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New records to the bryological flora of Uruguay

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Abstract – A list of 10 moss species collected in several Departments of Uruguay is presented. *Campylopus pilifer, Chryso-hypnum elegantulum, Sphagnum aciphyllum, S. perichaetiale* and *S. recurvum* are new records for the moss flora of Uruguay. *Hypopterygium tamariscina* and *Philonotis curvata* collected in Rocha, as well as *Bryum densifolium* and *Sphagnum uruguayense* found in Canelones are new records for the moss flora of these Departments; the last one mentioned species is reported for the second time for Uruguay. For each species ecology and distribution data are given. For some new records or uncommon taxa, photographs, morphological diagnostic characteristics, and comments on the nomenclature and taxonomy are also added.

Mosses / ecology / distribution / South America

Resumen – Se presenta una lista de 10 especies de musgos recolectados en varios Departamentos de Uruguay. *Campylopus pilifer, Chryso-hypnum elegantulum, Sphagnum aciphyllum, S. perichaetiale* y *S. recurvum* son nuevas aportaciones para el catálogo de la flora briológica de Uruguay. *Hypoptergium tamariscina* y *Philonotis curvata* recolectados en Rocha, y *Bryum densifolium* y *Sphagnum uruguayense* recolectados en Canelones son nuevas citas para la flora muscinal de estos Departamentos; ésta última se cita por segunda vez para Uruguay. Se dan los datos de ecología y distribución de cada especie. Para algunas especies que se citan por primera vez o son raras en Uruguay se aportan también fotografías, características morfológicas diagnósticas y se hacen comentarios sobre nomenclatura y taxonomía.

Musgos / ecología / distribución / América del Sur

INTRODUCTION

The bryoflora of Uruguay is generally poorly known and the references on mosses are scanty and dispersed. There are still large areas needing exploration and studies on the mosses and the level of knowledge of many of the species is generally poor and only a few of them have been re-evaluated in modern treatments (Matteri, 2004).

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The natural vegetation in Uruguay, principally some aquatic and terrestrial ecosystems, like the "bañados" (semi-permanent aquatic territories, extensive and less than one meter deep, bucket poorly defined, with abundant herbaceous and tender emergent vegetation), lakes, streams or evergreen forests, are highly disturbed, as a consequence of the continuous exploitation of the territory for firewood in many areas, for its transformation into pasture land for cattle or for agricultural development.

The purpose of this paper is to contribute to the knowledge of the bryoflora of Uruguay.

MATERIAL AND METHODS

This study is based on the revision of herbarium material from the Museo Nacional de Historia Natural y Antropología de Montevideo (MVM) and from the Facultad de Ciencias Biológicas de la Universidad Complutense of Madrid (MACB) as well as on specimens collected during a field expedition in 2008 by the first author, that are also kept at MACB. Available duplicates were donated to herbaria of the Real Jardín Botánico de Madrid (MA), Facultad de Farmacia de la Universidad Complutense de Madrid (MAF), Missouri Botanical Garden (MO), and New York Botanical Garden (NY).

Study area

It covers in Uruguay a strip of approximately 350 km, from the Departments of Montevideo, Canelones, Maldonado and Rocha, between 34°00´-34°50´S and 53°55´-55°58´W geographic coordinates (Fig. 1). Much of the territory explored is dominated by aquatic ecosystems, especially by "bañados" (Clara & Maneyro, 2014).

The soils are predominantly sandy, oligotrophic and their vegetation differs according to the degree of permanence of standing water.

The vegetation of the "bañados" is dominated by grasslands of Juncaceae and Cyperaceae (*Juncus acutus* L., *Scirpus giganteus* Kunth, *Schoenoplectus californicus* (C.A. Mey.) Soják, and *Spartina densiflora* Brongn. among others); while in the permanently flooded areas, vegetation is formed by *Sphagnum* bog and herbaceous plants such as *Drosera brevifolia* Pursh, *Eriocaulon* sp., *Urtricularia* sp., *Xyris jupicai* Rich. and various Cyperaceae, around which the "pajonales" (tall grasses) as *Cortaderia selloana* (Schult. & Schult. f.) Asch. & Graebn., *Erianthus* sp., *Panicum* sp., *Paspalum* sp., develop. To the NE, we explored the Sierra del Oratorio (Rocha), which has a lauroid neotropical forest of "ombú" (*Phytolacca decandra* L.) and groves of "butiá" (*Butia yatay* (Mart.) Becc.) (Alonso Paz & Bassagoda, 2002; Clara & Maneyro, 2014).

