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Plagiochila lamyana, a new liverwort species from the Guayana Highland of Brazil

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Abstract – The liverwort *Plagiochila lamyana* Gradst. & D.P.Costa sp. nov. is described from Mount Roraima National Park, Brazil. The new species is a member of *P.* sect. *Adianthoideae* and differs from other species in this group by the narrowly elongate leaves with a bifid apex and subentire margins, large radiating trigones and opposite male bracteoles not overlapping. The new species is a further addition to the rich endemic flora of the Guayana Highland.

***Plagiochila* section *Adianthoideae* / Brazil / Plagiochilaceae / liverworts / morphology / Mount Roraima / taxonomy**

INTRODUCTION

Plagiochila (Dumort.) Dumort. (Plagiochilaceae) is the largest genus of the liverworts (Marchantiophyta) with about 400-450 species worldwide (Heinrichs, 2002). About 135 species have been recorded from Brazil (Gradstein, 2015b) but many of these are now considered synonyms (e.g., Heinrichs, 2002; Heinrichs & Gradstein 2000; Heinrichs *et al.*, 1998, 1999, 2000, 2001, 2004, 2005; Gradstein, 2015a). Currently, 34 species are accepted for Brazil (http://floradobrasil.jbrj.gov.br/reflora/floradobrasil/FB97735; Gradstein, 2015b). Most of these are widely distributed in tropical America, three species are restricted to Brazil and the West Indies and adjacent coastal areas (*P. husnotii* Steph., *P. lingua* Steph., *P. subbidentata* Taylor), one is known from Brazil and Colombia (*P. subundulata* Lindenb.; Gradstein *et al.*, 2016), and two species, *P. flabelliflora* Steph. and *P. olivacea* Steph., are endemic to Brazil.

An unusual species of *Plagiochila*, which appears to be undescribed, was collected by the second author during a recent botanical exploration of Mount Roraima National Park, northern Brazil (Coelho *et al.*, 2015). The new species stands out by narrowly elongate leaves with a bifid apex, subentire leaf margins, ampliate ventral leaf bases and leaf cells with large, radiating trigones. It is a pleasure to dedicate the new species to our colleague and friend Denis Lamy in honor of his important contributions to bryology.

