



On the taxonomic position of *Panicum scabridum* (Poaceae, Panicoideae, Paspaleae)

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Abstract

Panicum scabridum, an *incertae sedis* species of *Panicum* s.l., is here included in the genus *Coleataenia*, following a phylogenetic analysis based on one new *ndhF* sequence of the species and associated morphological data. *Panicum scabridum* and species of *Coleataenia* are caespitose and perennial plants, with a lower glume (1–)3–5-nerved, 1/3 to 3/4 of the spikelet, upper glume and lower lemma 5–9-nerved, and upper antherium smooth, shiny, and indurate. Within *Coleataenia*, *P. scabridum* appeared as the sister taxon of the species pair *C. prionitis* and *C. petersonii*; these three species are the only NADP-me taxa of tribe Paspaleae exhibiting two bundle sheaths around the vascular bundles, i.e., with an outer parenchymatous sheath and an inner mestome sheath with specialized chloroplasts. The new combination *Coleataenia scabrida* is proposed and a lectotype is designated.

Key words: *Panicum scabridum*, phylogeny, combined analysis, anatomy

Introduction

Panicum scabridum Döll (1877: 201), originally described from a specimen collected in Brazil, grows in Colombia, Venezuela and the Guianas to northern Brazil and Bolivia, in wet open places at low elevations. *Panicum scabridum* was included by Zuloaga (1987) in *Panicum* Linnaeus (1753: 55) sect. *Laxa* Hitchcock & Chase ex Pilger (1931: 243), which includes species characterized by spikelets arranged in racemose unilateral branches, with the lower glume 3-nerved, 1/2 to 3/4 the length of the spikelet, and upper antherium indurate to membranous. Later, Zuloaga *et al.* (1992) excluded this species from sect. *Laxa* based on the presence of an indurate upper antherium, with simple papillae and a black caryopsis. Also, *P. scabridum* has major anatomical differences with species included in sect. *Laxa*: the species has 2–4 mesophyll cells between contiguous vascular bundles and specialized chloroplasts in the mestome sheath (Zuloaga *et al.*, 1992), while other taxa of sect. *Laxa* are classified as typically C₃ species, i.e., with several mesophyll cells between contiguous vascular bundles and without specialized chloroplasts (Brown 1977, Zuloaga *et al.* 1992).

Molecular phylogenetic studies have provided valuable information on the relationships within the Panicoideae (Gómez-Martínez & Culham 2000, Duvall *et al.* 2001, Giussani *et al.* 2001, Aliscioni *et al.* 2003, GPWG II 2012, Morrone *et al.* 2012). Aliscioni *et al.* (2003), based on a *ndhF* phylogeny, showed that *Panicum* is polyphyletic and has to be restricted to its type subgenus. Subsequently, several subgenera, sections or species were removed from *Panicum* and transferred to other genera or established as new ones (Morrone *et al.* 2007, 2008, Zuloaga *et al.* 2006, 2007, 2010, 2011, Salariato *et al.* 2012, Scataglini & Zuloaga 2013, Sede *et al.* 2008, 2009). Recently, Morrone *et al.* (2012) published a complete molecular and morphological phylogeny of Panicoideae, including 155 genera, and proposed a new classification for the subfamily. They split Paniceae Brown (1814: 582) into two tribes: Paniceae, with genera with a basic chromosome number of $x = 9$, and Paspaleae J. Presl (1830: 208), including all genera with a basic chromosome number of $x = 10$. Within the Paspaleae, three subtribes are recognized by these authors, Otachyriinae Butzin (1970: 182), Arthropogoninae Butzin (1972: 516), and Paspalinae Grisebach (1846: 468).