Species data

The species are presented in alphabetical order of families. Systematics and nomenclature follow the approach of Goffinet *et al.* (2008) and database Tropicos (2014). Taxa were classified mainly using the keys and monographs of genera and species mentioned in the text, such as Müller (1887), Phelippone (1909), Warnstorf (1911), Herter (1933, 1943), Frahm (1975, 1994), Ochi (1982, 1994), Crum (1987, 1994, 1995, 2002), and Anderson *et al.* (2009).

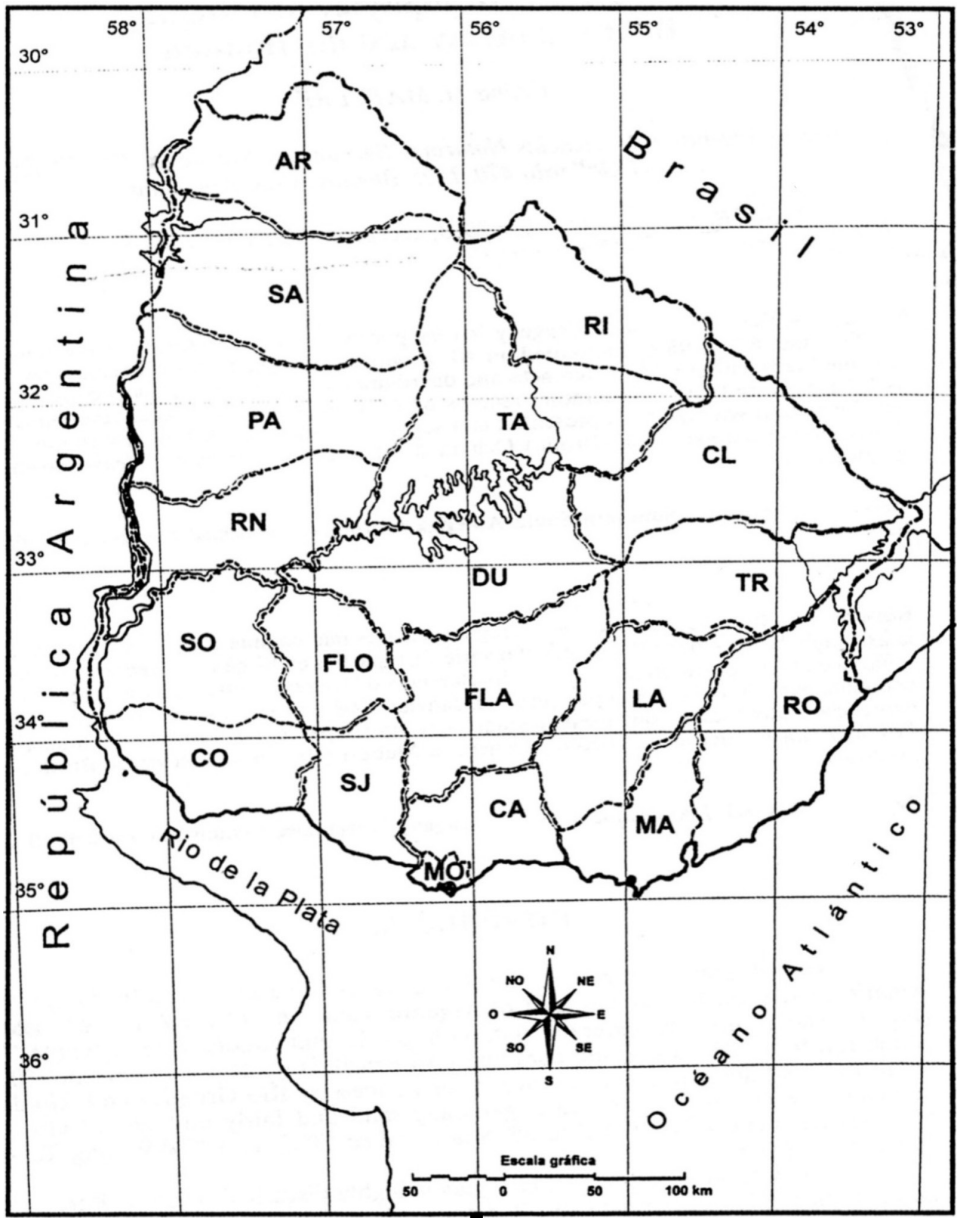


Fig. 1. Map of the República Oriental del Uruguay and its departamental political divisions: AR (Artigas), SA (Salto), PA (Paysandú), RN (Río Negro), SO (Soriano), CO (Colonia), RI (Rivera), TA (Tacuarembó), DU (Durazno), FLO (Flores), SJ (San José), FLA (Florida), CA (Canelones), MO (Montevideo), CL (Cerro Largo), TR(Treinta y Tres), LA (Lavalleja), MA (Maldonado), and RO (Rocha). Map from Matteri (2004).

