

## ***Plagiochasma intermedium* Lindenb. & Gottsche (Aytoniaceae, Marchantiophyta), the third species of *Plagiochasma* for southern South America**

Jorge R. FLORES\* & Guillermo M. SUÁREZ

Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET);  
Facultad de Ciencias Naturales e Instituto Miguel Lillo; Fundación Miguel Lillo,  
Miguel Lillo 251, San Miguel de Tucumán, Tucumán – CP 4000, Argentina

**Abstract** – *Plagiochasma* Lehm. & Lindenb. is a widely distributed genus mainly in semi-arid areas. Two species were formerly recognized for southern South America, *P. rupestre* (G. Forst.) Steph. and *P. argentinicum* Bischl. In the present contribution, we give account for the presence of *P. intermedium* Lindenb. & Gottsche in Southern South America, extending the previously known distribution range in a large extent. In order to distinguish *P. intermedium* from the remaining species of South America, a key is elaborated. Photomicrography and a distribution map of *P. intermedium* are also presented.

### **Geographical range / Marchantiophyta / Neotropics / *Plagiochasma* South America**

*Plagiochasma* Lehm. & Lindenb. is a genus of sixteen species, nine of them are present in the Neotropical Region (Bischler *et al.*, 2005) distributed mainly in Central America. Of these, only *Plagiochasma rupestre* (G. Forst.) Steph., with two varieties (*P. rupestre* var. *rupestre* and *P. rupestre* var. *volkii* Bischl.), is widespread in South America. In 1979, Bischler recorded a new species, *Plagiochasma argentinicum* Bischl., from Argentina. Recently, while studying material from “Parque Nacional Baritú” (Salta, Argentina) we have observed a specimen of *Plagiochasma*, the features of which did not fit with either known southern taxa of the genus. After comparing several specimens of *Plagiochasma* and performing an exhaustive literature survey, these samples have been identified as *P. intermedium* Lindenb. & Gottsche, a species never recorded for Southern South America.

Although further – and exhaustive – samples shall be collected in future, it remains as a particularity the disjunct austral location of *P. intermedium* given its mainly Central American distribution as well as the potential influence of dissimilar ecological conditions on the morphological variation. Therefore, in this work, we describe the most austral specimen of *P. intermedium*, and present a key of the southern South American species of *Plagiochasma*.

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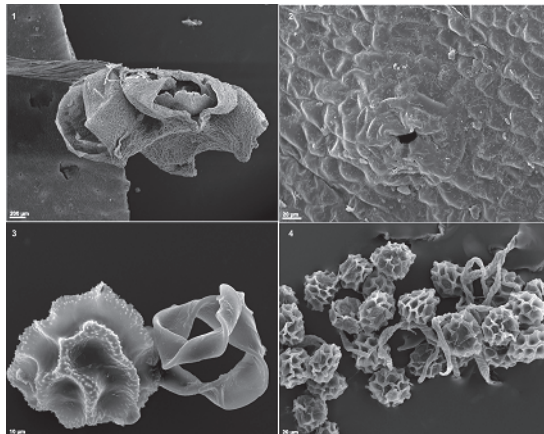
\* Corresponding author : jrfflores@conicet.gov.ar

**Key of southern South American *Plagiochasma***

1. Pores rounded by one ring of 4-6(-7) cells, not raised above epidermis level. Ventral scales without papillae and entire margin, never sinuous or toothed . . . 2
  2. Epidermal pores rounded by a ring of 4-5 cells of thin walls. . . . . *P. rupestre* var. *rupestre*
  2. Epidermal pores rounded by a ring of 5-6(-7) thick walled cells . . . . . *P. rupestre* var. *volkii*.
1. Pores rounded by 2-4 rings of 6-9 thick walled cells, raised above epidermis level. Ventral scales with differentiated margins . . . . . 3
  3. Epidermis surface smooth. Epidermal pores with 3-4 rings of 8-9 cells with thickened radial walls. Appendages purplish, becoming hyaline at apex, oblong-lanceolate, near constricted at insertion line. Elaters with no helical bands . . . . . *P. intermedium*
  3. Epidermis surface granular. Epidermal pores with 2-3 rings of 6-8 cells with thickened radial walls. Appendages purplish, (2-)3-4 per scale, acuminate with sinuous margins, not constricted at insertion line. Elaters with 3 to 5 helical bands . . . . . *P. argenticum*