150 m, 31 December 1973, *Davidse 5444* (COL, K, MO, US), *Zuloaga 3984* (COL, MO, SI). **GUYANA.** Rupununi District, *Chan Choong 24* (US). **FRENCH GUIANA.** Without locality, *Leprieur 14, 452, s.n.* (P); Cayenne, *Leprieur s.n.* (G). **SURINAME.** Republiek, marais le long du chemin de fer, 23 March 1956, *Hoock 1452* (MO). **VENEZUELA.** Amazonas: Dept. Río Negro, San Carlos de Río Negro, 1°55'N, 67°04'W, 26 June 1984, *Davidse & Miller 26668* (MO, VEN). Anzoátegui: Río Mapire, afluyente norte del Río Orinoco medio, 8°30'N, 64°30'W, 11 June 1987, *Rosales & Valles 127* (MO). Apure: northern end of the Galerías de Cinaruco, ca. 62 airline km NNE of Puerto Páez, 6°44'N, 67°20'W, 60–100 m, 28 Feb 1978, *Davidse & González 14617* (MO, NY, VEN). Bolívar: Sabana abierta y bosque húmedo del Río Apa, en el sector "El Caruto", 6° 27'N, 63° 19'W, 13 June 1987, *Stergios 11143* (MO); Distrito Roscio, selva ribereña a lo largo del Río Uairén, 12 km al noreste de Santa Elena de Uairén, Hato Divina Pastora, 900 m, *Steyermark & Liesner 127392* (MO). Delta Amacuro: Isla La Tórtola, *Ramia 2160, 2163* (VEN). Guárico: Sabanas bajas cerca del Caño Caracol, carretera Calabozo-Camaguán, *Badillo 3335* (VEN); Hato Flores Moradas, cerca de Corozopando, *Badillo 3345* (VEN). Monagas: Hato Santa Clara, 20 km W of Tucupita, 11 Agosto 1989, *Zuloaga et al. 4384* (MO, SI, VEN); Dtto. Sotillo, en canal principal Oeste en la Isla Guara, *Trujillo 12958, 12968* (MY); Isla de Guara, *Ramia 3286* (VEN); sabana de la serie Guaratuaro, Isla Guara, *Aristeguieta & Virrueta_7559* (VEN); alrededores de Jusepín, 25 Agosto 1970, hoja muy amarga, *Aristeguieta 7559* (MO).

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Appendix 1.

List of taxa used in the molecular analysis and GenBank accession numbers. The 109 taxa indicated were used previously in the Panicoid analysis of Morrone *et al.* (2012). The voucher information of the new sequence of *Coleataenia scabrida* is boldfaced.