For each taxon the next data are given: 1) Data of the specimens studied, including geograpical data, habitat, collection data and herbarium where they are kept; 2) previous references and known data in Uruguay if any; 3) ecology based mainly in our own observations and distribution data including type of distribution, and known distribution area at world scale and Sudamerica scale; 4) for some taxa comments are added related to nomenclature and taxonomy.

RESULTS

Here we present a list of 10 taxa that are either new records at national level (indicated by a black dot prior to the name of the species) or at departmental level (marked with an asterisk), or are scarcely present in Uruguay, according to the catalogue of Mosses of Uruguay (Matteri, 2004) and which are of great interest from floristic, ecological and biogeographical points of view.

Bartramiaceae

Philonotis curvata (Hampe) A. Jaeger

Figs 2-3. Other illustrations: Phelippone (1909)

Rocha Department, ruta de Castillos a Sierra del Oratorio, en rocas ácidas y húmedas y en suelos arenoso-silíceos, 34°00´S 53°58´W, 130 m a.s.l., 2008, *Fuertes s.n.* (MACB 103830).

Phelippone (1909) mentioned this species as new record for the flora of Uruguay (sub *Philonotis balansaeana* Besch.), collected in several localities of the Montevideo, Canelones and Paysandú Departments.

The species grows forming short turfs more or less lax, on siliceous, acid, wet substrates, located mainly in evergreen forests; it behaves as a hygrophytic, mesophytic and nitrophytic species. Neotropical, only known from South America (Tropicos, 2014), where it was reported from Argentina (Sehnem, 1976; Matteri, 2003), Bolivia, Brazil, Colombia (Sehnem, 1976), Paraguay (Bescherelle, 1877), Uruguay (Phelippone, 1909). This taxon is a new record for Rocha Department and the second record for Uruguay.

