



Article

***Pitcairnia frequens* (Bromeliaceae), a neglected new species from Morro dos Seis Lagos, Amazonas, Brazil**

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Abstract

This paper formally describes a *nomem in schedulum* for a *Pitcairnia* endemic to Morro dos Seis Lagos, São Gabriel da Cachoeira, Amazonas in North Brazil. It was first collected by Cyl Farney in 1987 in “Projeto Flora Amazônica”. The duplicate sent to New York Botanical Garden Herbarium was later annotated as *Pitcairnia frequens* by L. B. Smith and B. Holst, however it was never described and published.

Key words: Amazon, Guyana Shield, Neotropic, Pitcairnioideae

Introduction

Pitcairnia is a large and well distributed genus of Bromeliaceae; a Neotropical family that has its diversity related to high places in South America (Smith & Downs 1974, Martinelli *et al.* 2008). The genus has 391 accepted names (The Plant List 2010), and among these, 53 species occurs in Brazil and 17 in Brazilian Amazon (Forzza *et al.* 2012). It is generally associated with rivers and elevated places, such as inselbergs and tepuis (Smith & Downs 1974, Benzing 2000).

The hill Morro dos Seis Lagos is part of the Guyana Shield. This hill emerges above 300 m elevation, within the Amazon floodplains, and is covered with a reddish lateritic crust. It covers an area of ca. 20 km², and is located 60 km northeast of São Gabriel da Cachoeira, Amazonas, Brazil. This area covers the Ya river basin, one of the main tributaries of the river Cauaburi, watershed of the upper Rio Negro (Projeto Radambrasil 1976). These types of isolated outcrops have been separated from the surrounding vegetation, and shelter different vegetation physiognomies, providing different ecological conditions (Porembski & Barthlott 2000). Thin soils support trees that lodge between the laterite blocks, and form a canopy at 10–15 m on the undulating plateau. This forest has a structure more typical of the forests found on white sand soils than true wet forest (Bush *et al.* 2004).

Material & Methods

Morro dos Seis Lagos was visited in October 1987 by “Projeto Flora Amazônica”. A new Bromeliaceae species was collected by Cyl Farney and annotated on the specimen by Lyman Smith and Bruce Holst as *Pitcairnia frequens* (NY 329217); nevertheless this taxon was never published, being a *nomem in schedulum*. This specie was collected again in August 2011 by Deisy Saraiva in an excursion organized by “Projeto Fronteiras”.

The anatomy analyses were performed freehand in resin. For embedding in resin, cross sections from the middle region of an intermediate healthy leaf blade were initially fixed in 70% ethanol, dehydrated in an increasing ethanol series, and embedded in resin hydroxyethyl metacrylate. Cross sections approximately 3 m thick were obtained using a Spencer rotary microtome, and stained with Toluidine blue (O’Brien & McCully

1981). For freehand, the cross sections were stained with 1% Astra Blue and 0.125% basic fuchsin (Kraus *et al.* 1998). Then, they were mounted between a slide and cover-slip with 50% glycerin. These slides were analyzed and recorded in a bright-field Olympus BX50 optical microscope using an attached Coolsnap digital camera.

The anatomical description followed Tomlinson's nomenclature (1969), and the morphological concepts followed Smith & Downs (1974), Scharf & Gouda (2008) and Radford *et al.* (1974).

Taxonomy

Pitcairnia frequens L.B.Sm. & B. Holst ex Saraiva & Forzza *sp. nov.* (Fig. 1–4)

Pitcairnia frequens is related to *P. armata* Maury (1889: 270) and *P. maguirei* Smith (1960: 17) chiefly because its linear and serrate leaves, sessile flowers, unappendaged petals, included stamens and style, and alate seeds. However *P. armata* has its leaf-sheaths broadly ovate that form a pseudobulb; upper peduncle bracts entire; sepals asymmetrical, alate-carinate and its pale green petals. *P. maguirei* differs by its nerved floral bracts, with a narrow pale margin; 4 cm long sepals; 6 cm long and pale green petals.

Type:—BRAZIL. Amazonas: São Gabriel da Cachoeira, Morro dos Seis Lagos, Lago do Dragão, 66°40' 59"W, 0°17' 11"N, 27 August 2011, (fl.), M.H. Terra-Araujo, F.M. Costa, M.M.P. Souza, S.M. Esteves, C.R. Boelter, J. Meirelles, C.E. Zartman, A.M. Silveira & D.P. Saraiva 221 (Holotype: RB!, isotype: INPA!).