Tribe Arundinelleae. *Arundinella hirta* (Thunb.) Tanaka, AF117393. **Tribe Chasmantheae.** *Chasmanthium laxum* (L.) H. O. Yates subsp. *sessiliflorum* (Poir.) L.G. Clark, U27296. **Tribe Paniceae.** *Acroceras zizanioides* (Kunth) Dandy, AY029618; *Cenchrus ciliaris* L., AY029625; *Chaetium bromoides* (J. Presl) Benth. ex Hemsl., AY029626; *Dichantherium acuminatum* (Sw.) Gould & Clark, AY188485; *D. clandestinum* (L.) Gould, AY188461; *D. cumbucana* (Renvoize) Zuloaga, AY188464; *D. koolauense* (H.St. John & Hosaka) C.A. Clark & Gould, AY029627; *D. sabulorum* (Lam.) Gould & C.A. Clark, AY029654; *Digitaria setigera* Roth ex Roem. & Schult., AY029629; *Echinochloa colona* (L.) Link, AY029631; *Eriochloa punctata* (L.) Desv., AY029634; *Lasiacis sorghoidea* (Desv.) Hitchc. & Chase, AY029639; *Megathyrsus maximus* (Jacq.) B.K. Simon & S.W.L. Jacobsvar, AY029649; *Melinis repens* (Willd.) Zizka, AY029675; *Moorochloa eruciformis* (Sm.) Veldkamp, AY188452; *Oplismenus hirtellus* (L.) P. Beauv. AY029644; *Panicum* Section *Dichotomiflora* (Hitchc.) Honda: *Panicum aquaticum* Poir., AY029658; *P. dichotomiflorum* Michx., AY188466; *P. elephantipes* Nees ex Trin., AY029647; *P. pedersenii* Zuloaga, AY029646; *P. repens* L., AY029651; *Panicum* Section *Panicum*: *P. bergii* Arechav., AY188457; *P. fauriei* Hitchc., AY029650; *P. miliaceum* L., AY188472; *P. nephelophilum* Gaudich., AY029645; *P. stramineum* Hitchc. & Chase, AY188489; *Panicum* Section *Rudgeana* (Hitchc.) Zuloaga: *P. cervicatum* Chase, AY188459; *P. rudgei* Roem. & Schult., AY029661; *Panicum* Section *Urvilleana* (Hitchc.) Pilg.: *P. chloroleucum* Griseb., AY188460; *P. racemosum* (P. Beauv.) Spreng., AY188481; *Panicum* Section *Virgata* Hitchc. & Chase ex Pilg.: *P. tricholaenoides* Steud., AY188493; *P. virgatum* L., U21986; *Panicum incertae sedis*: *P. antidotale* Retz., AY188456; *P. mystasipum* Zuloaga & Morrone, AY188474; *P. olyroides* Kunth, AY188475; *Panicum* Section *Clavelligera* Stapf.: *P. adenophorum* K. Schum., AY188454; *P. claytonii* Renvoize, AY188462. *Panicum* Section *Monticola* Stapf.: *P. millegrana* Poir., AY029660; *P. sellowii* Nees, AY188484. *P. trichanthum* Nees, AY188492. *Panicum* Section *Verrucosa* Hitchc. & Chase ex C.C. Hsu: *P. verrucosum* Muhl., AY188496; *Parodiophyllochloa cordovens* (E. Fourn.) Zuloaga & Morrone, AY188463; *P. missiona* (Ekman) Zuloaga & Morrone, AY188473; *P. ovulifera* (Trin.) Zuloaga & Morrone, AY029653; *P. penicillata* (Nees ex Trin.) Zuloaga & Morrone, AY18847; *Pseudechinolaena polystachya* (Kunth) Stapf., AY029676; *Sacciolepis indica* (L.) Chase, AY029677; *Setaria lachnea* (Nees) Kunth, AY029683; *S. viridis* (L.) Beauv., U21976; *Stenotaphrum secundatum* (Walter) Kuntze, AY029684; *Zuloagaea bulbosa* (Kunth) Bess, AY029648. **Tribe Paspaleae.** *Altoparadisium chapadense* Filg. et al., AY029619; *Anthaenanthia lanata* (Kunth) Benth., AY029640; *Anthaenantiopsis rojasiana* Parodi, AY029620; *Apochloa euprepes* (Renvoize) Zuloaga & Morrone, AY029657; *A. subtiramulosa* (Renvoize & Zuloaga) Zuloaga & Morrone, AY188490; *Arthropogon villosus* Nees, AY029622; *Axonopus anceps* (Mez) Hitchc., AY029623; *Canastra lanceolata* (Filg.) Morrone, Zuloaga, Davidse & Filg., AY029621; *Coleataenia anceps* (Michx.) Soreng, GU253324; *C. caricoides* (Nees ex Trin.) Soreng, GU253329; *C. longifolia* (Torr.) Soreng, AY188482. *C. petersonii* (Hitchc. & Ekman) Soreng, AY188479. *C. prionitis* (Nees) Soreng, AY029652; *C. scabrida* Bloch 13508 (MO), **KF737387**; *C. stenodes* (Griseb.) Soreng, GU253333; *C. tenera* (Beyr. ex Trin.) Soreng, GU253326; *Cyphoanthus discrepans* (Döll) Morrone & Zuloaga, DQ646392; *Echinolaena inflexa* (Poir.) Chase, AY029633; *Homolepis glutinosa* (Sw.) Zuloaga & Soderstr., AY029637; *Hopia obtusa* (Kunth) Zuloaga & Morrone, AY029659; *Hymenachne donacifolia* (Raddi) Chase,