Bryaceae

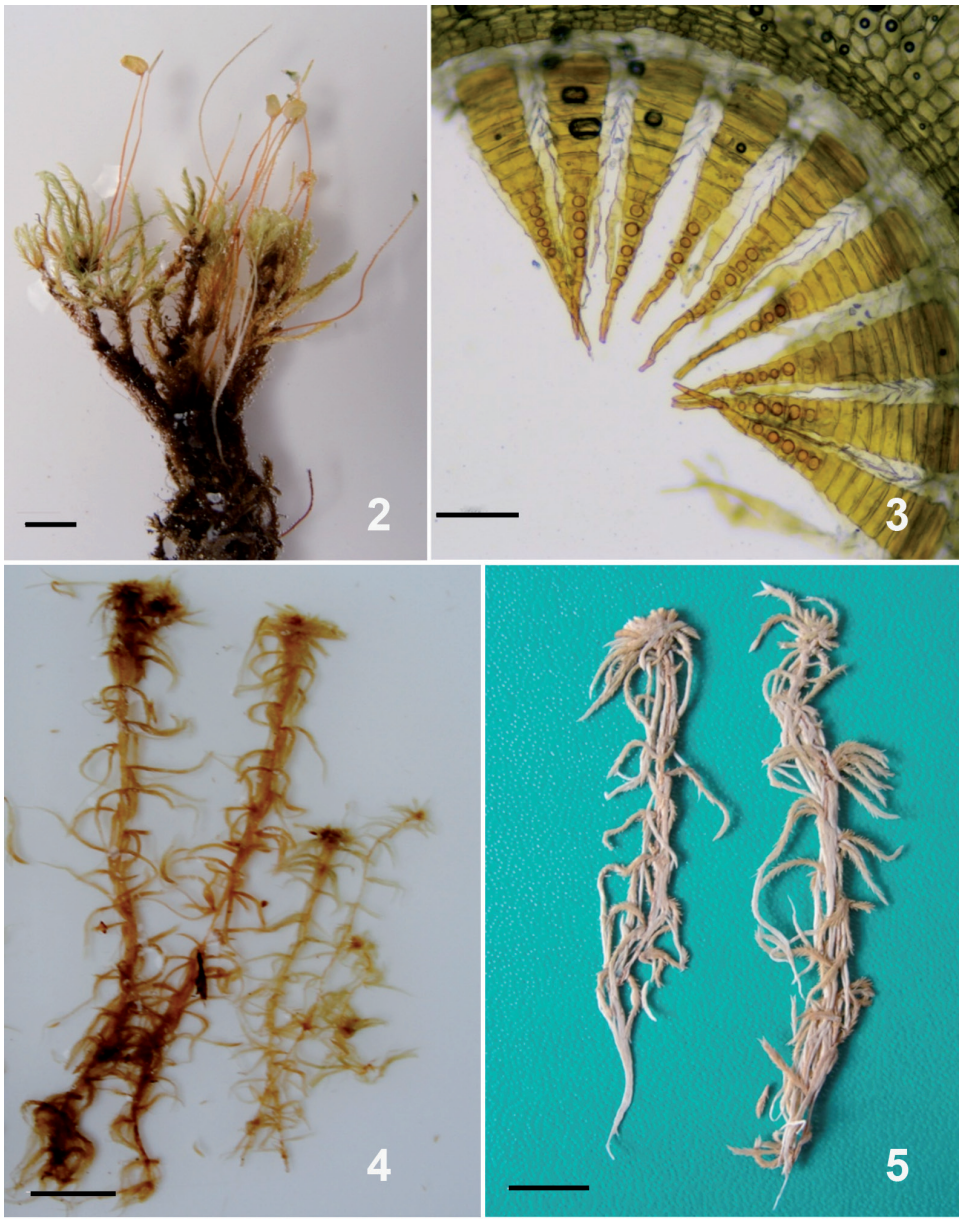
****Bryum densifolium*** Brid.

Illustrations: Ochi (1994)

Canelones Department, Bañados de Guazuvirá, en suelos arenosos de bosques que crecen sobre las dunas cercanas al estuario del río de La Plata, 34°46´S 55°50´W, 22 m a.s.l, 2008, *Fuertes s.n.* (MACB 103706, MVM).

Herter (1933) reported this species without a precise location in Cerro Largo and Paysandú Departments.

It grows in more or less lax short-turfs on siliceous acidic and moist substrates, usually in shaded habitats; hygrophilous, mesophilous, with nitrophilous trend. In Uruguay it was collected in forests around wetlands and streams, on stable dunes (Herter, 1933). Neotropical (Ochi, 1982), extending into North America (Mexico), Central America (Guatemala, Haití), South America (Argentina, Bolivia, Brasil, Colombia, Ecuador, Perú, Uruguay) (Ochi, 1982) and Australia (Streimann & Touw, 1981). This contribution is a new record for the bryoflora of Canelones.



Figs 2-5. Photographs of *Philonotis curvata* and *Sphagnum aciphyllum*. **2-3.** *Philonotis curvata* (MACB 103830). **2.** Habit when wet. **3.** Peristome. **4-5.** *Sphagnum aciphyllum* (MVM). **4.** Habit when wet. **5.** Habit when dry. Scales: Figs 2, 4, 5 = 1 cm; Fig. 3 = 100 µm.

Dicranaceae

●***Campylopus pilifer*** Brid.

Illustrations: Frahm (1994)

Maldonado Department, ruta de Montevideo a Rocha, km 118, en suelos ácidos y húmedos cerca del arroyo Zanja Honda, 34°46´S 55°20´W, 30 m a.s.l., 2008, *Fuertes s.n.* (MACB 103107, MVM).

The species grows in short–turfs or cushions on acidic exposed rocks and soils (grasslands, road and trail banks); it is considered as a meso-xerophilous and nitrophilous species. Cosmopolitan, widely spread in Neotropics from North America to South America (Argentina, Bolivia, Colombia, Ecuador, Peru, Venezuela, absent in the Amazon basin), Europe, Africa and Asia (India and Sri Lanka) (Frahm, 1975, 1994). This taxon is proposed as a new record for the bryological flora of Uruguay.

