
Three New Species of *Eleocharis* (Cyperaceae) from the Andean Páramos of Colombia and Ecuador

M. Socorro González Elizondo and Irma Lorena López Enriquez

CIIDIR IPN Unidad Durango, Sigma s.n. Fracc. 20 de Noviembre II, 34220 Durango, Mexico.
herbario_ciidir@yahoo.com.mx; lorena_lopez05@yahoo.com.mx

Paul M. Peterson

Department of Botany, National Museum of Natural History, Smithsonian Institution,
Washington, D.C., 20013-7012, U.S.A. peterson@si.edu

Carmen Ulloa Ulloa and Peter M. Jørgensen

Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.
carmen.ulloa@mobot.org; peter.jorgensen@mobot.org

ABSTRACT. Three new closely related species of *Eleocharis* R. Brown (Cyperaceae) from Andean páramos are described from Colombia: *E. fassettii* S. González & P. M. Peterson, *E. cuatrecasii* S. González & P. M. Peterson, and *E. moraosejoana* S. González, C. Ulloa & P. M. Jørgensen. They all belong to *Eleocharis* subgen. *Eleocharis*, sect. *Eleocharis*, and differ from related species by a combination of characters, among which are the thin, loose upper sheath apices and the unusual achene shape that is conspicuously tapered toward the base and apex.

RESUMEN. Se describen tres nuevas especies de *Eleocharis* R. Brown (Cyperaceae) de Colombia: *E. fassettii* S. González & P. M. Peterson, *E. cuatrecasii* S. González & P. M. Peterson y *E. moraosejoana* S. González, C. Ulloa & P. M. Jørgensen, conocidas solamente de páramos andinos. Todas forman parte de *Eleocharis* subgen. *Eleocharis*, secc. *Eleocharis*. Difieren de las especies relacionadas en una combinación de características entre las que destaca el ápice de la vaina superior delgado y laxo y la forma del aquenio, angostado hacia la base y el ápice.

Key words: Andes, Colombia, Cyperaceae, Ecuador, *Eleocharis*, IUCN Red List, páramo.

Eleocharis R. Brown (Cyperaceae) is a widely distributed genus of more than 200 species (González & Peterson, 1997) that can be distinguished by the following vegetative and reproductive morphological characters: leaves basal and reduced to tubular sheaths, inflorescence reduced to a single spikelet, and a stylopodium that is persistent on the achene. Despite its morphological simplicity, there is broad diversity within *Eleocharis* (González & Peterson,

1997; González & Tena, 2000). The genus was extensively studied by H. K. Svenson between 1929 and 1957 (see Svenson, 1929, 1937, 1957). However, no recent comprehensive worldwide taxonomic treatment of the genus is available (Smith et al., 2002), and many species remain undescribed in Latin America.

Three new closely related species are described here from the páramos in the northern Andes. The North Andean páramos are one of the richest high-elevation mountain ecosystems in the world with high biological diversity and endemism, but they are ecologically fragile and severely threatened by human activities (Luteyn, 1999; Sklenář et al., 2005).

The three new taxa belong in *Eleocharis* subgen. *Eleocharis*, sect. *Eleocharis*, which is the most diverse group of the genus in the classification proposed by González and Peterson (1997). Further studies will be necessary to place the species here described in the most appropriate subseries. In their general aspect, presence of horizontal rhizomes, and obscurely trigonous achenes, the new species are morphologically similar to species of *Eleocharis* subser. *Truncatae* Svenson (Svenson, 1932), but differ in the membranous, hyaline or subhyaline, and nontruncate apices of the upper sheaths. Differences with *E. dambeyana* Kunth and *E. mantana* (Kunth) Roemer & Schultes, with which specimens of the new species have been erroneously placed according to annotations on herbarium labels, are presented in a key to species below.

1. *Eleocharis fassettii* S. González & P. M. Peterson, sp. nov. TYPE: Colombia. Santander: Alto del Almorzadero, N of Cerrito, small pond on páramo, 12,500 ft., 31 Oct. 1944, *N. C.*

Fassett 25994 (holotype, US; isotypes, MO, NY, WIS). Figure 1.