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TAXONOMIC DESCRIPTION

Plagiochila lamyana Gradst. & D.P.Costa., **sp. nov.** **Figs 1-6**

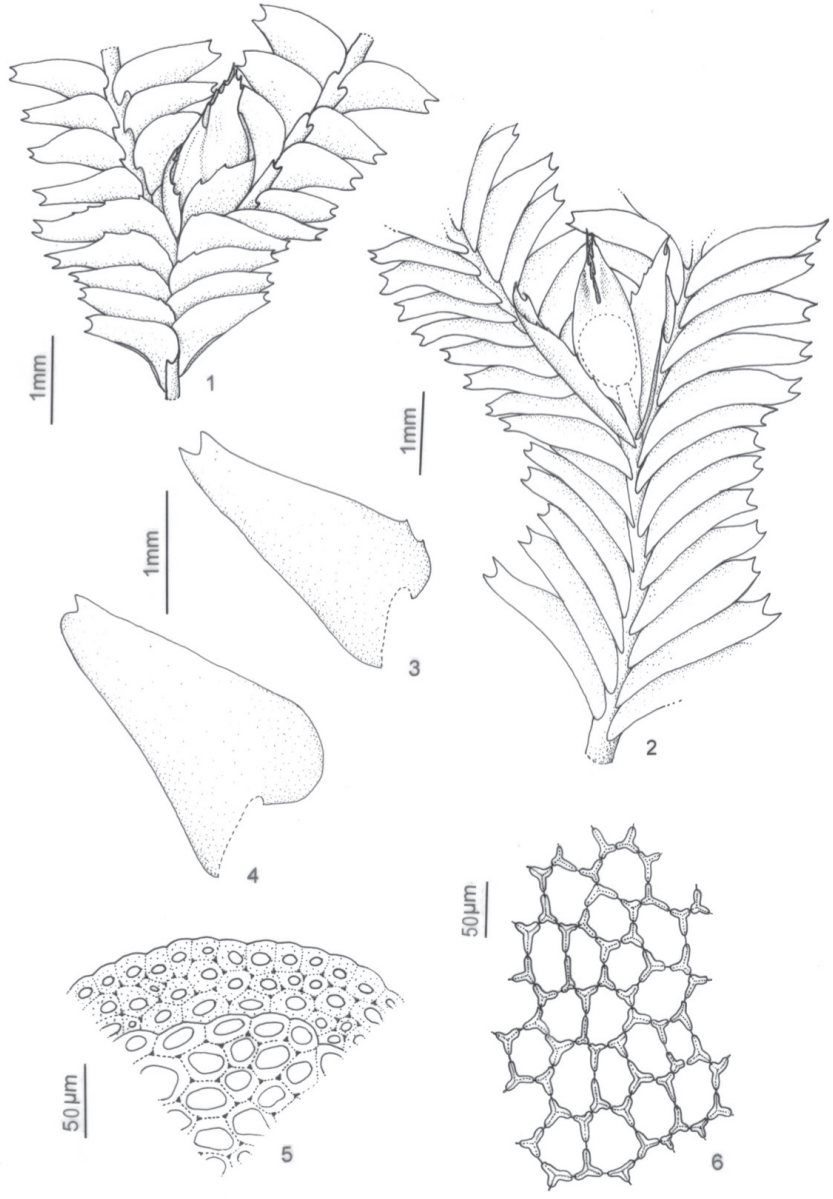
Characterized by: 1) plants 3-4 cm long, 3.5-5 mm wide, branches few, lateral-intercalary; 2) leaves horizontally spreading, ampliate, narrowly elongate, (2-2.5× as long as wide) with a bifid apex, subentire leaf margins and shortly decurrent leaf bases; 3) midleaf cells 25-35(-40) µm wide, vitta absent, cuticle smooth; 4) androecia intercalary and with overlapping opposite bracts; 5) female bracts covering the lower half of the perianth; 6) vegetative reproduction absent.

Type. Brazil, Roraima State, Uiramutã, Parque Nacional do Monte Roraima, summit area of Mt. Caburaí, 5°10'22"N 60°12'57"W, on trunk base in woodland, 1316 m, November 2014, *D.P. Costa et al. 6018*, c. gyn. & andr. (**holotype**: RB!; **isotype**: PC!). **Paratypes**: same general locality and habitat, *D.P. Costa et al. 6011 p.p., 6065, 6068, 6084 p.p., 6142 p.p* (RB!).

Plants relatively robust, 3-4 cm long, 3.5-5 mm wide, brown, sparsely branched, branches lateral-intercalary, leafy stems arising from a creeping, rhizome-like shoot. **Stems** rigid, *ca* 0.25 mm in diameter, in cross section oval, 8-10 cells high, with a dark brown, 2-3-layered cortex of very thick-walled cells surrounding a hyaline, thinner-walled medulla with pale brown cell walls. **Leaves** imbricate, alternate, narrowly elongate triangular, 2-3 × 1-1.3 mm, 2-2.5× longer than wide, horizontally and obliquely to widely spreading, straight to falcate, apex shortly bifid, the apical teeth 2-4 cells wide and 4-8 cells long, straight or diverging, sinus wide, tip cell of the teeth frequently broken; dorsal leaf margin convex and decurved, entire, ventral leaf margin plane, entire or with 1-4 scattered teeth, the teeth 1-2 cells long, made of thick-walled cells, the upper cell narrowly elongate; dorsal and ventral leaf bases shortly decurrent, entire, ventral bases weakly ampliate on branches, more strongly ampliate on main stems and covering the ventral stem surface but not forming a crest; dorsal leaf insertion line reaching the midline of stem; leaves on rhizomatous shoots very small, broadly ovate, shallowly bifid. **Leaf cells** isodiametrial to subrectangular, 35-60 × 30-40 µm in midleaf, walls strongly thickened, cells at leaf margin smaller and mostly rectangular, 35-75 × 25-35 µm, towards leaf base slightly larger but forming a vitta, all cells with large, radiating trigones and narrow pits, longer walls ca. 10 µm thick, intermediate thickenings absent, cuticle smooth. **Underleaves** present near shoot apex, small, linear or laminate, bifid to trifid, underleaves absent on mature shoots; paraphyllia absent; rhizoids not seen. **Male plants** as large as female plants or somewhat smaller; androecia simple, usually intercalary, bracts in 3-7 pars, much smaller than normal leaves, ovate-triangular, bract lobe *ca* 0.8 × 0.6 mm, apex acute-acuminate, ventral margin with 4-6 small teeth, dorsal margin with 1-2 small teeth, bract lobule small, inflated, containing 1(-2) antheridia; opposite bracts dorsally not overlapping. **Gynoecia** terminal on long stems, with a long subgynoecial innovation, bracts clasping the perianth, broader than normal leaves and with a more strongly toothed ventral margin; perianth shortly exserted, ovate-oblong, inflated, with two weak lateral keels, mouth not seen (broken). **Mature sporophyte** not seen.