Plant saxicolous, propagating by slender rhizomes, the flowering stem ca. 133 up to 200 cm tall. Leaves rosulate, arched-recurving, monomorphic, thinly coriaceous; sheaths ovate, ca. 4–22 × 7–25 mm, brownish-green, nearly glabrous, entire; blades linear, not narrowed at base, persistent, arched-recurving, 89–112 × 1–1.8 cm, nerved, green, densely white lepidote, apex acuminate, margins densely spinose; spines brown, complanate, antrorse, 1–1.3 mm long. Inflorescence erect, ca. 95–130 cm long, distinctly exceeding the leaves. Peduncle 5–8 mm diam., greenish-red, white floccose distally but soon sparsely so; peduncle bracts, the basal ones foliaceous and distinctly exceeding the internodes, the upper ones narrow triangular-lanceolate, acuminate, erect, shorter than the internodes, 2.1–4 × 0.6–1.1 cm, green, woolly white lepidote. Fertile part of the inflorescence simple (spike) or few-branches laxly arranged, erect, 30–60 cm long, the rachis slightly stout, 5–7 mm diam., terete, pinkish-red, soon glabrous. Floral bracts ovate-lanceolate, acute, 6–7 × 4 mm, entire, thin in texture, pinkish-red, spreading, glabrous, shorter than the sepals. Flowers, ca. 60–160, 25–30 mm long, subdensely arranged, spreading at anthesis and afterwards, sessile, actinomorphic. Sepals narrowly triangular-lanceolate, ecarinate, acuminate, erect, 16–18 × 4 mm, pinkish-red, glabrous. Petals spatulate, acuminate, ca. 27 × 5 mm, pinkish-red, erect except for the slightly recurved apex, unappendaged, glabrous. Stamens shorter than the petals, free; filaments white; anthers linear, 5–6 mm long, attached near the base, the base bifid, the apex obtuse, yellow. Stigma capitate, spirulate, conduplicated, included at anthesis, the stigmatic lobes pinkish-red. Ovary fusiform, 4/7 superior, glabrous, placentation axilar. Ovules many, winged. Fruits a capsule, seeds winged.

Anatomy:—The adaxial and abaxial surfaces are smooth (Fig. 2A). A uniseriate epidermis covers the leaf. The internal periclinal cell walls have secondary thickenings on both the adaxial and abaxial surfaces. There are U-shaped thickenings on these walls (Fig. 2C). Peltate scales are present on the adaxial and abaxial epidermis. The number of stalk cells is five (Fig. 2E). The leaf is hypostomatic, and subsidiary and guard cells are placed at the same level of the epidermis (Fig. 2D). Two layers of sclerenchymatic hypodermis, with secondary thickenings, are present in the adaxial and abaxial mesophyll portions (Fig. 2C,D). An aquiferous hypodermis with thin cell walls is found essentially in the adaxial portion. This hypodermis has rounded cells (Fig. 2A). Palisade chlorenchyma is present giving the appearance of an abrupt transition between the aquiferous tissue and the chlorenchyma. Chlorenchymatic inter-vascular cells are short-armed cells with less-

distinct air lacunae (Fig. 2A). The vascular bundles are collateral, with smaller or larger gauges. These vascular bundles are surrounded by sclerenchymatic sheaths. These sheaths are in direct contact with aquiferous hypodermis, in both adaxial and abaxial positions. Fibers are present in the phloem (Fig. 2B).