Eleochariti subarticulatae (Nees) Boeckeler similis sed atropiculis laxifloris, glumis latis et antheris longioribus differt; *E. dombeyanae* Kunth similis sed vaginis superioribus apice membranaceis, leviter obliquis, hyalinis, laxis, absque cuspis et acheniis ellipsoideis vel subfusiformibus leviter reticulatis differt.

Rhizomatous perennials; roots fibrous, brown; rhizomes (1–)2–4 mm wide, long-creeping to ascendant, covered by long scales (sheaths) up to 1 cm × 1–2 mm, purple to black, or stramineous with purple striations, the distal part sometimes foliaceous, the young scales sometimes translucent, red-striate or punctiform, the old scales becoming fibrous; culms 8–28 cm × 0.5–1.2 mm, solitary or tufted, pale green, terete or somewhat flattened when pressed, evidently sulcate or lineolate, usually septate-nodulose, soft, erect or slightly recurved. Leaf sheaths loose, stramineous, often purple-striate or punctiform at the base, membranous, hyaline and red-punctiform distally, slightly oblique, upper sheath apex rounded or sometimes bifid, the mouth concave or slightly cleft. Spikelets lanceoloid or ovoid, 5.5–9 × 1.5–3 mm, 8- to 22-flowered, apex acute; proximal scale empty, persistent, amplexicaulous or almost so, less than 1/3 (often less than 1/5) the length of the spikelet, the midvein region broad, greenish to stramineous, finely nerved, rounded at the apex, with a hyaline margin and apex less than 0.2 mm; floral scales polystichous, appressed or somewhat spreading at the apex, 2–2.8 × 0.7–0.9 mm in lateral view, ecarinate or obscurely carinate at the apex, membranous, ovate, obtuse to acute, with a green or stramineous midvein and dark purple to black sides, the margin and apex not hyaline or the hyaline part less than 0.2 mm wide; hypogynous bristles equaling or longer than the achene, 4 to 7, light reddish brown, finely retrorsely dentate; style trifid; stamens 3, anthers 0.9–2 mm, the connective short, prolonged. Achenes 1.1–1.6 mm (not including the stylopodium), 0.6–0.8 mm wide, obscurely trigonous with the sides convex, or biconvex with the abaxial angle represented by a paler, low ridge, the lateral angles slightly costulate, the achene ellipsoid, subfusiform, or narrowly obovoid, tapered to the base and to the apex, the apex forming a neck, pale to golden yellow or pale brown, somewhat iridescent, very finely reticulate, the pericarp fragile, easily breaking; stylopodium (0.2–)0.3–0.5(–0.9) mm, 0.1–0.2 mm wide at the base, lanceoloid, gray to pale brownish, often on a fine, pale ridge.

Distribution and habitat. *Eleocharis fassettii* is a subaquatic plant that occurs in ponds and wet washout of loose sandstone and other sedimentary rocks from

the páramos and chaparral of the Eastern Cordillera (Cordillera Oriental) in Colombia. This area includes the Cocuy region where there is a high diversity of plants (Cleef, 1997). Collection elevations have been reported from 2700 to 3550 m.

IUCN Red List category. *Eleocharis fassettii* fits the IUCN (2001) category of Near Threatened (NT), because of its restricted, patchy distribution, the possibility of habitat degradation by human-mediated fires, and overgrazing practices that are common in the region (Cleef, 1997). The species may be extant within the boundaries of Cocuy and Iguaque National Parks.

Etymology. The epithet honors Norman Carter Fassett (1900–1954), who collected the type specimen. Dr. Fassett was an expert on several groups of aquatic plants and vegetation, and participated in the Colombian Cinchona Project in the 1940s.

Discussion. Collections of *Eleocharis fassettii* have been identified as *E. dombeyana*, which it resembles in general habit and in its mucronate stylopodium. *Eleocharis dombeyana* belongs to *Eleocharis* subser. *Truncatae* and has upper sheaths with a firm, truncate, and evidently cuspidate apex.

In *Eleocharis fassettii*, the narrow stylopodium is usually 0.4–0.5 mm long, but it can be only 0.2 mm when the upper part is broken early, or as long as 0.9 mm when the base of the style is persistent. The shape of the achene, including an apex that is abruptly narrowed into a neck, the long, lanceolate stylopodium, and the general appearance of the plant are morphologically similar to *E. subarticulata*, a species of uncertain placement in *Eleocharis* (Svenson, 1939; da Silva et al., 2005) known from lower elevations in Brazil and Paraguay. Differences between the two species are presented in the key.