Distribution and ecology: *Plagiochila lamyana* is known only from the summit area of Mt. Caburaí (1456 m) in Mount Roraima National Park, Roraima State, northern Brazil (Figs 7-10). The species was found growing as an epiphyte on trunk bases in summit woodlands rich in "tepui" elements (Coelho *et al.*, 2015), at elevations between 1300-1400 m. The summit of Mt. Caburaí was accessed by helicopter from the municipality of Uiramutã; approximately 120 bryophyte

collections were made in the summit area. Common bryophyte species included *Cheilolejeunea trifaria* (Reinw. *et al.*) Mizut., *Herbertus pensilis* (Taylor) Steph., *Odontoschisma variabile* (Lindenb. & Gottsche) Trevis., *Riccardia fucoidea* (Sw.) Schiffn., *Squamidium brasiliensis* Broth. and *Syrrhopodon gaudichaudii* Mont.



Figs 1-6. *Plagiochila lamyana* Gradst. & D.P.Costa. **1, 2.** habit of female plant, ventral view. **3.** portion of stem in cross section. **4, 5.** leaves. **6.** midleaf cells. All drawn from the holotype.




Figs 7-10. Locality and habitat of *Plagiochila lamyana*. **7.** Mount Caburaí viewed from the air. **8.** The summit area of Mt. Caburaí, showing summit woodlands and herbaceous fields of *Stegolepis* (Rapataceae). **9.** *Stegolepis* field with summit woodland in the background**. 10.** Interior of summit woodland; *Plagiochila lamyana* grows here on trunk bases.

DISCUSSION

Plagiochila lamyana is characterized by the narrowly elongate leaves (2-2.5× as long as wide) with a bifid apex, subentire leaf margins, ampliate ventral leaf bases, and leaf cells with large, radiating trigones. The new species was previously identified as *Vanaea plagiochiloides* (Inoue & Gradst.) Inoue & Gradst. (Costa, 2015), a species endemic to Mt. Roraima and the only member of the genus *Vanaea* Inoue & Gradst. (Jamesoniellaceae). Although superficially similar to *Plagiochila*, this genus differs from *Plagiochila* by having laterally inserted leaves with the insertion line not extending to the dorsal midline, a flat dorsal leaf margin, leaf bases not decurrent and an inflated, plicate perianth.

