
Passiflora madidiana, a New Species of Passifloraceae from Northern Bolivia

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ABSTRACT. We describe *Passiflora madidiana* P. Jørg., Cayola & Araujo-Murakami (Passifloraceae) as new from Bolivia. It belongs to *Passiflora* L. subg. *Passiflora* and is probably closely related to *P. crassifolia* Killip, *P. mapiriensis* Harms, *P. actinia* Hook., and *P. jilekii* Wawra. The material was collected during a floristic inventory project of the dry forest within the Madidi National Park. We presume the species to be endemic to these highly seasonal and isolated dry forests that surround the upper part of the Río Tuichi within the Madidi National Park.

RESUMEN. Describimos a *Passiflora madidiana* P. Jørg., Cayola & Araujo-Murakami como una especie nueva, que pertenece a *Passiflora* L. subg. *Passiflora* y es probablemente cercana a *P. crassifolia* Killip, *P. mapiriensis* Harms, *P. actinia* Hook. y *P. jilekii* Wawra. El material fue colectado durante el inventario florístico del bosque seco en el Parque Nacional Madidi. Presumimos que esta especie es endémica de estos bosques secos estacionales y aislados que están en los alrededores de la parte alta del río Tuichi dentro el Parque Nacional Madidi.

Key words: Bolivia, dry forests, IUCN Red List, Madidi National Park, *Passiflora*, Passifloraceae.

As a result of making quantitative inventories, new species occasionally emerge. The new species described here was first collected in 2003, but flowering material was not secured until a concerted effort was made to inventory the dry forest in and around the upper part of Río Tuichi in 2004–2005. Both

inventories were part of the Proyecto Madidi, initiated in 2001, with the aim of making a botanical inventory of the Madidi region in northern Bolivia and educating university students in the process. We describe the new species here in order to make the name available for incorporation in the upcoming Bolivian catalog of vascular plants (Jørgensen et al., in prep.).

Passiflora madidiana P. Jørg., Cayola & Araujo-Murakami, sp. nov. TYPE: Bolivia. La Paz: Franz Tamayo, Parque Nac. y Área Natural de Manejo Integrado Madidi, Sect. Pintata próx. al Río Tuichi entre las comunidades de Virgen del Rosario y Suyu Suyu, bosque seco semideciduo en filos y cimas de cerros, 14°26'34"S, 68°34'47"W, 1150 m, 4 Dec. 2005 (fl., fr.), A. Araujo-Murakami, A. Fernández, S. Paredes, E. Cuevas & C. Cuevas 2599 (holotype, LPB; isotypes, BOLV, MA, MO, US, USZ). Figures 1, 2.

Haec species a *Passiflora crassifolia* Killip caulibus vetustis hirsutis, stipulis bis minoribus, bracteis obtusis adaxilaliter glabris atque coronae serie externa ter longiore differt.

Herbaceous to woody vine; stems cylindric, striate, hirsute, older stems dark olive green, younger stems light green, puberulent; stipules (2–)2.4–3(–4.1) × 0.7–1.1(–1.6) cm, reniform, extremely asymmetric, sessile, apex abruptly acuminate, mucronate, base rounded, margin glandular-serrate, hirsute. Petiole (1.5–)2.4–3.2(–3.8) cm, hirsute; glands (2 to)4(to 6), sessile, 1 pair 1–1.5 cm from leaf base, opposite-subopposite, the rest irregularly distributed. Leaf



Figure 1. Fertile habit of *Passiflora madidiana* P. Jørg., Cayola & Araujo-Murakami. Illustration by Carmen Ulloa Ulloa from the holotype Araujo-Murakami et al. 2599 (LPB).