Eleocharis subarticulata and *E. fassettii* are morphologically similar, but their taxonomic relationship is unclear. The former species has the lowest chromosome number known in *Eleocharis*: $n = 3$ (da Silva et al., 2005). In the state of Rio de Janeiro, it is recorded only for the Serra do Itatiaia, a region with a puzzling biogeographical history with the Sierra Nevada del Cocuy; this relationship was discussed by Cleef (1997), who reported the presence in the Cocuy area at 4060 m of an aquatic liverwort (*Herbertus ablangifolius* (Stephani) Gradstein & Cleef), otherwise known only from the Itatiaia massif. The Itatiaia massif is the highest area near Rio de Janeiro, reaching 2787 m (Guedes-Bruni & de Lima, 1997). A formation called Atlantic Brazilian paramos of the high altitudes from the Atlantic coastal chain of Brazil, floristically somewhat related to Andean

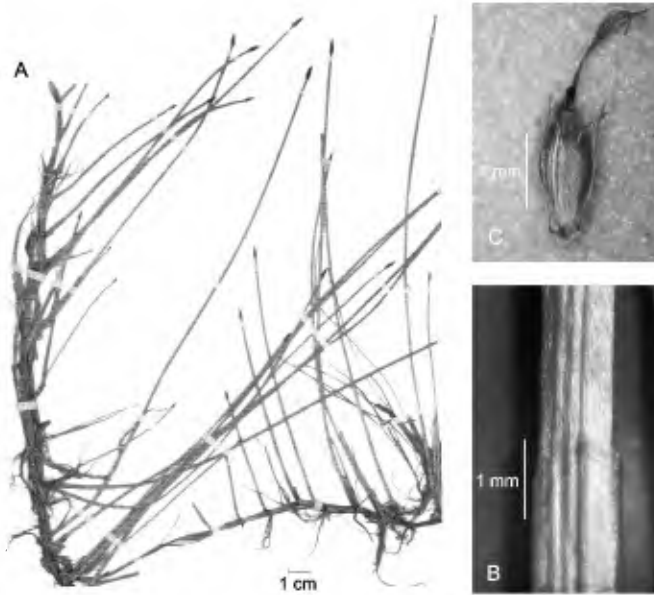


Figure 1. *Eleocharis fassettii* S. González & P. M. Peterson. —A. Habit. —B. Upper portion of distal leaf sheath. —C. Achene. A and B from *G. Smith 1006*; C from *N. C. Fassett 25994*.

páramos, was first described by Schnell in 1987 (cited in a Report by the Institute of Terrestrial Ecology, Institut Royal des Sciences Naturelles de Belgique [1996]). The firmer apex of the upper sheaths and fewer-flowered spikelets of the plants identified as *E. subarticulata* from Itatiaia (Gil & Bove, 2007) indicate that they could represent a new taxon or a variety of either *E. fassettii* or *E. subarticulata*, which is otherwise known from much lower elevations.

Paratypes. COLOMBIA. **Depto. Boyacá**: Cordillera Oriental. Sierra Nevada del Cocuy, Quebrada de San Paulino próx. Alto Ritacuva, 7 Apr. 1959, *H. G. Barclay & P. Juajibioy 7316* (COL not seen, MO, US); valley of Río Pomera, 13 km NW of Arcabuco, 20 Aug. 1944, *N. C. Fassett 25644* (NY, US, WIS). **Depto. Cundinamarca**: Cordillera Oriental, hills at W base of Monserrate, E of Bogotá, 13 June 1950, *S. Galen Smith 1006* (COL not seen, K, MO, US).

2. *Eleocharis cuatrecasii* S. González & P. M. Peterson, sp. nov. TYPE: Colombia. Depto. Antioquia: “Páramo de Sonson” along or near carretera betw. Sonson & Narino, 9000–9600 ft. [not actually páramo, “paramillo”], 23 May 1944, *E. L. Care 729* (holotype, US). Figure 2.