Plagiochila lamyana approaches *P. bicornis* Hampe *et* Gottsche (= *P. herminieri* Steph.), a species widely distributed in the West Indies, but the latter species has much less elongate leaves, *ca* 1-1.5× longer than wide, smaller trigones and opposite male bracts dorsally overlapping (Heinrichs, 2002, as *P. herminieri* Steph.). *Plagiochila bicornis* is a member of *P.* sect. *Adianthoideae* Lindenb., a small neotropical group of five species (*P. adianthoides* (Sw.) Lindenb., *P. bicornis*, *P. cristata* (Sw.) Lindenb., *P. grandicrista* Steph., *P. olivacea*) characterized by intercalary branching, horizontally spreading leaves with an ampliate ventral base and without vitta, midleaf cells *ca* 25-35(-40) µm wide, androecia intercalary and with overlapping opposite bracts, and female bracts covering the lower half of the perianth (Heinrichs, 2002). Morphologically, *Plagiochila lamyana* fits the *Adianthoideae* quite well and is therefore placed in this section. The species of *P.* sect. *Adianthoideae* are keyed out as follows:

1. Leaves ovate-oblong, with a broadly rounded apex. Leaf margin with a yellowish border of thicker-walled cells. Widespread in tropical America but not yet known from Brazil ..... *P. adianthoides*
1. Leaves mostly ovate-triangular, with a rather narrow apex. Leaf margin without border of thicker-walled cells 2
2. Mature stem leaves 1.8–2.5× longer than wide. Leaf apex bifid 3
2. Mature stem leaves 1.2-1.8× longer than wide. Leaf apex bifid or not bifid .. 4
3. Leaves subentire, ventral margin with 0-4 teeth, ventral base entire. Guayana Highland ..... *P. lamyana*
3. Leaves strongly toothed, ventral margin with more than 4 teeth, ventral base toothed. Widespread in tropical America ..... *P. cristata*
4. Stem leaves with less than 7 teeth, apex bifid. West Indies ..... *P. bicornis*
4. Stem leaves usually with more than 7 teeth, apex not bifid 5
5. Ventral leaf bases weakly ampliate, not forming a crest. SE Brazil ... *P. olivacea*
5. Ventral leaf bases strongly ampliate, forming a high crest. Mexico to Peru ..... *P. grandicrista*

Mount Roraima National Park is part of the "Pantepui" region of northern South America, or Guayana Highland. This region includes about 50 table mountains, or "tepuis", made of precambrian sandstone and reaching to *ca* 1000-3000 m in elevation. These mountains rise as isolated, continental islands from surrounding lowland tropical rainforest or savannas and are inhabited by a unique flora and fauna, rich in endemic taxa (e.g., Berry *et al.*, 1995-2005; McDiarmid & Donnelly, 2005). About one third of all species of vascular plants of the Guayana Highland are endemic and many of them are found on one single tepui only (Berry & Riina, 2005). Bryophyte endemism, even though being much lower than in vascular plants, amounts to about 10% in liverworts making the Guayana Highland the second most important center of bryophyte endemism in the Neotropics, after the northern Andes (Gradstein *et al.*, 2001; Desamoré *et al.*, 2010). Seven liverwort genera are endemic or sub-endemic to the Guayana Highland and the region is the center of diversity of *Micropterygium* Lindenb. *et al.* (Lepidoziaceae; ca. 20 spp.) with almost half of the species in the genus being endemic to the Guayana Highland. Moss diversity in the "Pantepui" region is lower than that of liverworts (Buck, 1989; Desamoré *et al.*, 2010) and includes two endemic genera (*Holomitriopsis* H.Rob., *Steyermarkiella* H. Rob.), both members of Leucobryaceae and monospecific.

As argued by Desamoré *et al.* (2010), the table mountains of the Guayana Highland remain underexplored for bryophytes due to their remoteness and difficulty

of access, and offer ample opportunity for discovery of new taxa. Several new liverworts have recently been described from the Brazilian part of the region, including *Cheilolejeunea amazonica* C.J.Bastos & C.E.Zartman (Bastos & Zartman, 2016), *C. aracaensis* C.J.Bastos *et al.*, *C. caracariensis* C.J.Bastos *et al.* and *C. cuspidifera* C.J.Bastos *et al.* (Bastos *et al.*, 2016), and *Syzygiella renifolia* (Gradstein & Costa, 2016). The discovery of *Plagiochila lamyana* in Mount Roraima National Park adds a further species to the rich endemic flora of the Guayana Highland.

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