Hypnaceae

●***Chryso-hypnum elegantulum*** (Hook.) Hampe

Illustrations: Nishimura & Hisatsugu (1994)

Maldonado Department, Arroyo Zanja Honda, en la ruta de Montevideo a Rocha, km 118, 34°46´S 55°20´W, 30 m a.s.l., 2008, *Fuertes s.n.* (MACB 103831, MVM).

It grows as epiphyte in bright, dispersed green mats, on trunks of evergreen forests; it is a mesophilous and hygrophilous species. Apparently widespread in the Neotropics (Tropicos, 2014); it was until now known from Mexico (Nishimura & Hisatsugu, 1994), Argentina (Fuertes *et al*., in press), Bolivia (Tropicos, 2014) and Venezuela (Pursell, 1973). It is as a new record for the bryological flora of Uruguay.

Only one species of *Chryso-hypnum* genus was reported previously from Uruguay, *C. diminutivum* (Hampe) W.R. Buck, collected in Tacuarembó by Herter (1943). It is characterized by the ovate-lanceolate, with straight apex, gradual and long acuminate phyllidia of primary caulidia, 0.60-0.80 × 0.30-0.40 mm; square and conspicuous alar cells; 1.0-1.5 mm long seta and ovoid capsule, 1.0-1.2 × 0.5 mm. These characteristics clearly separates it from *C. elegantulum* in which phyllidia of primary caulidia are broadly ovate-triangular, with curved apex, abruptly and shortly acuminate, 0.70-0.90 × 0.60-0.80 mm; short-rectangular, weakly differentiated alar cells; 20-25 mm long seta and obloid to cylindrical capsule, 2.0 × 0.5-0.6 mm.

Hypopterygiaceae

****Hypopterygium tamariscina*** (Hedw.) Brid. *ex* Müll. Hal.

Illustrations: Kruijier (2002)

Rocha Department, Sierra del Oratorio**,** en raíces y suelo del bosque neotropical, 34°00´S 53°58´W, 130 m a.s.l., 2008, *Fuertes s.n.* (MACB 103708).

In Uruguay it was previously recorded in the next Departments: Canelones (Müller, 1897; Kruijier, 2002), Montevideo (Müller, 1897; Matteri, 1973; Kruijier, 2002), and Treinta y Tres (Herter, 1943).

The species forms dendroid mats and grows on trunks or rocks in wet habitats. Hygrophilous, mesophilous and nitrophilous. Pantropical, with disjunct areas in North America, Central America, South America (Argentina, Brazil, Colombia, Uruguay, and Venezuela), Africa, Asia, Australia. In Europe it was reported from Portugal by Kruijier (1997, 2002), who considered it to have been introduced by man, and from Italy (Aleffi *et al.*, 2010). This contribution is a new record for Rocha Department.

Sphagnaceae

●***Sphagnum aciphyllum*** Müll. Hal.

Figs 4-5. Other illustrations: Crum (1987), Pinheiro da Costa & Fleschen Fares (2012)

Canelones Department, Bañado de El Negro, km 27.5, en suelos arenosos permanentemente encharcados, donde crecen gramíneas y helechos, *Osorio s.n.* (MVM).

It grows in intermediately mineral rich wetlands, and appears in the firmest and consolidated zones on meso-moist habitats that usually are subject to periodic wetting and drying. Neotropical (Crum, 1987). In South America occurs in Brazil, Colombia and Venezuela (Pinheiro de Costa & Fleschen Fares, 2012).

The studied specimen was identified by Crum in 1994 as *Sphagnum pendulirameum* H.A. Crum (unpublished). Crum (1987) described this species on a specimen collected by Sucre in 1969, in the State of Espirito Santo, district of Vila Velha, Vitoria (Brazil) and designated as holotype a sheet in MICH. He was aware of the close relationship of this species with *Sphagnum aciphyllum*, described by Müller (1887) with material collected in 1874 by *Odebech s.n.* in Santa Catarina, Brazil. Therefore Crum (1987) discussed the differences and similarities between both species. Subsequently, Pinheiro da Costa & Fleschen Fares (2012) considered *S. pendulirameum* a new synonym of *S. aciphyllum*. This revision discloses the only locality at the present time of *S. aciphyllum* in Uruguay and should therefore be considered as a new record for the bryoflora of the country.

