, it is most similar to *R. spruceana* Körn. from the Río Negro basin in the Amazonian region of Brazil, Colombia and Venezuela (**Berry**, 2004). However, *R. isanae* differs from the latter in its shorter stature 15–30 cm tall (vs. 30–80 cm tall), leaf blades 8–13 cm long, the lower surface sparse verrucose (vs. 15–30 cm, glandular-punctate), peduncles 10–15 cm long (vs. 16–35 cm), involucral bracts covered by shorter glandular trichomes in the basal portion outside, and the attenuate portion 1–5 mm long (vs. glabrous, 10–45 mm long), spikelets shortly pedicellate (vs. sessile), bractlets not ciliate at the margins (vs. ciliate), petals white, widely-obovate (vs. yellow, widely-ovate), and the apical appendage of the anthers brown (vs. purple).

In its leaf sheath shape, the convex inflorescences, and the petal color, *R. isanae* also has affinities with *R. longipes* Spruce ex Körn. and *R. modesta* Maguire, however, it can be distinguished from these species by the characters indicated in Table 1.

Etymology. *Rapatea isanae* is named after the Isana river. This river drains into the Rio Negro; geographically, its basin is nested between the Xié (to the north) and the Vaupés (to the south) river basins. Politically, the upper portion is in Colombia and the lower portion in Brazil (where it is called Içana). The headwaters of the Isana river are considered sacred land for the Kuripaco and Baniwa Indigenous groups, a nation that belongs to the Arawak language family that number about 14.000 people who has lived for centuries in the upper Río Negro area (**Cabrera-Becerra**, 2010). This culture believes that the center of the world ("umbilicus"), where all the human races began, is found in the pristine region of the upper Isana (**Alveiro Calero-Cayopare**, pers. comm., 2016). This ancient heritage clearly demonstrates that forests also provide an array of cultural and spiritual benefits to the people that occupy them. Notwithstanding, these compensations are only recently being explicitly considered as ecosystem services (**Daniel, *et al.*,** 2012).

Phenology. Known to flower in May, but information from other times of the year is lacking.

IUCN Red List category. According the IUCN criteria this species would be ranges in DD (data deficient category). In this grade, more information is required and acknowledges that future research will show that threatened classification is appropriate (**IUCN**, 2016). Currently, *R. isanae* is known from only two collections, but we expect this new species to have a wider distribution in the upper Río Negro basin, an area poorly known botanically (**Aymard & Castro-Lima**, 2015).

Table 1. Comparison of the distinguishing characters of *Rapatea longipes, R. modesta* and *R. isanae*.

Character	*Rapatea longipes*	*Rapatea modesta*	*Rapatea isanae*
Habit; leaf sheaths and petiole	Plants robust , 25–50 cm tall, leaf sheaths elongate, three or more times long than broad; base of leaf blades abruptly widened at the base above the petiole; apex of leaf blade abruptly narrowed; petiole as long as the blade or longer	Plants robust , 25–50 cm tall, leaf sheaths ventricose, 2–3 times broader than long; base of leaf blades abruptly widened at the base above the petiole; apex of leaf blade abruptly narrowed; petiole as long as the blade or longer	Plants slender , 15–30 cm tall; leaf sheaths elongate, 5–6 times long than broader; petiolar region gradually tapered into the base of the blade; apex of leaf blades not abruptly narrowed, petiole shorter than the blade
Leaf blades	Oblong-linear to lanceolate, 3–3.5 cm wide, apex 0.5–1.5 long; lower surface without verrucosites	Oblong to oblong-elliptic; 3–6 cm wide, apex 2–3 cm long; lower surface without verrucosites	Lanceolate, 1–1.3 cm wide, apex ca. 1 cm long; sparsely verrucose at the lower surface
Attenuation of the involucral bracts	5–15 mm long	10–25 mm long	1–5 mm long
Inflorescence	peduncle 12–25(35) cm long; head 1–2 cm broad, involucral bracts glabrous	peduncle 6–20 cm long, head 3–4 cm broad, involucral bracts glabrous	peduncle 10–15 cm long; head ca. 1.5 cm broad, involucral bracts glandular pilose on the outside
Spikelets	Sessile	Sessile	Pedicellate
Sepal lenght	8–10	8–10	4–6
Petals	Yellow, ovate–deltoid, 5–6 mm long	White, or red*, ovate–deltoid, ca. 10 mm long	White, widely–obovate, 8–11 mm