Eleochariti fassetti S. González & P. M. Peterson valde affinis sed habitu minore. caulibus rigidis recurvatis, spiculis paucifloris et squamis infimis longioribus ad 1/2 spiculae longitudinem differt.

Rhizomatous perennials; rhizomes 2–4 mm wide, long-creeping, covered by scales (sheaths) 7–15 × 1.5–2 mm, purple-colored or stramineous with dark

purple to black striations, the apex translucent, rounded, the old scales becoming fibrous; culms 1.2–4 cm × 0.3–0.6 mm, in fascicles along the rhizome, pale green, terete, slightly sulcate, rigid and arching or recurved. Leaf sheaths loose, stramineous and purple-striated at the base, membranous and slightly inflated distally, slightly oblique, hyaline and red-punctiform distally, upper sheath apex rounded (sometimes bifid), concave at the ventral part (mouth). Spikelets ovoid, 2–5.6 × 1–3 mm, 2- to 12-flowered, apex acute; proximal scale up to 1/2 the length of the spikelet, sterile, with the midvein broad, greenish to straw-colored, finely nerved; floral scales polystichous, somewhat spreading at the apex, 1.8–2.6 × 0.5–0.7(–0.8) mm in lateral view, obscurely carinate at the apex, membranous, ovate, obtuse to acute, the midvein green or stramineous and dark purple, sometimes with black sides, the margin and apex not hyaline or the hyaline part less than 0.2 mm wide; hypogynous bristles equaling to longer than the achene, 4 to 7, light reddish brown, finely retrorsely dentate; style trifid; stamens 3, anthers 0.8–1 mm, the connective short prolonged. Achenes 1.2–1.4 mm (not including the stylopodium), 0.6–0.7 mm wide, obscurely trigonous with the sides convex, or biconvex with the ahaxial angle represented by a paler, low ridge, the lateral angles slightly costulate, the achene narrowly obovoid to subfusiform, the apex forming a neck, pale to golden yellow or pale brown, somewhat iridescent, very finely reticulate, the pericarp often breaking along from the base to the apex; stylopodium

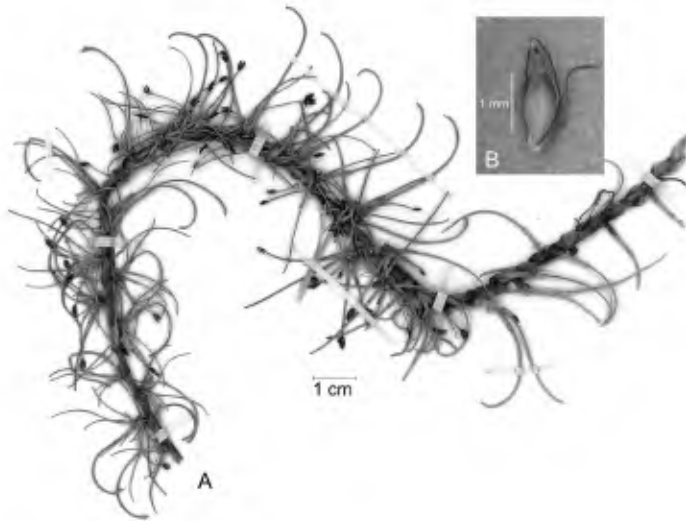


Figure 2. *Eleocharis cuatrecasii* S. González & P. M. Peterson. —A. Habit. —B. Achene. A and B from *E. L. Core* 729 (US).

(0.3–)0.4 mm long, 0.15–0.2 mm wide at the base, lanceoloid, gray to pale brown-colored.

Distribution and habitat. This species appears to be a narrow endemic and is only known from the type collection in the Cordillera Central of Colombia between 2735 and 2920 m.

IUCN Red List category. It is problematic to assign an IUCN conservation status to species only known by the type collection (Valencia et al., 2000); however, its limited occurrence would fit the category of Critically Endangered (CR), according to IUCN Red List criteria (IUCN, 2001).

Etymology. The epithet honors the outstanding botanist, José Cuatrecasas (1903–1996), who was Spanish by birth, an American citizen since 1953, and a passionate student of the Colombian flora since his first trip to the country in 1932. His words, “There is nothing better than botany and the páramos” (García Kirkbride, 1997), are a reflection of this.