●***Sphagnum perichaetiale*** Hampe

Figs 6-8. Other illustrations: Fuertes *et al.* (2012)

Canelones Department, Bañados El Pinar Norte, entre los km 27-30 de la ruta de Montevideo a San Carlos, 34°50´S 55°58´W, 15 m, 2008, *Fuertes s.n.* (MA, MACB 103711, MO, MVM, NY). *Ibidem*, Bañado de Los Pájaros, *prope* Guazuvirá, cerca de la ruta de Montevideo a Rocha, 2008, 34°45´S 55°42´W, 20 m, *Fuertes s.n.* (MA, MACB 103927, MVM).

It grows in intermediately mineral rich wetlands, in mounds, in the firmest and consolidated zones of the islets on meso-moist habitats that usually are subject to periodic wetting and drying. Pantropical (Anderson *et al.,* 2009); the species was until now reported from Africa (Madagascar), Asia (The Philippines), Australia (New Zealand), and America (U.S.A., Mexico, Panama, Brazil, Colombia, and Paraguay) by Anderson *et al.* (2009) and more recently in Argentina by Fuertes *et al.* (2012). It is as a new record for the bryological flora of Uruguay.

Sphagnum perichaetiale may be confused with *S. magellanicum* Brid., but the cross section of the branch phyllidia presents the green cells narrowly elliptic to rectangular, with thickened end walls, more o less equally exposed on either surface; whereas in *S. magellanicum* the green cells are rounded to short-elliptic, with end walls not thickened, centrally located, and entirely included.

****Sphagnum uruguayense*** Crum

Fig. 9. Other illustrations: Crum (2002)

Canelones Department, Bañados El Pinar Norte, 27-30 km en la ruta de Montevideo a San Carlos, 15 m a.s.l., 34°50´S 55°58´W, 2008, *Fuertes s.n*. (MACB 103710, MACB 103713, MACB 103714, MAF 2663, MVM).

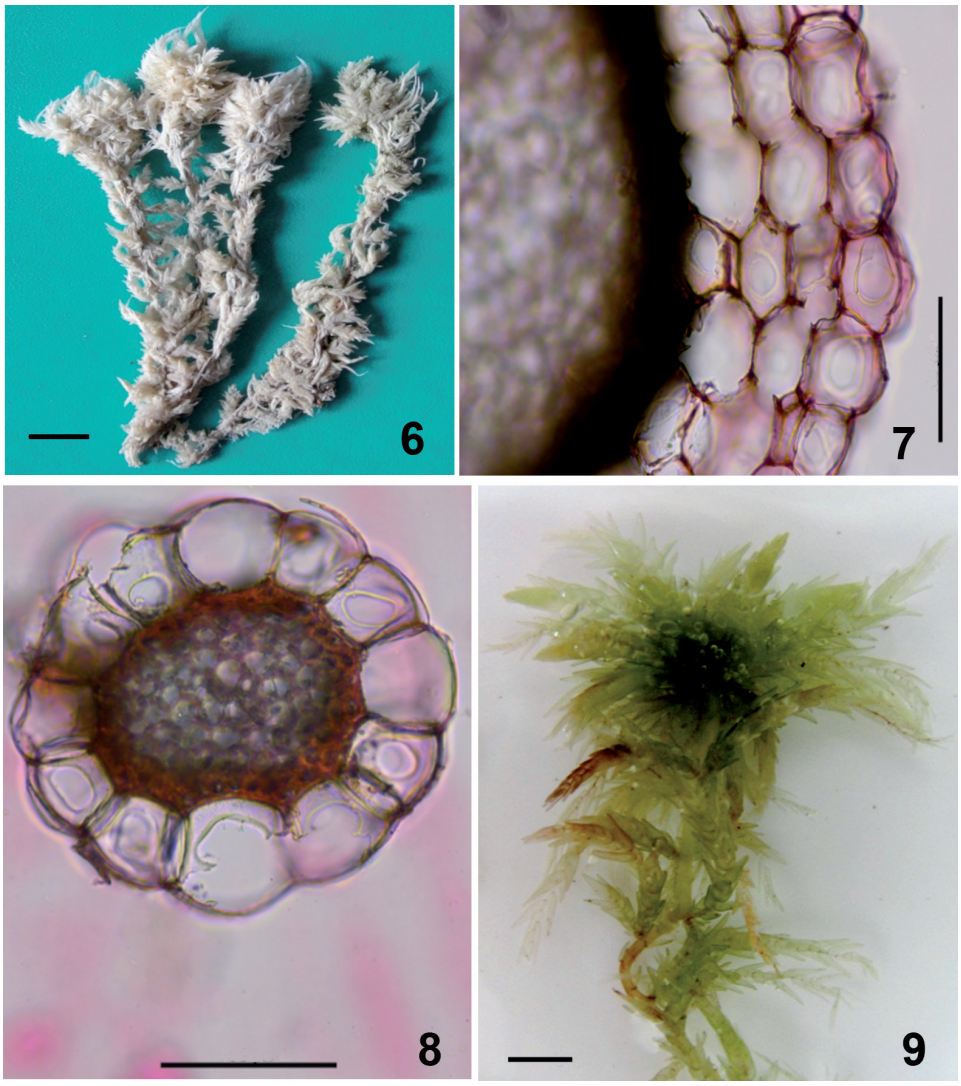
The collection made by Herter in 1934 in Montevideo Department was designated by Crum (2002) as the holotype of *Sphagnum uruguayense* (Uruguay, Carrasco, in ripariis aren.- arg., Oct. 1934, *W.G. Herter 1432a*, MVM!).

