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Sphagnum (velvet) species used by rural communities at the Guaratuba EPA, Paraná State, Brazil

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ABSTRACT. The results of a survey of *Sphagnum* used by the Descoberto and Empanturrado rural communities (Guaratuba municipality and Guaratuba Environmental Protected Area – EPA) are presented. The analysis was based on fresh material collected in different harvesting areas. Five species were recorded: *S. capillifolium* (Ehrh.) Hedw., *S. cuspidatum* Ehrh. ex Hoffm., *S. erythrocalyx* Hampe, *S. perichaetiale* Hampe and *S. recurvum* P. Beauv.. All of them are native species that grow spontaneously in that region and are intensively harvested by the local community. A key is presented to differentiate the species, and the botanical description, common names, geographic distribution and illustrations for each species are included.

Keywords: non-wood forest product, bryophytes, Atlantic Forest, tropical forest, harvesting.

Espécies de *Sphagnum* (veludo) utilizadas pelas comunidades rurais da APA de Guaratuba, Estado do Paraná, Brasil

RESUMO. Apresenta-se resultado de levantamento das espécies de *Sphagnum* L. utilizadas pelas comunidades rurais de Descoberto e Empanturrado (Município de Guaratuba, APA de Guaratuba, Paraná). A partir de coletas e identificação de material botânico nos locais de extrativismo, foram registradas cinco espécies: *S. capillifolium* (Ehrh.) Hedw., *S. cuspidatum* Ehrh. ex Hoffm., *S. erythrocalyx* Hampe, *S. perichaetiale* Hampe e *S. recurvum* P. Beauv.. Todas com ocorrência natural na região de estudo e submetidas a intenso extrativismo pela demanda do segmento floricultor. Incluem-se chave dicotômica para identificação, descrições, caracterização do hábitat, distribuição geográfica e ilustrações para cada espécie identificada.

Palavras-chave: produto florestal não-madeireiro, briófitas, Mata Atlântica, floresta tropical, extrativismo.

Introduction

Sphagnum L. species are globally important due to their great capacity for peat formation (type of soil formed by the deposition and decomposition of *Sphagnum*-type gametophyte with high concentrations of carbon and acidity), which cover approximately 3% of the Earth's surface (CHARMAN, 2002). Peatlands have a significant influence on the hydrological cycle, acting effectively as water reservoirs (BULLOCK; ACREMAN, 2003). Additionally, they regulate the atmospheric chemistry of the planet, acting as a carbon source and sink (DORREPAAL et al., 2006).

The genus includes between 250 and 450 species (SHAW, 2000), but fewer than 50 of them contribute to peat formation in a large scale (*Sphagnum peatlands)*. These areas are characterized by a continuous and superficial moss layer over a peat layer in different levels of anaerobic decomposition, which can reach several meters in depth. The superficial stratum is biologically active, shaped for affiliations of species, with predominance of plants with higher aptitude to retaining moisture. The principal component of these affiliations is the moss *Sphagnum*, which forms a poor nutritional ambience (low concentration of nitrogen), acid, anoxic and cold (DÍAZ et al., 2008). These conditions impede the presence of decomposers such as fungi and bacteria, allowing the peatland to be formed.

Sphagnum peatlands are commercially explored for different uses, such as substrate or compost for horticulture, fuel, bio-indicator and antipollution, production of light concrete, animal fodder and human food, medicinal, craftwork, filling of cushions, mattresses and quilts, production of pieces of clothing for cold regions, and for covering houses (GLIME, 2007).

In the coastal zone of Paraná State (southern Brazil), particularly inside Guaratuba Bay, there is spontaneous growth of *Sphagnum* species, especially in places of sandy wet to soaked soils without arboreal

covering (locally called 'brejos de restinga'). Similarly to the 'mallines' or 'pomponales' found in Chile and designated as anthropogenic bogs (DÍAZ et al., 2007, 2008; VALENZUELA-ROJAS; SCHLATTER, 2004), in these places there is no peat accumulation. They correspond to recent wetlands, formed by clear-cutting of pine plantations in poor drainage places where the *Sphagnun* species grow due to their higher capacity to tolerate flood conditions (Figure 1). The presence of *Sphagnun* can considerably delay the restoration of natural tree species in these areas (DÍAZ; ARMESTO, 2007).