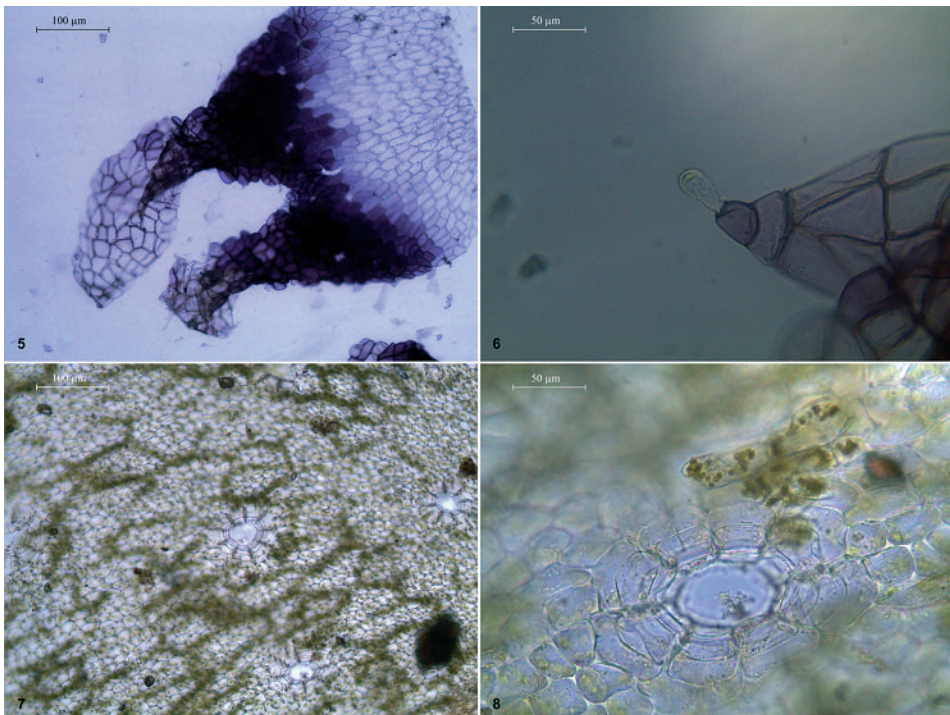
***Plagiochasma intermedium* Lindenb. & Gottsche**, Gottsche, Lindenb. & Nees, *Syn. Hep.* 513. 1846 (Figs 1-3).  $\equiv$  *Ruppinia intermedia* (Lindenb. & Gottsche) Trevis., *Mem. Reale Ist. Lombardo Sci., Ser. 3, Cl. Sci. Mat.*, 4: 437. 1877. *Aytonia intermedia* (Lindenb. & Gottsche) Kuntze, *Revis. Gen. Pl.* 1: 143. 1891. *Aytonia intermedia* (Lindenb. & Gottsche) Underw., *Bot. Gaz.* 20: 66. 1895.

Thallus dark green to greyish when dry, 2-3 cm long, 5.3-8.0 mm wide and 0.4-0.6 mm height; adventitious branches present. Margins dark purple, entire to slightly repand. Dorsal surface plane to somewhat concave. Ventral surface purple, mostly plane – sometimes slightly convex; wings convoluted when dry. Epidermis almost non-granular; cells rounded to pentagonal/hexagonal with well-



Figs 1-4. **1.** Archegoniophore and involucre. **2.** Simple pore. **3.** Spore and smooth elater. **4.** Spore and elaters with helical bands of *Plagiochasma rupestre*.

developed trigones, 30-42  $\mu\text{m}$  long, 18.75-33.75  $\mu\text{m}$  wide and 20-31  $\mu\text{m}$  height. Epidermal pores simple, 100-175  $\mu\text{m}$  diameter (including rings of cells), raised 4-6 cells above epidermis level, rounded of 8 concentric series of 4(5) thick walled cells and an internal membrane; pore opening diameter of 20-25  $\mu\text{m}$ . Assimilatory layer constituted by 4-5 strata of irregular to polyhedral photosynthetic air chambers in the middle and 3-2 to the margins. Fundamental tissue of 9-10 strata of thin irregular cells 6-10  $\mu\text{m}$  height and 10-17 wide; parenchyma usually disappearing to the margins. Scales purplish oblong-lunates, 1.240-1.800 mm long (with appendages)  $\times$  1.02-1.08 mm wide, margins entire or slightly sinuous; provided with 2(1) whitish appendages 0.5-0.9 mm long  $\times$  0.225-0.250 mm wide and entire margins, not constricted basally. Antheridia receptacles few, mainly at base of adventitious branches. Archegoniophores born near the apex of thallus or adventitious branches, archegoniophore stalk of striated surface, 4-7 mm long, without rhizoid furrows and external cell walls slightly thickened. Involucres, (2-)3-4 per archegoniophore, bilabiate of entire margins, with acute endings, cell hexagonal to pentagonal, 41.25-50.0  $\mu\text{m}$  long, 31.25-37.50  $\mu\text{m}$  wide, with papilla-like ornamentation at angles. Capsule spherical, cells rectangular to polyhedral of somewhat thickened walls, 37.40-50.0  $\mu\text{m}$  long, 21.35-37.5  $\mu\text{m}$  wide, with papilla-like projections at angles. Elaters brownish, 150-200  $\mu\text{m}$  long, 12.5-16.25  $\mu\text{m}$  wide at middle length (6.25-8.75  $\mu\text{m}$  near the apex), acute to distinctly rounded apex, without spiral thickening bands. Spores brownish, well developed equatorial wing, trilete scar present at proximal face, 65-85  $\mu\text{m}$  diameter.



Figs 5-8. **5-6.** Scales and appendages with an apical papilla. **7-8.** Simple pore rounded by eight-nine radial series of cells.



Fig 9. Distribution map of *Plagiochasma intermedium*. Previously known distribution (grey dots) and Southern South American location (black star).