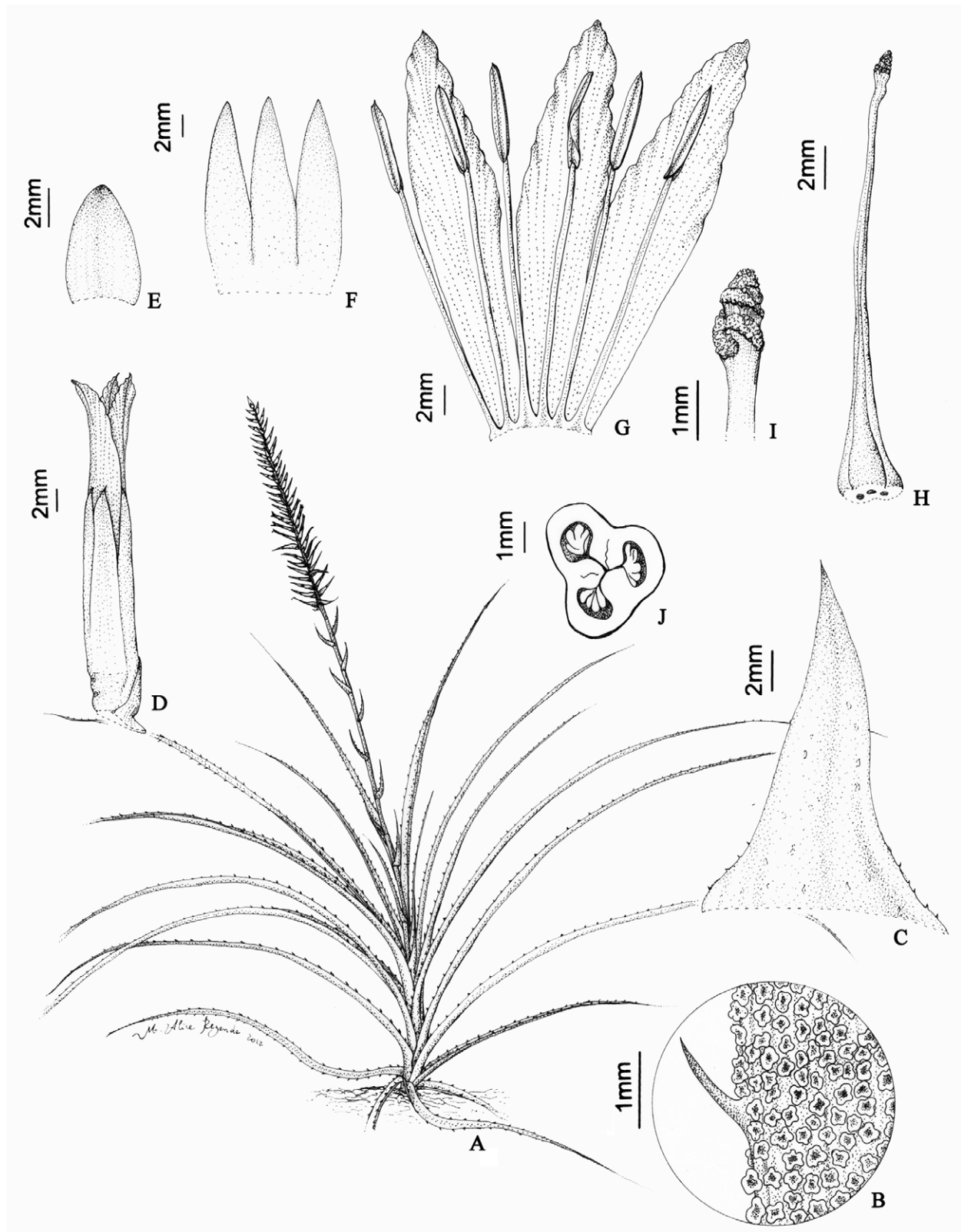


FIGURE 1. Habit of *Pitcairnia frequens*. **A.** Flowering habit. **B.** Detail of spine and scales in adaxial surface. **C.** peduncle bract. **D.** Flower with floral bracts. **E.** Floral bract. **F.** Sepals. **G.** Petal and androecium. **H.** Gynoecium. **I.** Stigma. **J.** Transversal cut of ovary, showing its axial placentation.