Locally designated as 'veludo' (velvet), lively *Sphagnum* growing in these places has been subjected to a growing wild harvesting dynamic (Figure 2), meeting the demand from the floriculture market, which uses it as substrate for orchids and bromeliads as well as a base for flower and funeral crown arrangements (Figure 3). The harvesting activity is predominantly performed by women and is an important additional revenue source for low-income rural families. However, the growing harvesting demand, lack of knowledge of the available moss biodiversity and its natural replacement dynamic, are important factors that can severely affect the future availability of this resource, as reported by Ticktin (2004) for similar non-wood forest products.

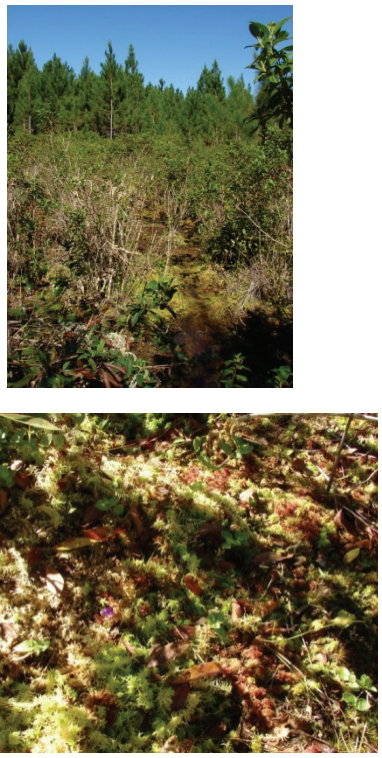

Figure 1. General view and details of a recent wetland formed after a clear-cutting of pine plantation with presence of *Sphagnum,* in Guaratuba Municipality, Paraná State, Brazil.
Photos: Leonardo Sampaio (2008).

Figure 2. Wild harvesting of *Sphagnum* recorded in Guaratuba, Paraná State, Brazil: harvesting, drying and packing stages.
Photos: Leonardo Sampaio (2008).

Figure 3. *Sphagnum* used as base for flower and funeral crown arrangements produced by floriculture shops in Curitiba, Paraná.
Photos: Leonardo Sampaio (2008).

In this context, aiming to provide bases for the establishment of sustainable management plans of this resource, the results are presented of a floristic survey of *Sphagnum* species used by the rural communities of Guaratuba Municipality at the coastal area of Paraná State, southern Brazil.

Material and methods

Study area

The study was performed at the rural zone of Guaratuba Municipality (Paraná State, southern Brazil - 25º 52' 816" S; 48º 43' 565" W), at the localities named Descoberto and Empanturrado, approximately 40 km from the Municipality urban center. This region is part of the Guaratuba EPA (Environmental Protection Area) and is covered by Atlantic Lowland Rain Forest (VELOSO et al., 1991) (Figure 4).