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Additional specimens examined (Paratype):

Colombia. Guianía: Corregimiento de Venado, Comunidad Punta Tigre: same locality and date as the type. *M. González, F. Castro-Lima, G. Aymard C., V. Minorta-C., H. Arellano-P., L. Niño, A. Lozano* & *C. Villegas V. 742* (COL); *F. Castro-Lima, G. Aymard C., Vladimir Minorta-C., H. Arellano-P., L. Niño, A. Lozano, M. González* & *C. Villegas V. 18291* (COL).

Rapatea modesta Maguire, Bot. Mus. Leafl. 14: 112. 1950. – *Rapatea longipes* Spruce ex Körn. var. *modesta* (Maguire) Maguire, Mem. New York Bot. Gard. 12(3): 100. 1965. **Type:** COLOMBIA: Comisaría del Amazonas, Trapécio Amazónico, interior regions of trapecio between the Amazon and Putumayo watersheds, ca. 100 m, Nov 1945, *R. E. Schultes 6900* (holotype: NY, isotype: GH).

Taxonomic history. *Rapatea modesta* was described by **Maguire** based on three specimens collected in 1945 by Richard Evans Schultes during his explorations to the "Trapecio Amazónico", a broad trapezoid strip of land 150 km long between the Putumayo and Amazon rivers. Maguire made a detailed description but did not mention an affinity to his new taxon. Afterwards he wrote to R. E. Schultes and remarked that *R. modesta* is most closely related to *R. longipes*, from which it differs in its smaller habit, broader, shorter, more conspicuously veined membranous leaf-sheaths, relatively broader and more numerously veined leaf blades, considerably larger heads, more acuminate spiked bractlets, and white rather than yellow petals (**Schultes**, 1950). In his monograph of the genus *Rapatea*, Maguire referred this species to a variety of *R. longipes* (i.e., *R. longipes* var. *modesta* (Maguire) Maguire), also providing a key to separate both varieties (**Maguire**, 1965). Examination of type specimen, the study of additional material, and Maguire´s data clearly indicates that *R. modesta* should be restablished and treat as distinct species. Because of its bractlets of the spikelets of equal length and the inflorescence receptacle convex or hemispheric, this species belongs to *Rapatea* sect. *Longipes* Maguire, and by the base of leaf blades abruptly constricted above the summit of the sheath forming a long and slender petiole, *R. modesta* is most similar to *R. longipes*, however, these two species can be distinguished by the characteristics presented in Table 1.

The label of on *R. E. Schultes 6899** states (handwritten, but the label data) "red flowers" for *R. modesta* Maguire. Schultes observed that the red-flowered form grows together with the white-color form (**Schultes**, 1950). According to **Maguire** (1950, 1982), as well as hundreds of specimens examinated, red flowers have not been reported for the genus besides this Schultes´s collection (**Paul Berry**, pers. comm., 2016). We are not questioning Schultes´s field observations, but perhaps he was referring to the reddish involucral bracts, which can indeed be reddish, rather than to the petals themselves.

Additional specimens examined:

Colombia. Amazonas: Trapécio Amazónico, interior regions of trapecio between the Amazon and Putumayo watersheds, ca. 100 m, Nov 1946, *G. A. Black & R. E. Schultes 46–361* (NY); ibid, flowers red, Nov 1945, *R. E. Schultes 6899**(COL, GH, K, NY). P. N. N. Río Puré, Varillal de Aguanegra, 2° 02´ 52.44´´S; 69° 41´ 33.96´´ O, July 2010, *A. Barona 46* (COAH); La Pedrera, La Tonina, 1° 29´ S; 69° 29´ O, 10 Oct 1994, *D. Cárdenas, D. Giraldo C. & E. Yukuna 5750* (COAH).Vaupés: *Río* Apaporis, raudal Jirijirimo, Aug 1951, *R. E. Schultes & I. Cabrera 13467* (GH); Río Piraparana, Cerro E-ree-eé-ko-mee-o-kee. 0° 19´ 60´´ N; 70° 30´ 00´´ W, Sep 1952, *R. E. Schultes & I. Cabrera 17500* (COL); Río Piraparana, Misión San Miguel, Oct 1976, *E. W. Davis 127* (COL).