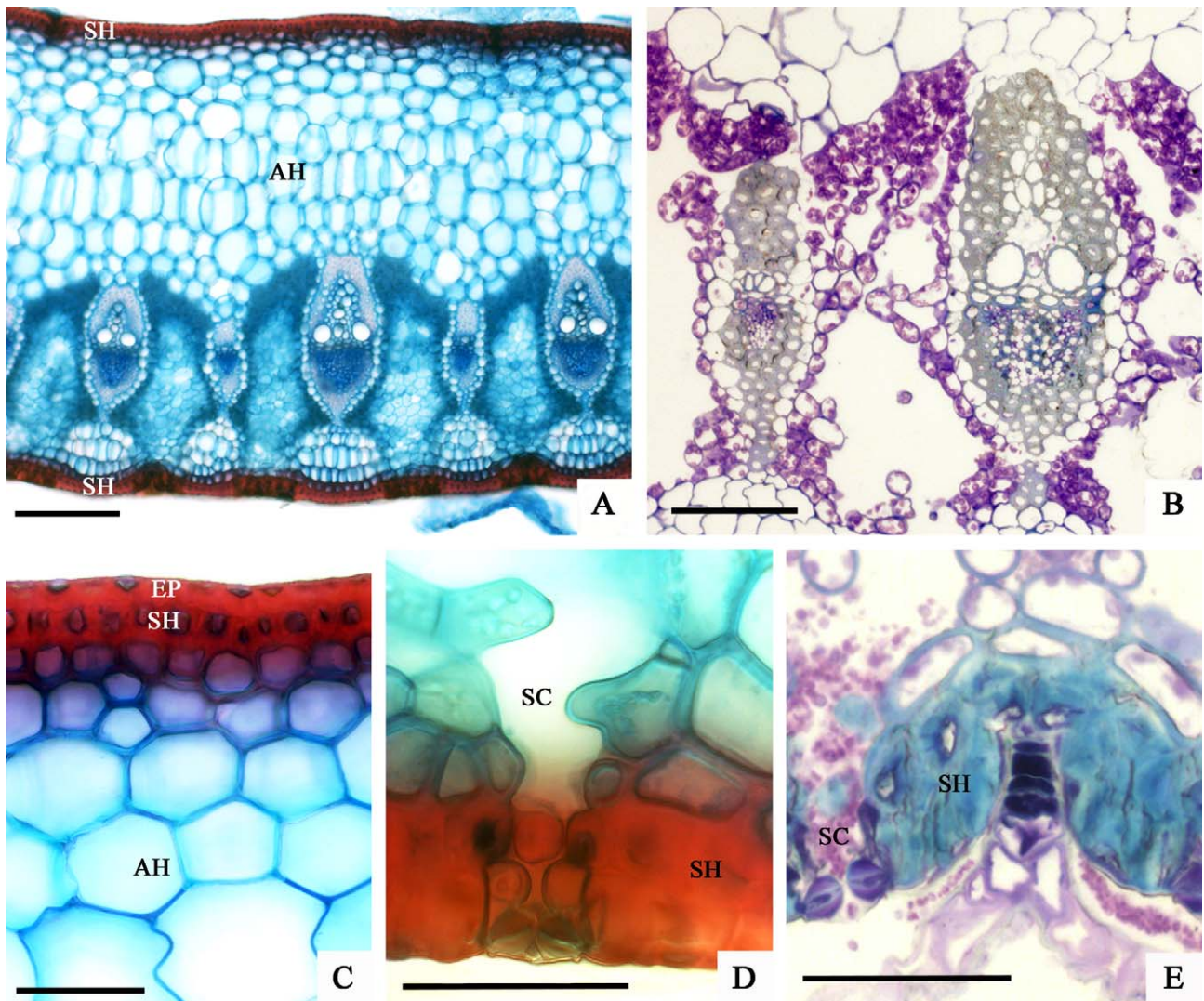


FIGURE 2. Micrographs of *Pitcairnia frequens* in cross section. **A.** General aspect of the leaf with smooth adaxial and abaxial contour, and abrupt transition between the aquiferous tissue and the chlorenchyma. **B.** Sclerenchymatic sheaths surrounding the vascular bundles and phloem fibers. **C.** Adaxial epidermises, sclerified hypodermis, and aquiferous hypodermis. **D.** Stomata on abaxial epidermis. **E.** Pedicel of a peltate scale on abaxial surface. AH-aquiferous hypodermis, EP-epidermis, SC-substomatal chamber, SH-sclerified hypodermis. Scale bars: A-200 mm; B-100 mm; C, D, E-50 mm.

Paratype:—BRAZIL. Amazonas: São Gabriel da Cachoeira, Morro dos Seis Lagos, Lago do Dragão, 400–450 m, 14 and 15 October 1987 (fl.), W.A. Rodrigues, D.C. Daly, P.J.M. Maas, D.W. Stevenson, R.P. de Lima, J.F. Ramos & J.C. Oliveira & C. Farney 1712 (NY!, RB! [2 sheets])

Etymology:—The name given by L.B. Smith is related with the high frequency of the species in the herbaceous strata of the hill top.