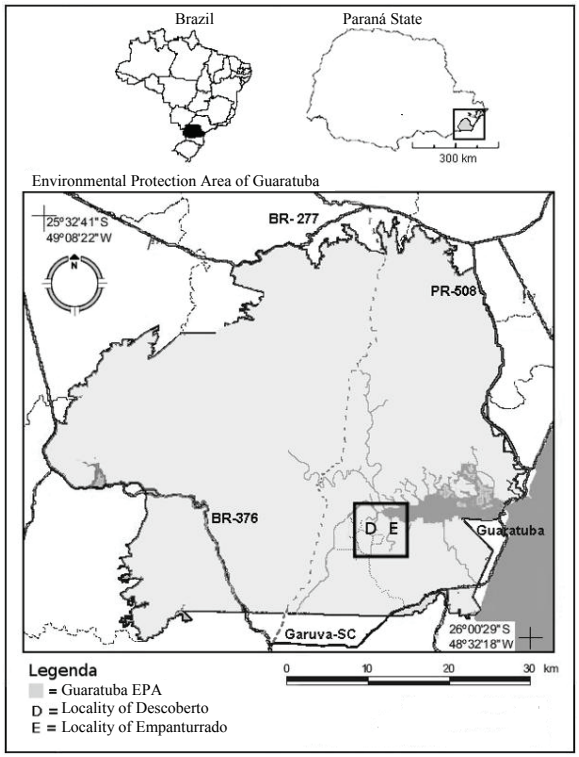

Figure 4. Study area: localities of Descoberto (D) and Empanturrado (E) at the Guaratuba EPA (Environmental Protection Area), Paraná State coastal area, southern Brazil.
Map: Leonardo Sampaio (2008).

The floristic survey covered all harvesting areas used by local harvesters. Usually, these areas corresponded to former pine plantations, characterized by a well developed herbaceous-shrub community combined with scattered arboreal representatives. In those places, sand wet to soaked soils was recorded, with expressive presence of *Sphagnum*. This region of the coastal plain is characterized as an intermediate instability zone, usually covered by Podsol sandy soils with a ferruginous layer (SILVEIRA et al., 2005), flooded by fluvial influence (IBGE, 1992). The main soil types are Spodosols, Neosols, Quartzenic, Hydromorphic and Organosols (RODERJAN et al., 2002), usually regarded as poor soils for agriculture.

The climate is Af type, that means highly humid, without a dry season, no frosts, with mean temperature never below 18ºC. Mean rainfall during the driest month is above 60 mm (SONDA, 2002).

Sampling and botanical identification

The bryophyte material was collected from March to May 2008, at the sites of velvet wild harvesting, following information from local harvesters. The collection and herborization of the material was carried out in accordance with Yano (1989), with the samples deposited at the UPCB Herbarium of the Federal University of Paraná. The following bibliography was used for the identification, classification and description of bryophyte material: Yano et al. (1985), Crum (1984), Sharp et al. (1994), and Chien and Crosby (2009). The information related to species geographical distribution was obtained through literature survey.

Results and discussion

According to local harvesters, there were three velvet types in the studied area: a) **shrimp or macaroni**, characterized by a pale-green to reddish-chestnut color and longer stem; b) **red**, with a smaller and red stem, and c) **green**, with medium size green stem.

Five *Sphagnum* species were identified from the collected material, being two in the shrimp type (*S. erythrocalyx* Hampe – UPCB 59442, and *S. perichaetiale* Hampe – UPCB 59443), one in the red type (*S. capillifolium* (Ehrh.) Hedw – UPCB 59444) and two in the green type (*S. cuspidatum* Ehrh. ex Hoffm – UPCB 59445 and *S. recurvum* P. Beauv. – UPCB 59446) (Figure 5).

Two of the identified species were not previously reported for Paraná State – *S. erythrocalyx* and *S. perichaetiale*. Angely (1968) indicates only the occurrence of *S. recurvum* for Paraná. According to Kummrow and Prevedelo (1982), this species was recorded in the municipalities of Guaraqueçaba, Paranaguá and São José dos Pinhais. According to the herbaria records from the Municipal Botanic Museum, during 1966 until 1997, *S. recurvum* was

collected in coastal zones (Guaraqueçaba and Paranaguá), first tableland (Campina Grande do Sul, Piraquara and São José dos Pinhais) and second tableland (Palmeira) of the State. Yano et al. (1985), in addition to this species, also reports the occurrence of *S. capillifolium* in Jaguariaiva, Ponta Grossa and Balsa Nova municipalities and *S. cuspidatum* in Balsa Nova.

Figure 5. *Sphagnum* types according to local harvesters from Descoberto and Empanturrado localities, Guaratuba, Paraná State, Brazil: a) shrimp or macaroni (*S. perichaetiale* and *S. erythrocalyx*); b) red (*S. capillifolium*); and c) green (*S. cuspidatum* and *S. recurvum*).
Photos: Leonardo Sampaio (2008).