blade (5–)7.2–10 × (2.7–)3.4–4.5(–4.9) cm, ovate, entire, rarely irregularly bilobed or trilobed, when bilobed or trilobed the angles between midvein and lateral veins 34°–38°; entire leaves (1 to)3(to 5)-nerved, angle between lateral veins and midvein (20°–)30°(–36°) in 3-nerved leaves, angle (45°–)55°(–60°) in 5-nerved leaves; apex obtuse, base truncate-cuneate, margin barely glandular-serrate toward the base, revolute; adaxial surface hirsute, pubescence denser along the principal veins, abaxial surface densely hirsute. Peduncle (2–)2.8–3.5 cm, longer in fruit to 3.3–4 cm, hirsute; bracts 1–1.3 × 0.7–0.9 cm, ovate-elliptic, adaxial surface glabrous, abaxial surface hirsute along principal vein, light green or occasionally light yellow, caducous before the fruit matures, apex obtuse, base cuneate, margin glandular-serrate, hirsute; pedicel (0.5–)0.7–0.9 cm, hirsute; flower solitary; sepals 21–22 × 6.5–7 mm with a pronounced keel, abaxial surface puberulent; awn ca. 1.5 mm; petals white, ca. 21 × 5 mm; corona in 3 filiform series, outer series ca. 19 mm, white with lower 1/5 purple, base occasionally white; second series 2.8–3 mm, white with purple apex; third series 1–1.5 mm, white with purple apex; operculum (1.5–)2–3.5(–4) mm tall, purple, with a filament series attached on the outside; limen ca. 1 mm, placed at 2/3 of the distance between the base of the androgynophore and the operculum; androgynophore ca. 7.5 mm; free part of filaments ca. 5.5 mm; anthers ca. 6.5 × 2.1 mm; ovary ca. 5 × 3 mm, green; style ca. 7 mm, light green, stigma ca. 2 mm, green. Fruit (3–)3.4–3.6 cm, ovoid, immature green, drying dark brown; seeds 4.5 × 3 mm, foveolate with 20 to 22 pits, dark brown.

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Distribution, habitat, and IUCN Red List category. *Passiflora madidiana* is found in semideciduous dry forest, along the Río Tuichi in the Madidi National Park at 850–1150 m elevation. We consider the species to be Vulnerable (VU B1,C) following IUCN Red List criteria (IUCN, 2001; IUCN Standards and Petitions Working Group, 2008). The threat to the species is limited if Madidi National Park is respected, but several places within the dry forest area are at risk of fragmentation as a result of increasing cattle and farming activities. So far *P. madidiana* has been collected in three different settings, first on the upper slopes and ridges where the vegetation is somewhat stunted and dominated by *Tabebuia aurea* (Silva Manso) Benth. & Hook. f. ex S. Moore, *Jacaranda mimosifolia* D. Don, *Hymenaea courbaril* L., *Pseudobombax septenatum* (Jacq.) Dugand, *P. longiflorum* (Mart. & Zucc.) A. Robyns, *Aralia soratensis* Marchal, *Anadenanthera colubrina* (Vell.) Brenan, *Trichilia elegans* A. Juss., *Agonandra excelsa*



Figure 2. Flowering branch of *Passiflora madidiana* P. Jørg., Cayola & Araujo-Murakami, from the type Araujo-Murakami et al. 2599. Photograph by A. Araujo-Murakami.

Griseb., *Astronium urundeuwa* (Allemão) Engl., and *A. fraxinifolium* Schott ex Spreng. The new species has also been found in taller semideciduous forest with a canopy height of 15–20 m dominated by *Anadenanthera colubrina*, *Tabebuia impetiginosa* (Mart. ex DC.) Standl., *Phyllostylon rhamnoides* (J. Poiss.) Taub., *Astronium urundeuwa*, *Machaerium scleroxylon* Tul., *Acacia riparia* Kunth, *Allophylus edulis* (A. St.-Hil., Cambess. & A. Juss.) Radlk., *Ceiba boliviana* Britten & Baker f., *Ximenia americana* L., and *Zanthoxylum fagara* subsp. *lentiscifolium* (Humb. & Bonpl. ex Willd.) Reynel as emergent and canopy-forming species, with an understory composed of *Trichilia catigua* A. Juss., *Amyris* P. Browne, *Ruprechtia apetala* Wedd., *Maytenus cardenasii* Rusby, and *Urera baccifera* (L.) Gaudich. ex Wedd., and in some places dominated by *Chusquea* Kunth and three species of Cactaceae—*Praecereus euchlorus* (F. A. C. Weber) N. P. Taylor, *Cereus tacuaralensis* Cárdenas, and *Opuntia brasiliensis* (Willd.) Haw. The third

location was a semideciduous dry forest on slopes dominated by *Anadenanthera colubrina*, *Oxandra espinosa* (Spruce ex Benth.) Baill., *Phyllostylon rhamnoides*, *Machaerium scleroxylon*, and *Capparis polyantha* Triana & Planch.

Phenology. *Passiflora madidiana* has been found with flowers and fruits from late November to early December and in fruit in February. The new species seems to be synchronized with the pronounced changes in temperature and humidity of the rainy season, which starts with torrential rains in November and lasts until March–April.