Rapatea sessiliflora (Maguire) Aymard & Arellano-Peña, *comb. et stat. nov.*: *Rapatea paludosa* Aubl. var. *sessiliflora* Maguire, Bull. Torrey Bot. Club 75: 204. 1948. **Type:** SURINAME: Sipaliwini District: Tafelberg (Table Mountain), Grace Creek, 1 kilometer east of Savanna VIII, 03° 54' N; 56° 20' W, ca. 1000 m, 01 Sep 1944, *B. Maguire 24587* (holotype: NY, isotypes: A, F, U, US).

Rapatea sessiliflora was described as a variety of *R. paludosa* based on two specimens (**Maguire**, 1948). The examination of type specimen and the additional material indicates that it should be treated as a separate species, which can be distinguished from *R. paludosa* by the following characters: slender plants (vs. stout), leaf blades 40–60 cm long. 1–2.5(3.5) cm wide (vs. 60–90 cm long, 4–12 cm wide), inflorescences 3–4 cm broad (vs. 4–8 cm broad), apex of the bracts ca. 10 cm long, 2.0–2.5(3.2) cm wide at the base (vs. 15–20 cm long, 4–6 cm wide), and spikelets sessile or with pedicels 0.5–3 mm long (vs. spikelets with pedicels 5–12(20) mm long).

Additional specimens examined. BRAZIL: Amazonas, *In vicinibus Barra* (Manaus), December–March 1850–51, *R. Spruce s.n.* (NY). Amazonas, vicinity of Manaus, Tarumã, Cachoeira baixa Tarumã, June 1967, *G. T. Prance, B. S. Pena & J. F. Ramos 3859* (INPA, NY). SURINAME: base of Tafelberg Mountain, Coppename River headwaters, 106 m, July 1944, *B. Maguire 24177* (NY); Tafelberg, Savanna landing strip, March 1961, *K. U. Kramer & W. H. A. M. Hekking 3029* (NY, U); Sipaliwini District: Tafelberg National Park, western side of Lisa Creek, 3° 55´ N; 56° 11´ W, ca. 1000 m, June 1998, *L. G. Lohmann 207* (MO, WIS); Tafelberg Mountain, Grace Creek, 1 km north of Grace fall, 3° 54´ 32´´ N; 56° 12´ 44´´ W, ca. 800–820 m, July 1998, *T. Hawkins 1870* (MO, WIS). VENEZUELA: Bolívar: ríos Icabarú y Hacha, March 1955, *L. A. Bernardi s.n* (MER, NY).

Key to the species of *Rapatea* (Modified from Berry, 2004). Supplementary information 2, http://www.raccefyn.co/index.php/raccefyn/article/downloadSuppFile/403/1750.

1. Leaf blades 0.5–2.5 cm wide.....2

2(1). Receptacle plane-convex; bractlets strongly gradate.....*R. linearis* Gleason (Amazonian of Brazil, Colombia, Guyana)

2. Receptacle shallowly convex, at least hemispheric or elongate, bractlets equal in length.....3

3(2). Leaves blades orange punctate below, inflorescence elongate, base of the involucral bract deeply cordate.....*R. xiphoides* Sandw. (Guyana: Kaieteur savannas)

3. Leaves blades if punctate, without orange dots, inflorescence shallowly convex or at least hemispheric, base of the involucral bract truncate, rounded or subcordate.....4

4(3). Base of leaf blades abruptly widened at the base above the petiole; apex of leaf blade abruptly narrowed; petiole as long as the blade or longer.....*R. longipes* Spruce ex Körn. (Río Negro basin: Amazonian of Brazil, Colombia and Venezuela)