Distribution and Habitat:—*Pitcairnia frequens* is an endemic species of the Morro dos Seis Lagos top in São Gabriel da Cachoeira, Amazonas, Brazil—Amazonian domain (Fig. 4). The undulating plateau of the hill has six lakes, and the *Pitcairnia* is growing near the Lakes Dragão and Verde as a rupicolous plant on sun-exposed surfaces or in places slightly shaded by shrubs (Fig. 3).

Conservation status:—According to the IUCN Red List (IUCN 2011), the species should be treated as least concern (LC). Due to its large population size growing at the top of a difficult to access hill, and for its placement in the intersection of three protected areas: Pico da Neblina National Park, Morro dos Seis Lagos Biological Reserve, and Balaio Indigenous Park (Fig. 4).

Note:—The latest voucher (Saraiva 221) was chosen here to be the holotype instead of the oldest, sent to New York Botanical Garden Herbarium (Farney 1712), and appointed by L.B. Smith & B. Holst as new species. This decision was taken to ensure a more detailed description of the species.

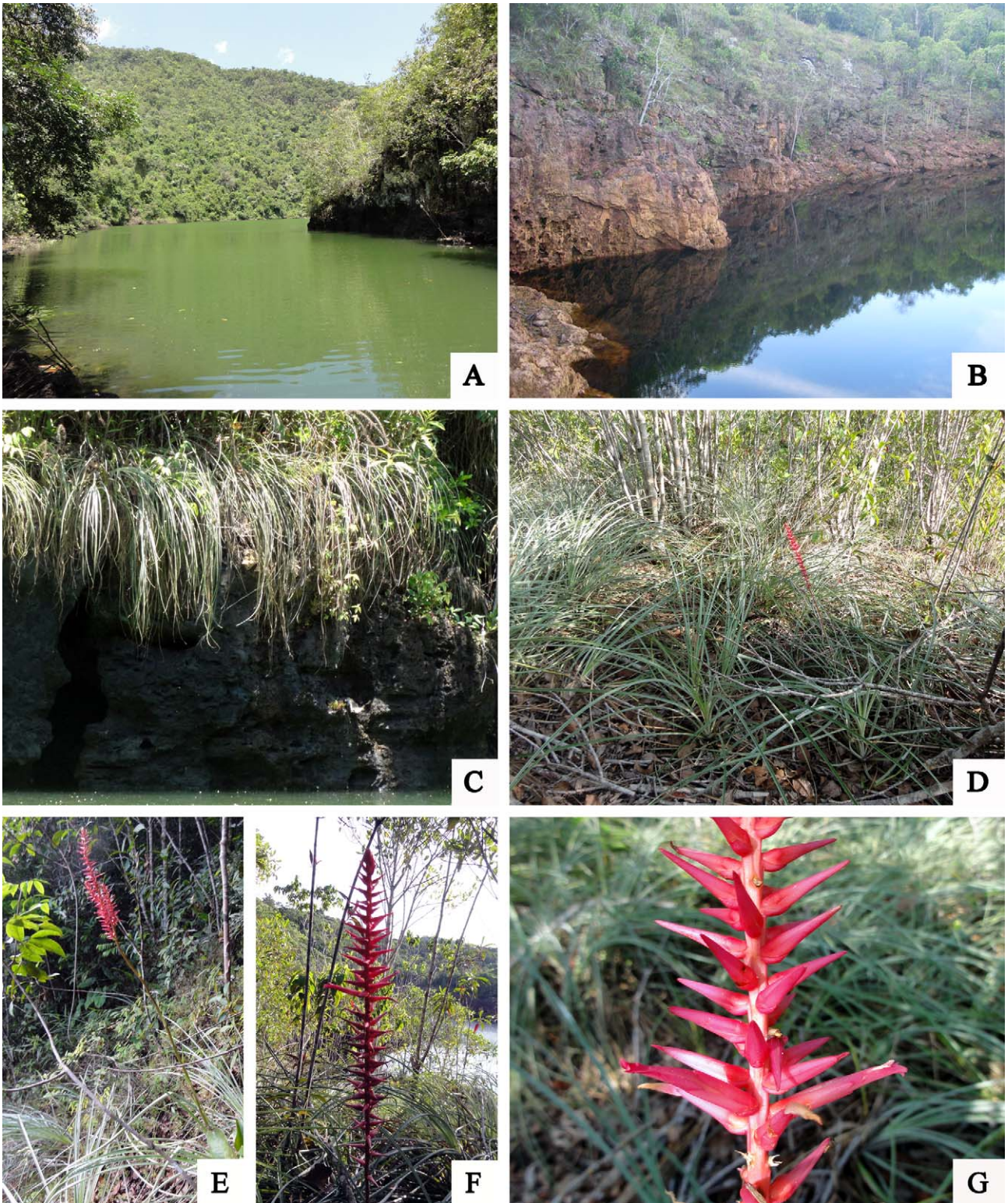


FIGURE 3. *Pitcairnia frequens* occurrence places at Morro dos Seis Lagos and inflorescences details. **A.** Verde Lake. **B.** Dragão Lake. **C.** Rupicolous population in the Verde Lake. **D.** Population between shrubs near Dragão Lake. **E.** Compound inflorescence. **F.** Simple inflorescence. **G.** Spreading flowers.