All five identified species were abundantly growing in the studied area. However, with the natural further development of the forest and resulting increase in shading, there is a strong possibility of a negative effect on moss growth, since they prefer environments with higher sunlight availability. Additionally, the continuous and increasing wild harvesting process has serious implications on the natural regeneration dynamic of these moss species, threatening their respective maintenance in the area (McNEIL; WADDINGTON, 2003; VAN SETERS; PRICE, 2001).

Through their empirical moss management, local harvesters maintain a small amount of moss for future regeneration at the harvesting area. According to the harvesters, regeneration time is quite variable, being directly related to the quality and amount of the moss remnant. The selective extraction of larger and older individuals, leaving a base of younger individuals, results in faster regeneration (approximately one year). Conversely, non selective and intense harvesting, with few and smaller areas of moss remnant, will require up to three years to regenerate the moss area. Unfortunately, due to high market demand for the resource, this latter harvesting model is very frequent in the studied area. Because of that, there is a continuous search for new harvesting areas.

As such, the socio-economic viability and environmental sustainability of moss harvesting depend on the urgent establishment of a sustainable management plan. However, there is still a great lack of ecological knowledge, including growth and reproductive dynamics, which need to be fulfilled. Another important component in the sustainability perspective is the domestication and establishment of cultivation areas for these moss species (WICHTMANN; JOOSTEN, 2007). Moss cultivation will provide a secure base to meet market demand as well, as it will reduce the negative ecological impact of wild harvesting, as pointed out by Homma (1993). Similarly important is the education of the harvester community about the vulnerability of the non selective and well-planned harvesting.

If adequate management plans are implanted, moss harvesting is potentially sustainable (RAMSAR CONVENTION SECRETARIAT, 2010; WHINAM; BUXTON, 1997), even contributing to local biodiversity conservation (CHAPMAN et al., 2003).

Key for the identification of *Sphagnum* species from the Guaratuba Environmental Protection Area (EPA), Paraná State (Brazil):

1. Hyaline cortical cells of stems and branches with spiral fibrils (weakly fibrillose, sometimes without fibrils; branches always present; branch leaves with rounded or cucullate apex; branch cortex without curved cells.

Subgenus *Sphagnum*

Section *Sphagnum*

2. Flat wall between the hyaline and green cells; green cells in cross section ecliptic to rectangular or triangular-isosceles, rarely trapezoid, not entirely included by adjacent hyaline cells, exposed in one or both leaf surfaces.

3. Elliptic to rectangular green cells equally exposed in both surfaces.....*S. erythrocalyx*

3'. Strictly elliptic green cells, located at the center, in both surfaces, sometimes more densely exposed at the dorsal surface.....*S. perichaetiale*

1'. Hyaline cortical cells of stems and branches without spiral fibrils; with or without branches, branch leaves with attenuate apex not cucullate, frequently truncate-dentate; branch cortex usually with curved cells.

Subgenus *Isocladus*

4. Branches always present and fasciculate, the divergent branches are well distinct from the pendent ones, that are longer and slender; hyaline cells at the dorsal surface of the branch leaves with 1-5(-8) pores, big to small, ringed or not, never in two rows. Green cells in cross section triangular, with the smallest face towards the ventral surface of the branch leave.

Section *Acutifolia*

5. Branch leaves pores bigger than 8 μm in diameter, rounded to elliptic and lightly ringed or not ringed; Stem leaves with attenuate truncate-dentate apex; branch leaves erect, not falcate, eventually imbricate only in 5 longitudinal rows .....*S. Capillifolium*

4'. Green cells in cross section triangular, with the smallest face towards the ventral surface of the branch leave and trapezoid with the biggest face towards the dorsal surface.