3. *Eleocharis moraosejoana* S. González, C. Ulloa & P. M. Jørgensen, sp. nov. TYPE: Colombia. Depto. Nariño: Cumbal, páramo shore or lake, 4000 m, 24 Mar. 1941, *K. von Sneidern s.n.* (holotype, NY; isotype, LL). Figure 3.

Planta *Eleochariti fassetti* S. González & P. M. Peterson similis sed culmis crassitudine 2- ad 3-plo maioribus, vaginis superioribus apice chartaceis, cuspidatis et spicula longiora, squamis floralibus longioribus differt.

Perennials, probably rhizomatous; culms 24–53 cm × 2.3–3.5 mm, in fascicles, sometimes solitary, erect,

green, spongy, terete or somewhat flattened when pressed, longitudinally striate, appearing septate-nodulose, the internal septae incomplete. Leaf sheaths loose, papery, stramineous or light purple at the base, pale green or stramineous above, upper sheath apex subtruncate to slightly oblique, the margin hyaline with red dots at the union with the rest of the sheath, cuspidate, the cusp 0.4–1 mm, green or dark purple to almost black. Spikelets cylindrical to lanceoloid, 13–25 × 2.6–4.6 mm, ca. 35- to 120-flowered, apex acute; 2 proximal scales ± equal, lacking a flower, the main body 1.5–2.4 mm wide, broad, finely nerved, greenish to stramineous, appearing to be a continuation of the culm, apex up to 1.1 mm, rounded or acute with a dark purple to black border, margin and apex hyaline; floral scales 2.8–4.7 × 0.6–1.1 mm in lateral view, polystichous, apiculate, ecarinate, membranous, oblong to lanceolate, apex acute or obtuse, with a broad green or stramineous midvein region contrasting with the reddish to dark purple or almost black sides, the margin and apex hyaline; hypogynous bristles equaling to longer than achene, 4 to 7, stramineous to light reddish brown, retrorsely dentate; style trifid; stamens 3, the filaments sometimes dark-colored, anthers 1.2–1.7 mm, the connective prolonged. Achenes 1.4–1.7 mm (not including the stylopodium), 0.7–0.8 mm wide, obscurely trigonous or plano-convex with the abaxial angle represented by a paler, low ridge, the angles costulate, the achene ellipsoid to subfusiform, narrowed to the base and to the apex, the apex gradually narrowed into a short neck, finely punctate-reticulate with longitudinal cells, shiny and yellow to olivaceous or reddish, ripening to dark brown or



Figure 3. *Eleocharis moraosejoana* S. González, C. Ulloa & P. M. Jørgensen. —A. Habit. —B. Upper portion of distal leaf sheath. —C. Achene, bristles, and filaments removed. —D. Achene. A, B, and C from *K. von Sneidern s.n.*; D from *W. B. Drew E-473*.

sometimes becoming paler and dull; stylopodium 0.2–0.5 mm long, 0.2–0.3 mm wide at the base, narrowly pyramidal, whitish or dark brown, somewhat spongy at least at the base and papillate at $\times 30$, often on a fine, pale or dark ridge.

Distribution and habitat. *Eleocharis moraosejoana* is apparently an uncommon endemic known only from two localities: the eastern slopes of Volcán de Chiles in the Cordillera Occidental of Ecuador from wet swales of páramo associated with *Juncus* L. (as seen on paratype), and the type locality in southwestern Colombia, from a lakeshore on the páramo on the Cumbal volcano. This record adds the genus *Eleocharis* to the genera known from the páramos of the Nariño volcanoes, as listed in Rangel and Garzón (1997). Elevations for collections have been reported from 3495 to 4000 m.

IUCN Red List category. *Eleocharis moraosejoana* could be considered in the IUCN (2001) category of Critically Endangered (CR) given its restricted distribution, possible habitat loss, its rarity (i.e., known only from two collections 25 km apart, both from the 1940s), and the recent history of intense fires in the area (Ramsay, 2001). The specimens were collected from a region that has only partial floristic inventories (Mendoza & Ramírez, 2000; Ramsay, 2001; Peñafiel Cevallos, 2003) and still remains poorly known. It may occur within the boundaries of Ecological Reserve of El Ángel in northern Ecuador.