**Specimen examined: SOUTH AMERICA. Argentina.** Salta, Parque Nacional Baritú, sendero a termas, sobre talud expuesto a la luz, 22° 22.665'S, 64° 44.410'W, 1143 m, May 2013, JR. Flores 34 (CTES; LIL; MA).

As Evans (1915) pointed out, several conflicts are related with gametophytical characters. Stephani (1898; in Evans, 1915) described *P. intermedium* as having thalli with apical innovations (rarely dichotomous), epidermal cells with no trigones and three series of eight concentric cells. In this regard, Evans found no considerable differences between *P. japonicum* (Stephani) C. Massal. and *P. intermedium*, suggesting that slight differences noted by Stephani are expected and inconsistent. However, in the Neotropics, *P. intermedium* has no comparable taxon and can be easily distinguished from remaining Marchantiales by the elaters and scales appendages. Even more, except for *Monosolenium* Griff. no other thalloid liverwort is defined by elaters without helical bands (Bischler *et al.*, 2005). Until now, the two other southern species of *Plagiochasma* were from Argentina (Bischler, 1979; Bischler *et al.*, 2005). Of these, *P. rupestre* is highly variable and widely distributed in South America; nevertheless, the pore features are distinct enough to separate it from the rest of the species. *Plagiochasma argentinicum*, however, shares some characters with *P. intermedium* (Bischler, 1979; Bischler *et al.*, 2005). Namely, these two species are more similar in terms of pore rings and scales appendages than each species with *P. rupestre*.

According to literature (Bischler, 1979; Bischler *et al.*, 2005), *P. intermedium* is the only member of Aytoniaceae whose elaters have no helical bands. This, along with pores characters, confirms the identity of this sample as *P. intermedium*. However, little differences exist between the descriptions available (Bischler, 1979; Bischler *et al.*, 2005) and current samples. In the first place, thallus size vary from 5.3 to 8.0 mm in width while that reported (Bischler, 1979; Bischler *et al.*, 2005) vary from 3.7 to 5.0 mm. In the present specimen epidermal cells are wider than those indicated in previous descriptions (Bischler, 1979; Bischler *et al.*, 2005). Although spore diameter in this southern specimen has a wider size range, mean size is considerable smaller here than described elsewhere. In general, current sample exhibits narrower size ranges for the remaining structures. This is the case for the pore aperture and the archegoniophore stalk. Measurements on this exemplar are also different from those of *P. argentinicum*. Despite spore size (considerable bigger in *P. argentinicum*; Bischler, 1979; Bischler *et al.*, 2005), general mean proportions are wider or higher in present case. Relevant characters to distinguish *P. argentinicum* from southernmost *P. intermedium* sample are depicted in Table 1.

Table 1. Main characters to recognize *P. intermedium* from *P. argentinicum*

	<i>P. intermedium</i> *	<i>P. argentinicum</i>
Thallus width	5.3-8.0 mm	3.7-8.0 mm
Epidermis surface	smooth	granulose
Elaters color	Yellowish	Reddish
Elaters thickenings	None	3-5
Spore size	65-85	106-118

\*: current specimen



Originally, *Plagiochasma intermedium* was described from material collected in Vera Cruz (Mexico). According to Bischler *et al.* (2005), this is a common species in Central Mexico and Guatemala. Although the southernmost distribution was registered in Peru, the location of this record remains uncertain (Bischler, 1979), not being considered in current monographs (e.g. Bischler *et al.*, 2005). Consequently, the most austral record was from Venezuela (Aragua, 10° N approx.; Bischler *et al.*, 2005). In terms of habitat, *P. intermedium* is restricted to the lowlands and lower montane zones (800-2000 m; sensu Gradstein, 1995) and, as most of *Plagiochasma* species, it is found in exposed areas under water stress conditions (Gradstein *et al.*, 2001; Bischler *et al.*, 2005). In Central America, it can be found from montane temperate forest to rainforest. In addition, there are two isolated records for North Carolina (United States) and Aragua (Venezuela; Bischler *et al.*, 2005). In southern South America, *P. intermedium* was found in the Argentinean Northwest rainforest (Yungas) at “Parque Nacional Baritú” (Salta), at the side of the road below the forest canopy. This area is characterized by a tropical climate with 1300 mm of annual precipitations, being dominated by evergreen species. By contrast, *P. argentinicum* is only registered in the phytogeographical region of Chaco at 1000 m. This latter region has a mean precipitation of 100-700 mm and is dominated by spiny shrubs and deciduous tree species. The third species of Argentina is the widespread *P. rupestre*; present in all phytogeographical regions at altitudes between 150-3800 m (*P. rupestre* var. *rupestre*) and 1200-1600 m (*P. rupestre* var. *volkii*).

This note accounts for the first record of *Plagiochasma intermedium* in the southernmost part of the Neotropics in Southern South America. A detailed description and comparison of the founded specimen has been done with the explicit purpose of providing information for future studies. Additional information can be found in Bischler's (1979) monograph about American taxa and the recent update of Bischler *et al.* (2005) for the Neotropics.

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