Section *Cuspidata*

6. Branches leaves linear-lanceolate, gradually bigger toward the apex, up to 4.8 mm length; apex not curved after drying.....*S. cuspidatum*

6'. Branch leaves 8-3.0 × 0.3-1.0 mm, oval-lanceolate, approximately equal, concave, curved after drying, apex acute truncate-dentate, margin entire involute near the apex *S. recurvum*

Species description:

***Sphagnum capillifolium* (Ehrh.) Hedw.**

Plants variable in size and color, usually green to yellowish brown, somewhat tinged with pinkish color, sometimes distinctly reddish, not shiny when dry, in loosely compact tufts. Stem cortex in 2–4 layers, hyaline cells thin-walled, without fibrils and pores; central cylinder yellowish or light reddish. Stem leaves differentiated in size on the same stem, generally larger in the lower parts and smaller in the upper parts of the stems, 1.0–1.5 x 0.4–0.7 mm, oblong-ovate to oblong-isosceles-triangular, upper margins involute to a nearly cucullate apex; borders narrow above, clearly widened below; hyaline cells broad-rhomboidal in the upper parts of leaves, mostly divided, narrow-rhomboidal below, less divided, with large pores on both surfaces. Branches in fascicles of 3–5, with 2–3 spreading. Branch leaves 0.9–1.4 x 0.4–0.5 mm, ovate-lanceolate, upper margins involute, with blunt, dentate apex; hyaline cells densely fibrillose, upper cells with pores at ends and at corners, lower cells and marginal cells with large pores on ventral surface, with numerous, ringed, elliptic pores in the upper cells, gradually enlarged in the lower cells on the dorsal surface; green cells in cross section triangular, exposed on the ventral surface. Dioicous or monoicous; branches with antheridia reddish; perigonial leaves short and broad with abruptly narrowed apex. Perichaetial leaves broadly ovate, abruptly involute-concave at the apex. Spores pale-yellowish, smooth or slightly papillose, 20–25 μm in diameter.

Habitat: Wet to soaked places with wooded edges, marshes, edge of brooks and ponds; wet sand soil of open forests, rarely in open places; found also in wet rupestris areas (YANO et al., 1985). In peatlands under conifers or Rhododendron brush, on wet humus and the sides of hummocks (CHIEN; CROSBY, 2009).

Geographic distribution: China, India, Korea and Japan, Russian Extreme Orient, Europe, North and South America, and Africa (CHIEN; CROSBY, 2009). It is one of the most common species of peatmoss in the Sphagnum-dominated peatlands of northeastern North America and Eurasia (CRUM, 1975). The species is well distributed in Brazil, being recorded in Amazonas, Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Paraná and Santa Catarina States (YANO et al., 1985), and Rio Grande do Sul State (YANO; BORDIN, 2006).

Occurrence at Paraná State (Brazil): Interior of the coastal plain (Guaratuba) and second tableland (Balsa Nova, Jaguariaiva, Ponta Grossa), according to Yano et al. (1985).

***Sphagnum cuspidatum* Ehrh. ex Hoffm.**

Plants slender, soft, yellowish green to brown, somewhat shiny when dry. Stem cortex in 2–3 layers, hyaline cells large, thin-walled, without fibrils; central cylinder deeply yellowish green, clearly distinguished from the cortical cells. Stem leaves 1.2–2.0 x 0.5–0.8 mm, oblong-triangular to isosceles-triangular, gradually acute and slightly dentate at the apex, borders narrow above, clearly widened from the middle to the

base (ca. 1/3 leaf base); hyaline cells narrow, undivided, often with fibrils, sometimes with small end pores on the dorsal surface. Branches in fascicles of 4, with 2 spreading. Branch leaves 2.0–4.0 mm x 0.5–0.6 mm, slightly shiny, often undulate at margins and secund when dry, narrowly ovate-lanceolate, gradually narrowed to a blunt, dentate apex; margins bordered by a few rows of linear cells; central hyaline cells narrowly elongate-rhomboidal, with small, ringed pores at the upper corners, rarely with pores at the lower corners on the dorsal surface, mostly with numerous small pores, rarely with rather large pores at the corners on the ventral surface, the inner walls adjacent to green cells smooth; the green cells in cross section trapezoidal, more broadly exposed on the dorsal surface. Dioicous; antheridial branches reddish brown; perigonial leaves shorter and wider than vegetative branch leaves. Perichaetial leaves broadly ovate with rounded apex, margins entire. Spores yellowish brown.