It grows in intermediately mineral rich wetlands, on meso-moist habitats, hidrophilous. Neotropical, endemic to Uruguay (Crum, 2002). This contribution is the second record to Uruguay and a new record to the Department of Canelones.

Sphagnum herteri Crum

Figs 10-12. Other illustrations: Crum (1995)

Canelones Department, Bañados El Pinar Norte, entre el 27-30 km, ruta de Montevideo a San Carlos, 34°50´S 55°58´W, 15 m, 2008, *Fuertes s.n.* (MACB 103713, MACB 103714, MVM). I*bidem,* Bañados de Guazuvirá, cercanos a las dunas del estuario del río de La Plata,

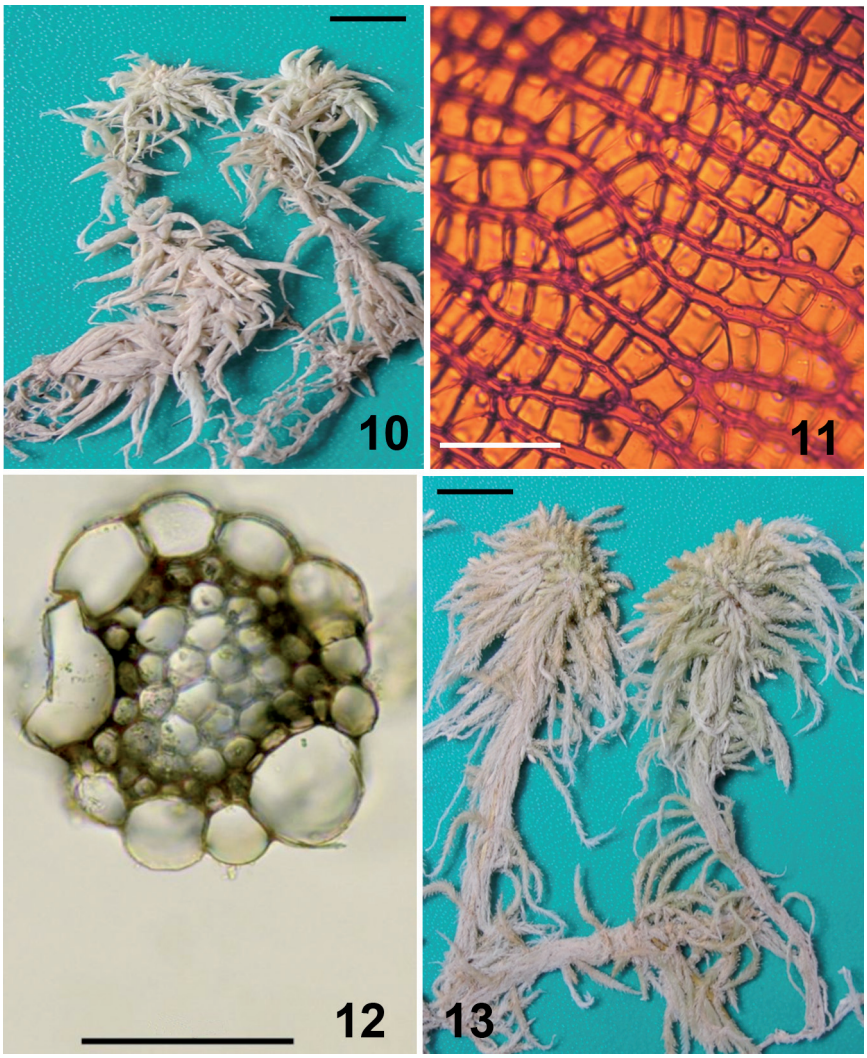


Figs 6-9. Photographs of *Sphagnum perichaetiale* and *S. uruguayense*. **6-8.** *Sphagnum perichaetiale* (MACB 103711). **6.** Habit when dry. **7**. Stem cross-section. **8.** Branch cross-section. **9.** Habit when wet of *S. uruguayense* (MACB 103710). Scales: Fig. 6 = 1 cm; Figs 7, 8 = 100 µm; Fig. 9 = 0.5 cm.

34°46´S 55°50´W. 22 m, 2008, *Fuertes s.n.* (MACB 103925). *Ibidem*, Bañado de Los Pájaros, *prope* Guazuvirá, en la ruta de Montevideo a Rocha, 34°45´S 55°42´W, 20 m, 2008, *Fuertes s.n*. (MACB 103929, MVM).

The collection *Herter s.n.,* July 6th 1947, MVM, from Canelones, *prope* Floresta was designated as holotype by Crum (1995).

The species grows in intermediately mineral rich wetlands, in the firmest and consolidated zones on meso-moist habitats that usually are subject to periodic wetting and drying. Neotropical, endemic to Uruguay (Crum, 1995).



Figs 10-13. Photographs of *Sphagnum herteri* and *S. recurvum*. **10-12.** *Sphagnum herteri* (MVM). **10.** Habit when dry. **11.** Upper cells of branch phyllidium, outer surface. **12.** Branch cross-section. **13.** Habit when dry of *S. recurvum* (MACB 103928). Scales: Figs 10, 13 = 1 cm; Fig. 11 = 50 µm; Fig. 12 = 100 µm.

Sphagnum herteri is highly variable morphologically, perhaps due to the diversity of habitats where it develops, from permanently flooded wetlands to others in which the vegetation suffers periods of more or less prolonged drought.

●***Sphagnum recurvum*** P. Beauv.

Fig. 13. Other illustrations: Fuertes *et al.* (2012)