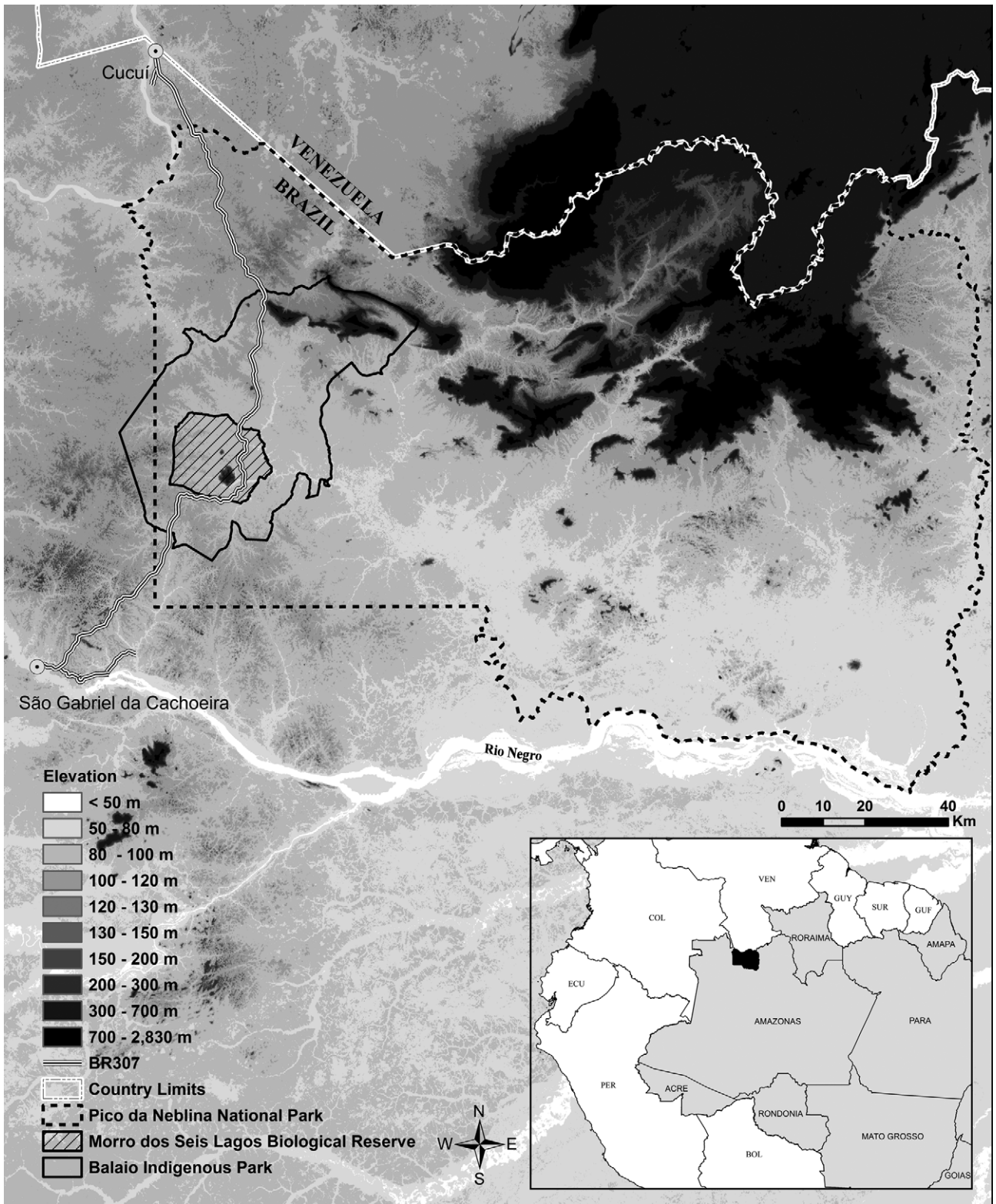


FIGURE 4. Intersection of the three areas of protection that include the Morro dos Seis Lagos (Hill of the Six Lakes). The large and darkest spot into Morro dos Seis Lagos Biological Reserve represents Morro dos Seis Lagos. It is near BR-307 that connects the municipalities of São Gabriel da Cachoeira to Cucuí.

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Bibliography

- Benzing, D.H. (2000) *Bromeliaceae: Profile of an adaptive radiation*. Cambridge University Press, Cambridge, 639 pp.
- Bush, M.B., De Oliveira, P.E., Colinvaux, P.A., Miller, M.C. & Morenov, J.E. (2004) Amazonian paleoecological histories: one hill, three watersheds. *Palaeogeography, Palaeoclimatology, Palaeoecology* 214: 359–393.
- Forzza, R.C., Costa, A., Siqueira Filho, J.A., Martinelli, G., Monteiro, R.F., Santos-Silva, F., Saraiva, D.P. & Paixão-Souza, B. (2012) *Bromeliaceae*. In: *Lista de espécies da Flora do Brasil*. Jardim Botânico do Rio de Janeiro. Available from: <http://floradobrasil.jbrj.gov.br/2012/FB006307> (accessed: 23 May 2012).
- IUCN (2011) *Guidelines for Using the IUCN Red List Categories and Criteria. Version 9.0*. Prepared by the Standards and Petitions Subcommittee. Available from: <http://www.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed: 10 July 2012).
- Kraus, J.E., Sousa, H.C., Rezende, M.H., Castro, N.M., Vecchi, C. & Luque, R. (1998) Astra blue and basic fuchsin double staining of plant materials. *Biotechnic & Histochemistry* 73: 235–243.
- Maury, P.J.B. (1889) Énumération des plantes du Haut-Orénoque. *Journal de Botanique* 3: 266–273.