Etymology and history of discovery. The new species is named after the Madidi National Park, one of the world's most biodiverse protected areas (WCS Bolivia, 2007). *Passiflora madidiana* was first collected in 2003 by Cayola near Sipia in the Madidi National Park; the material consisted only of two

branches and a single immature fruit, but we were already convinced then that the material represented a new species. It was not until 2005, however, when a more concentrated collecting effort took place in the dry forest along Río Tuichi that more and fully flowering material was collected by Araujo-Murakami.

Diagnostic characters and possible relationships. *Passiflora madidiana* is difficult to key to series within the subgenus *Passiflora* L. (named subgenus *Granadilla* (Mill.) Rchb.) in the most recent monograph treatment of Passifloraceae (Killip, 1938). The species has mostly entire leaves, but 2- and 3-lobed leaves are found, which makes it difficult to fit it within series *Simplicifoliae* sensu Killip (1938), characterized by entire leaves. In the series with 3-lobed leaves, *Lobatae* sensu Killip (1938) and *Menispermifoliae* Killip ex Cervi, it stands out by either being densely puberulent (if placed in *Lobatae*) or not having the dense hirsute pubescence of *Menispermifoliae*.

Species of series *Lobatae* are glabrous except for *Passiflora gardneri* Mast., and *P. madidiana* clearly differs from that species by having mostly entire semicoriaceous leaves versus 3-lobed membranous leaves. The stipules of *P. madidiana* are five times longer and two times wider than in *P. gardneri*, and the leaves are only half as wide. *Passiflora madidiana* has only three corona series versus four to five in *P. gardneri*, but the outer corona is twice as long. The two species do not appear to be closely related.

In series *Simplicifoliae*, *Passiflora madidiana* keys to *P. actinia* Hook., *P. jilekii* Wawra, or *P. mapiriensis* Harms in Killip (1938). *Passiflora mapiriensis* is found only about 115 km south of the Tuichi drainage, but differs from *P. madidiana* by being a glabrous species with a pubescent ovary; smaller lanceolate stipules that are early deciduous; bracts that are much larger and lanceolate, cuneate, and acuminate; and a corona of four or five series and larger for all series, but with the awn of the sepal smaller. The Brazilian species *P. actinia* and *P. jilekii* differ from *P. madidiana* by being glabrous. *Passiflora madidiana* further differs from *P. actinia* in its narrower leaves, obtuse bracts that are about half the size, much smaller flowers, the corona in fewer series, and the markedly different coloration of the corona; it can be distinguished from *P. jilekii* by its smaller and more membranous leaves, shorter peduncles, and much longer awn.

In series *Menispermifoliae*, *Passiflora madidiana* will key to *P. crassifolia* Killip, a species from Junín, Peru, found at similar elevations but in humid vegetation (T. Boza, pers. comm.). This species is very similar to *P. madidiana* in general appearance, and it is the only member of the series with entire

leaves; however, it differs from *P. madidiana* in a number of characteristics, particularly in being puberulent versus densely villous, having stipules that are twice as large and bracts that differ in pubescence and shape, and most noticeably in the outer corona, which is almost 2 cm long in *P. madidiana* versus only 7 mm long in *P. crassifolia*.

The discovery of *Passiflora madidiana* and the postulated relationships with *P. crassifolia*, *P. jilekii*, *P. actinia*, and *P. mapiriensis* suggest that both series *Simplicifoliae* and series *Menispermifoliae* are in need of taxonomic rearrangement. The new species is placed in section *Granadillastrum* Triana & Planch. (Feuillet & MacDougal, 2003), which includes all the series and species discussed above.

Paratypes. BOLIVIA. **La Paz:** Franz Tamayo, Parque Nac. y Área Natural de Manejo Integrado Madidi, Sect. Pintata próx. al Río Tuichi entre Virgen del Rosario y Suyo Suyo, 14°26'34"S, 68°34'47"W, 4 Dec. 2005 (fl., fr.), A. Araujo-Murakami, A. Fernandez & S. Paredes, E. Cuevas & C. Cuevas 2574 (LPB); Sect. Pintata próx. a la comun. de Sipia entre Virgen del Rosario y Suyo Suyo, 14°28'06"S, 68°32'19.7"W, 19 Feb. 2003 (fr.), L. Cayola, A. Araujo, H. Cabrera, M. Calzadilla, F. Canqui, C. Maldonado, N. Paniagua, R. Alvarez, A. Alvarez & M. Alvarez 3 (LPB, MO); Sect. Pintata próx. al Río Tuichi entre Virgen del Rosario y Suyo-suyo, 14°26'34"S, 68°34'47"W, 4 Dec. 2005 (fr.), A. Araujo-Murakami, A. Poma, P. Garagorri, S. Paredes & E. Cuevas 2420 (LPB).

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