Etymology. The epithet honors the Colombian botanist, Luis Eduardo Mora-Osejo (1931–2004), a

native of Nariño and a specialist in Cyperaceae and in several other families. Dr. Mora-Osejo was “doubtlessly the most eminent botanist of Colombia” (González, 2004).

Discussion. *Eleocharis moraosejoana* is morphologically similar to *E. fassettii*, as indicated by the similar shape and size of the achenes. However, *E. moraosejoana* is a more robust plant (culms 24–53 cm vs. 8–28 cm in *E. fassettii*) with a cuspidate apex of the upper sheaths, larger spikelets (13–25 \times 2.6–4.6 mm vs. 5.5–9 \times 1.5–3 mm), longer floral scales (2.8–4.7 mm vs. 2–2.8 mm), and different proximal floral scales. The external aspect of *E. moraosejoana* is similar to *E. densa* Bentham, from Mexico and Central America. However, *E. densa* has more densely flowered spikelets, as well as obovate, biconvex achenes that are thicker, wider, and more finely reticulated.

A note on the type specimen at NY indicates that this species was perceived as similar to *Eleocharis nodulosa* (Roth) Schultes (= *E. montana*). Although *E. moraosejoana* is superficially similar to *E. montana*, *E. moraosejoana* is a coarser plant with irregular internal septa (that sometimes appear as complete septa when only a layer of the spongy interior is viewed), apex of the upper sheaths subtruncate to oblique, fewer-flowered spikelets, and ellipsoid to subfusiform achenes.

Paratype. ECUADOR. **Prov. Carchi:** Cordillera Occidental. E slopes of Volcán de Chiles, above Tufino [Ecuadorian Chinchona Mission], 17 Aug. 1944, *W. B. Drew E-473* (NY, US).

KEY TO NEW AND MORPHOLOGICALLY SIMILAR SPECIES OF *ELEOCHARIS* IN COLOMBIA AND ECUADOR

- 1a. Distal portion of upper sheaths herbaceous to papery, the apex truncate, thickened, and abruptly cuspidate; achenes obvoid to nbpyriform, nnt narrowed to the apex or base. 2
2a. Culms internally with regular, complete transverse septa (which are evident or not externally); achenes evidently reticulate at $\times 30$ *E. montana*
2b. Culms internally lacking complete transverse septa; achenes smooth to papillous at $\times 30$ *E. dombeyana*
1b. Distal portion of upper sheaths membranous or papery, the apex oblique, thin, lacking a cusp or subtruncate and with a cusp (in *E. moraosejoana*); achenes ellipsoid, fusiform, or narrowly obvoid, narrowed to the apex and to the base 3
3a. Floral scales 0.5–0.6 mm wide in lateral view, densely crowded, greenish to castaneous with a castaneous or dark purple border; anthers 0.5–0.7 mm long; achenes deeply reticulate; known from 200–900(–1200) m in Brazil and Paraguay *E. subarticulata*
3b. Floral scales 0.5–1.1 mm wide in lateral view, in dense or lax arrangements, greenish or stramineous on midvein, sides castaneous to dark purple or almost black; anthers 0.8–2 mm long; achenes finely reticulate; known from 2700–4000 m in Andean páramos 4
4a. Culms 2.3–3.5 mm wide; apex of the upper sheaths cuspidate; spikelets 13–25 mm long; floral scales 2.8–4.7 mm long *E. moraosejoana*
4b. Culms 0.3–1.2 mm wide; apex of the upper sheaths not cuspidate; spikelets 2–9 mm long; floral scales 1.8–2.8 mm long 5
5a. Rhizomes creeping to ascendant; culms 8–28 cm \times 0.5–1.2 mm, soft, not or slightly recurved; spikelets 5.5–9 mm long, 8- to 22-flowered; proximal scale less than 1/3 the length of the spikelet; anthers 0.9–2 mm long *E. fusetii*
5b. Rhizomes creeping; culms 1.2–4 cm \times 0.3–0.6 mm, rigid and recurved; spikelets 2–5.6 mm long, 2- to 12-flowered; proximal scale 1/3–1/2 the length of the spikelet; anthers 0.8–1 mm long *E. cuatrecasii*

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