Habitat: Occurs in very wet sand soils ('Restingas') or marshes, sometimes submerged. It forms pure ground carpets or associations with *Sphagnum auriculatum* (YANO et al., 1985). On wet humus under forests and bases of trees forming a hummock-hollow complex adjacent to bog mats (CHIEN; CROSBY, 2009).

Geographic distribution: China, India, Thailand, Indonesia, Malaysia, New Guinea, Australia, Europe, North, Central and South America, and Africa (CHIEN; CROSBY, 2009). East and West Canada; North, Northeast and Southeast USA; Central America and West South America; North, Southwest and Centre Europe; East Asia; China and Malaysia (ALLEN, 1994). Absent at North Scandinavia but present in most part of Europe, up to Portugal (DANIELS; EDDY, 1985). Recorded in Southeast and South Brazil, from Rio de Janeiro to Rio Grande do Sul State (YANO et al., 1985).

Occurrence at Paraná State (Brazil): Interior of coastal plain (Guaratuba) and second tableland (Balsa Nova), according to Yano et al. (1985).

Sphagnum erythrocalyx Hampe

Plants moderately robust pale-green to opaque chestnut. Stem cortex in 2–3 layers, hyaline cells without fibrils or sparsely fibrillose, with one pore; central cylinder reddish brown. Stem leaves 0.7-1.8 x 0.4-0.9 mm, oval-oblong blade, attenuated, cucullate dentate apex, margin entire or denticulate, involute towards the apex; little enlarged and auriculate base. Hyaline cells lengthened in the basic portion to rhomboidal, with fibrils and pores and pores only in the superior half. Branches in fascicles of 2-3 divergent, 2 pendants. Branch oval leaves 0.6-1.3 x 0.4-0.7 mm, cucullate apex, margin entire involute and attenuate base; hyaline cells rhomboidal fibrillose, with small ringed pores; smooth wall between the hyaline and green cells; green cells in cross section elliptic to rectangular, equally exposed on both surfaces. Dioicous or Monoicous. Sporophytes with perichaetial oblong leaves 2.0-3.0 mm length. Hyaline pseudopodium ca. 1.5 mm length; obovoid-cylindrical brownish capsules, ca. 2.0 mm height.

Habitat: Very wet places. Usually, over rocks in marshes and slopes at the Atlantic Forest (YANO; MELLO, 1992).

Geographic distribution: Galapagos (ITOW; WEBER, 1974); South and Central America up to New Jersey, USA (ANDREWS, 1913, 1941; BREEN, 1963); Colombia e Venezuela (GRIFFIN III, 1981). Indochina (HANSEN, 1965). In Brazil, it was recorded in Roraima State (YANO; MElLO, 1992); Pernambuco, Bahia, Rio de Janeiro, São Paulo (VATTIMO, 1978, 1970; YANO et al., 1985), and Paraná State.

Occurrence at Paraná State (Brazil): Interior of the coastal plain (Guaratuba).

Sphagnum perichaetiale Hampe

Plants moderately robust, soft, pale green or yellowish brown, tinged with purple, in dense tufts. Stem cortex in 2–4 layers, hyaline cells thin-walled, sparsely fibrillose and porose; central cylinder reddish brown. Stem leaves 0.7–1.0 x 0.5–0.6 mm, short and small, flat, short ligulate, rounded and dentate at the apex; hyaline cells broadly rhomboidal, often divided, without fibrils and pores, or rarely fibrillose and porose in the upper cells. Branches in fascicles of 3–5, with 2–3 spreading. Branch leaves 1.6–2.0 x 1.2–1.4 mm, broadly ovate, strongly concave, margins involute in the upper half, cucullate-concave and dorsally roughened at the apex; hyaline cells rhomboidal, with large, rounded, unringed pores on the ventral surface, more pores in the upper cells, with few elliptic, ringed pores at the opposite ends on the dorsal surface; green cells in cross section narrowly elliptic, centrally located, slightly and equally exposed on both surfaces. Dioicous. Sporophytes not seen.