4. Base of leaf blades gradually passing into the petiole; apex of leaf blades not abruptly narrowed; petiole shorter than the blade.....5

5(4). Apex of the involucral bracts attenuate 1–45 mm long, < twice as long as the expanded broader basal portion; lower surface of the leaf blade glandular-punctate or sparse verrucose mainly on the lower surface.....6

6. Plants 30–80 cm tall; lower surface of the leaf blade glandular-punctate; attenuate portion of the involucral bracts 10–45 mm long; peduncle of inflorescence 16–35 cm long, petals yellow.....*R. spruceana* Körn. (Río Negro basin: Amazonian of Brazil, Colombia and Venezuela)

6. Plants 15–30 cm tall, lower surface of the leaf sparsely verrucose; attenuate portion of the involucral bracts 1–5 mm long, peduncle of inflorescence 8–13 cm long; petals white.....*R. isanae* Aymard & Arellano-Peña (Río Negro basin: Amazonian Colombia)

5. Attenuate portion of the involucral bracts 20–80 mm long, 2–4 times longer than the expanded broader basal portion; lower surface of the leaf blade smooth (not glandular-punctate or sparsely verrucose).....7

7(5). Attenuate portion of the involucral bracts 20–35 mm long, 2–3.5 times longer than the expanded broader basal portion; lower surface of the leaf blade densely and minutely papillate; bracteoles aristate.....*R. yapacana* Maguire (Venezuela, Amazonas state: savanna Yapacana)

7. Attenuate portion of the involucral bracts 35–80 mm long, 4–5 times longer than the expanded basal portion; lower surface of the leaf blade not minutely papillate; bracteoles acute, apiculate, or sharply acuminate.....8

8(7). Plants slender; expanded basal portion of involucral bracts 7–12 mm wide; attenuate portion of involucral bracts 35–50 mm long, 4–5 mm broad; leaf blades 3–7 mm wide; peduncle 4–20 cm long, shorter than the leaves; plants growing in dense circular clumps of numerous individuals.....*R. angustifolia* Spruce ex Körn. (Río Negro basin: Amazonian of Brazil, Colombia and Venezuela)

8. Plants stout; expanded basal portion of involucral bracts 20–25 mm wide; attenuate portion of involucral bracts 55–85 mm long, 9–14 mm broad; leaf blades 9–15 mm wide; peduncle 35–45 cm long, longer than, or equal to, the leaves; plants generally growing as solitary individuals.....*R. circasiana* García-Barr. & L. E. Mora (Río Negro basin: Amazonian of Brazil, Colombia and Venezuela)

1. Leaf blades 3–14 cm wide.....9

9(1). Leaf sheath short, 2–9 (-15) cm long; involucral bracts 1.5–8 cm long, apex narrowed, 0.5–3.5 cm long; heads 1–3 cm broad.....10

10(9). Base of leaf blades gradually narrowed at the base to a union with the sheath, petiolar portion ca. 0.2 cm long**;** involucral bracts 6–8 cm long, narrowed apical part 3–3.5 cm long.....*Rapatea sp.* A (Colombia; Cauca)

10. Base of leaf blades abruptly widened at the base above the petiole; portion more than 1 cm long; involucral bracts 1.5–3.5 cm long, narrowed apical part 0.5–2.5 cm long.....11

11(10). Leaf sheaths lanceolate, 3 or more times longer than broad; petiole as long as the blade, leaf blades 3–3.5 cm wide, oblong-linear to lanceolate; narrowed apical part of the involucral bracts 0.5–1 cm long; peduncle 12–25(30) cm long; petals yellow.....*R. longipes* Spruce ex Körn. (Río Negro basin: Amazonian Brazil, Colombia and Venezuela)

11. Leaf sheaths strongly ventricose, 2–3 times longer than broad; petiole longer than the blade; leaf blades 3–6 cm wide, oblong-elliptic; apex 2–3 cm long; narrowed apical part of the involucral bracts 1–2.5 cm long; inflorescence 6–15 cm long; petals white.....*R. modesta* Maguire (Amazonian Colombia)