Canelones Department, Bañados El Pinar Norte, 27-30 km en la ruta de Montevideo a San Carlos, 34°50´S 55°58´W, 15 m a.s.l., 2008, *Fuertes s.n.* (MACB 103928, MAF 2662, MO, NY). *Ibidem*, Bañado El Negro, km 27.5, en suelos permanentemente encharcados, 20 m a.s.l., 1985, *Osorio s.n.* (MVM), *det.* Crum 1994 as *Sphagnum pulchricoma* Müll. Hal. (unpublished).

It forms wide mounds with emergent, overwhelmed capitula in intermediately mineral rich wetlands, in the firmest and consolidated zones on meso-moist habitats that usually are subject to periodic wetting and drying. Circumboreal, from eastern North America north to Nova Scotia and west to Minnesota (Anderson *et al*., 2009). In South America it was until now known from Bolivia, Colombia, Ecuador, Venezuela (Anderson *et al.*, 2009) and Argentina (Fuertes *et al*., 2012). In Europe it was reported from the Azores (Dias *et al.*, 2009).

According to Smith (1977) this name is a synonym of *S. recurvum*. The revision of the specimen by Fuertes in 2008, confirmed its identity as *S. recurvum*. This revision discloses the only two localities at the present time of *S. recurvum* in Uruguay and should therefore be considered as a new record for the bryoflora of Uruguay.

CONCLUSIONS

In spite of all the references to the presence of *Sphagnum magellanicum* in Canelones and Montevideo Departments (Herter, 1933; Matteri, 2004), we have not found it in any of the places visited in our campaigns; therefore its presence cannot be confirmed. However, we did find *S. perichaetiale*, which looks like *S. magellanicum*.

We have observed that the areas surrounding the "bañados" closest to urban populations, particularly the Bañados of Guazuvira (Canelones Department), are subjected to strong anthropogenic pressure mainly due to the density of houses and shops of different entity, built in recent years, which has led to the drying of oligotrophic wetlands and desertification of habitats, so the hygro-hydrophilous, endemic, rare or more characteristics moss species of those habitats are seriously endangered. Only a special protection of these ecosystems can prevent the decline of the bryophytes in Uruguay.

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