Habitat: in bogs, on wet ground under forests; also submerged in water on grasslands (CHIEN; CROSBY, 2009).

Geographic distribution: Pan tropical. New Zeeland (KARLIN; ANDRUS, 2006). China, Himalaya, India, Thailand, Cambodia, Vietnam,

Indonesia, Malaysia, Filipinas, Europe, North, Central and South America, South Africa and Madagascar (CHIEN; CROSBY, 2009). In Brazil, it was recorded at Distrito Federal, Amazonas, Espírito Santo, Minas Gerais, Mato Grosso do Sul, Pará, Rio de Janeiro, Rondônia, Santa Catarina and São Paulo State (CÂMARA, 2008); Bahia (HARLEY, 1995); Goiás (YANO; PERALTA, 2007); Rio Grande do Sul (YANO; BORDIN, 2006); Tocantins State (CÂMARA; LEITE, 2005).

Occurrence at Paraná State (Brazil): Interior of the coastal plain (Guaratuba) and first tableland (Mun. Campo Largo).

Sphagnum recurvum P. Beauv.

Plants rather large, slender, to 20 cm high, bright green to yellowish green or sometimes brown, in loose tufts. Stem cortex in 2–4 layers, indistinct, hyaline cells thick-walled, without fibrils and pores; central cylinder not much differentiated from cortical layers, green or yellowish green. Stem leaves 0.5–1.0 x 0.5–1.0 mm, nearly equilateral-triangular, with abruptly pointed apex or strongly lacerate across the apex; borders narrow above, gradually widened below the middle; hyaline cells undivided, mostly without fibrils and pores. Branches in fascicles of 3–5, with 1–2 spreading. Branch leaves 0.8–3.0 x 0.3–1.0 mm, ovate-lanceolate to lanceolate, strongly concave and cucullate near the apex, often cucullate-curved in the apex when dry; borders narrow; hyaline cells with rather large, rounded, unringed pores at the corners on the ventral surface, with a few small pores at the corners or along commissural rows, often becoming larger near the base on the dorsal surface; green cells in cross section isosceles-triangular, exposed on the dorsal surface, enclosed by hyaline cells on the ventral surface. Dioicous; antheridial branches brownish orange; perigonial leaves oblong-elliptic with a broad base and an apiculate apex. Perichaetial leaves large, broadly ovate, abruptly sharp pointed at the apex, borders wide, almost consisting of all green cells near the base. Spores yellowish, smooth or papillose, ca. 25 μm in diameter.

Habitat: Soaked soils. Usually in bogs, hummocks or on wet ground under coniferous forests (CHIEN; CROSBY, 2009).

Geographic distribution: China, Nepal, India, Japan, Russia (Siberia), Europe, North and South America, New Zeeland (CHIEN; CROSBY, 2009). In Brazil, it was recorded in Minas Gerais, Rio de Janeiro, São Paulo, Paraná, Santa Catarina and Rio Grande do Sul State (VATTIMO, 1978; YANO et al., 1985); Bahia (HARLEY, 1995); Mato Grosso do Sul State (YANO, 2006).

Occurrence at Paraná State (Brazil): Curitiba (Serra do Mar, Rio Itararé) according to Yano (1981). Interior of the coastal plain (Guaratuba): coastal zone (Guaraqueçaba; Guaratuba and Paranaguá), according to Kummrow and Prevedello (1982). First tableland (Mun. Campo Largo, Piraquara, S. José dos Pinhais) and second tableland (Palmeira), according to data from MBM Herbarium.

Conclusion

Five *Sphagnun* species were recorded: *S. capillifolium* (Ehrh.) Hedw., *S. cuspidatum* Ehrh. ex Hoffm., *S. erythrocalyx* Hampe, *S. perichaetiale* Hampe and *S. recurvum* P. Beauv. All of them are native species that grow spontaneously in the studied region and are intensively harvested by the local community.

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