- Martinelli, G., Vieira, C.M., Gonzalez, M., Leitman, P., Piratininga, A., Costa, A.F. & Forzza, R.F. (2008) Bromeliaceae da Mata Atlântica brasileira: lista de espécies, distribuição e conservação. *Rodriguésia* 59: 209–258.
- O'Brien, T.P. & McCully, M.E. (1981) *The study of plant structure: Principles and selected methods*. Thermancarphi, Melbourne, 357 pp.
- Porembski, S. & Barthlott, W. (2000) *Inselbergs: biotic diversity of isolated rock outcrops in tropical and temperate regions*. Springer, Berlin, 146 pp.
- Projeto Radambrasil (1976) *Folha NA. 19 - Pico da Neblina: geologia, geomorfologia, pedologia, vegetação e uso potencial da terra*. Levantamento de Recursos Naturais, Rio de Janeiro, 380 pp.
- Radford, A.E., Dickison, W.C., Massey, J.R. & Bell, C.R. (1974) Phytography-Morphological Evidence. In: Radford, A.E., Dickison, W.C., Massey, J.R. & Bell, C.R. (eds.) *Vascular Plant Systematics*. Harper & Row, New York, pp. 83–166.
- Scharf, U. & Gouda, E.J. (2008) Bringing Bromeliaceae Back to Homeland Botany. *Journal of the Bromeliad Society* 58(3):123–129.
- Smith, L.B. (1960) Bromeliaceae. In: Maguire, B. & Wurdack, J.J., Botany of the Guayana Highlands - Part IV. *Memoirs of The New York Botanical Garden* 10: 17.
- Smith, L.B. & Downs, R.J. (1974) Bromeliaceae (Pitcairnioideae). In: *Flora Neotropica Monograph* 14 (1). Hafner Press, New York, 1–660 pp.
- The Plant List (2010) *Version 1*. Royal Botanic Gardens, Kew and Missouri Botanical Garden. Available from: <http://www.theplantlist.org/> (accessed: 30 July 2012).
- Tomlinson, P.B. (1969) Commelinales-Zingiberales. In: *Anatomy of the Monocotyledons* III. Oxford University Press, Oxford, pp. 193–294.