9. Leaf sheath elongate, 15–30 cm long; involucral bracts 5–25 cm long, apical attenuate portion 3–22 cm long; heads 3–8 cm broad.....12

12(9). Lamina base gradually narrowed to petiole region.....13

13(12). Petiolar region 0.5–3 cm long.....14

14(13). Leaves (4-) 5–9 cm wide; leaves smooth throughout; involucral bracts cordate at the base; bracteoles acuminate, spotted (maculate) at the apex.....*R. spectabilis* Pilg. (Brazil, Bolivia, Colombia, Ecuador and Peru)

14. Leaves 3–4 cm wide; lower surface of the leaves slightly scabridulous; involucral bracts truncate at the base; bracteoles cucullate-obtuse, without spots at the apex..... *R. scabra* Maguire (Venezuela, Amazonas state: Cerro Sipapo)

13. Petiolar region more than 3.5 cm long.....15

15(13). Leaves 4–12 cm wide, inflorescence 4–8 cm broad, involucral bracts 10–20 cm long, cordate, spikelets pedicellate (pedicels 10–20 mm long), widespread in the Neotropics (from Panama, Trinidad, Venezuela to Bolivia).....*R. paludosa* Aubl.

15. Leaves 3–4 cm wide, inflorescence ca. 3 cm broad, involucral bracts 8–10 cm long, involucral bracts rounded or deeply cordate at the base, spikelet sessile or pedicels not longer than 3 mm (Brazil, Guayana Shield of Suriname and Venezuela).....16

16(15). Involucral bracts deeply cordate at the base; spikelet bractlets 5(–7) nerved at the apex.....*R. pycnocephala* Seub. (Brazil: Bahia, Goiás, Maranhão, Mato Grosso, Pará, Piauí, Rondônia)

16. Involucral bracts rounded at the base; spikelet bractlets 3–nerved at the apex.....*R. sessiliflora*

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(Maguire) Aymard & Arellano-Peña (Brazil-Amazonas, Suriname and Venezuela)

12. Base of leaf blades abruptly constricted above the summit of the sheath.....17

17(12). Floral receptacle elongate.....18

18(17). Leaf blades strongly rugulose; inflorescences 5–14 cm long.....19

19(18). Leaves blades coriaceous, narrower–lanceolate, ca. 3.5 cm long; petiole 8–10 cm long: head 5–8 cm long, bracteoles scarious-membranaceous.....*R. rugulosa* Maguire (Brazil: Amazonas state)

19. Leaves blades membranaceous, linear–lanceolate, 6–10 cm wide; sessile, head 6–12 cm long, bracteoles coriaceous.....*R. membranacea* Maguire (Guyana: Pakaraima mountains)

18. Leaf blades smooth; inflorescences 4–8 cm long.....20

20(18). Leaf blades 1.5–3 cm wide, with 14-16 nerves, orange punctate; receptacle 1.5–2 cm; involucral bracts 15–25 x 1.5–2 cm, cordate, inflorescence ovoid–spherical, 3.5–4 x 3–3.5 cm.....*R. xiphoides* Sandw. (Guyana: Kaieteur Savannas)

20. Leaf blades 3–5 cm wide, with 10–12 nerves, if punctate, without orange dots; receptacle 5–19 cm long; involucral bracts 20–37 x 3–5 cm, rounded or attenuate, inflorescence oblong, 7–8.5 x 5–6 cm..... *R. elongata* G. K. Schultze (Brazil and Colombia)

17. Floral receptacle convex or hemispheric.....21

21(17). Leaves blades oblong, abruptly short-acuminate at the apex, constricted at the base into an evident petiole of 1–20 cm long.....22

22. Leaves blades coriaceous, petiolar portion 10–20 cm long; bracteoles rigid, 3–7-nerved, short–acuminate.....*R. muaju* García-Barr. & L. E. Mora (Brazil-Acre, Colombia, Ecuador and Peru)

22(21). Leaves blades membranaceous; petiolar portion 1–10 cm long; bracteoles membranaceous, 3–5-nerved, long–aristate.....23

23(22). Leaves blades ca. 50 x ca. 10.5 cm; base subcordate to oblique; petiolar portion 8–10 cm long; penducle of the inflorescence 18–25 cm long; bracteoles 5–nerved.....*R. saulensis* Boom (French Guiana and Suriname)

23. Leaf blades 16–21 x 4–8 cm; base inequalateral; petiolar portion 1–3 cm long; penducle of the inflorescence 4–5 cm long; bracteoles 3–5-nerved.....*R. undulata* Ducke (Amazonian of Brazil, Colombia and Peru)

21. Leaf blades lanceolate, gradually acuminate at the apex, cordate or attenuate at the base, with a shorter petiole, 5–20 mm or less of long.....24

24(21). Leaf blades smooth; inflorescences elongate-hemispheric; bracteoles not all gradate.....25

25(24). Leaf blades 33–38 x 5–6 cm, leaf sheaths 10–14 cm long, ventricose.....*R. ulei* Pilg. var. *ulei* (Amazonian of Brazil, Guyana, French Guiana and Peru)

25. Leaves blades 40–60 x 10–14 cm, leaf sheaths 20–30 cm long, elongate.....26

26(25). Inflorescence uni–capitate.....*R. ulei* Pilg. var. *latifolia* Maguire (Brazil, Amazonas state)

26. Inflorescences multicapitate.....*R. ulei* Pilg. var. *latifolia* Maguire fm. *multicapitata* Maguire (Brazil, Amazonas state)

24. Leaves blades glandular–papillate; inflorescences shallow–hemispheric to sub-hemispheric; bracteoles evidently gradate.....27

27(24). Peduncle 3–14 cm long; involucral bracts broadly deltoid, nearly as broad as long, 6–10 cm long.....28

28(27). Lower surface of leaf sheath densely brown-pubescent with elongate, crisp-villosulous, loose, multicellular hairs; upper surface of leaf with short, divaricate, pointed hairs irregularly scattered on the veins in addition to the minutely papillate surface; spikelets 16–20 mm long (excluding the sepals); lowest bracteoles 12–13 mm long; anthers ca. 5 mm long; filaments glabrous.....*R. steyermarkii* Maguire (Guayana Shield of Guyana and Venezuela)

28. Lower surface of leaf sheath brown–dotted between smaller, pale punctuations; upper leaf surface densely verruculose–papillate throughout; spikelets 23–25 mm long (excluding the sepals); lowest bracteoles 17–18 mm long; anthers ca. 10 mm long; filaments ciliolate.....*R. aracamuniana* Steyerm. (Venezuela, Amazonas state: Cerro Aracamuni)

27. Peduncle 20–50 cm long; involucral bracts lanceolate, longer than broad, 10–25 cm long.....29

29(27). Bracteoles stiff, obviously different in size, the lower ones much less than 1/2 the length of the spikelet; leaf blades 25–75 cm long, 6–11 cm wide; involucral bracts 10–20 cm long; lower leaf surface with the primary veins acutely elevated, separating the broad, flat depressions; primary veins of upper leaf surface shallowly raised, not presenting a plaited appearance, 0.5–1 mm apart.....*R. fanshawei* Maguire (including *R. fanshawei* var. *minor*) Guayana Shield of Guyana and Venezuela

29. Bracteoles sub-membranaceous, of nearly equal length; leaf blades ca. 130 cm long, 9–12 cm wide; involucral bracts ca. 25 cm long; lower leaf surface with shallowly convex surfaces separated by shallow sulcations, lacking acutely elevated primary veins; primary veins of upper surface conspicuously elevated and presenting a plaited appearance, 1–2 mm apart.....*R. chimantensis* Steyerm. (Venezuela, Bolívar state: Chimantá tepui)

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Supplemental materials

Supplementary information 1. Abstract in Kuripaco. See Supplemental information in: http://www.raccefyn.co/index.php/raccefyn/article/downloadSuppFile/403/1749

Supplementary information 2. Key to the species of Rapatea (Modified from Berry, 2004). See Supplemental information in: http://www.raccefyn.co/index.php/raccefyn/article/downloadSuppFile/403/1750

Conflicts of interest

The authors declare that they have no conflict of interest.

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