

Syntrichia bogotensis (Bryopsida, Pottiaceae) New for Macaronesia

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Abstract. *The neotropical moss Syntrichia bogotensis* (Hampe) R. H. Zander is reported for the first time for Macaronesia on the basis of six collections from Madeira Island (Portugal). This species has previously been known only from tropical America. The principal distinctive characters that separate it from the two nearest species, *S. andicola* and *S. norvegica*, are discussed. The species is illustrated, its distribution is mapped, and its name lectotypified. A key to the Madeiran taxa of *Syntrichia* is provided.

Keywords. Bryophyte, distribution, Madeira, Pottiaceae, *Syntrichia bogotensis*.

In the course of a study of *Syntrichia* specimens from Portugal deposited in MADJ, we observed that some of the samples, identified as *Tortula princeps* De Not., *Tortula norvegica* (F. Weber) Lindb., *Tortula* sp., and *Barbula aciphylla* Bruch & Schimp. from Madeira, were not attributable to any previously known *Syntrichia* for the area. Also, the same species was found in two samples that had been identified as *Tortula subulata* Hedw. deposited in s. After studying syntypes deposited in BM and PC we concluded that the specimens from Madeira were *Syntrichia bogotensis* (Hampe) R. H. Zander.

Syntrichia bogotensis is a neotropical species to date only known from Mexico, Central America (Guatemala), and western South America (Bolivia, Colombia, Ecuador, Peru, and Venezuela) (Allen 2002; Churchill et al. 2000; Churchill & Linares 1995; Delgadillo et al. 1995; Mishler 1994). The world distribution of the species based upon current literature reports and new records is given in Figure 1. The citation from Venezuela was not included in the general distribution map of *Syntrichia bogotensis* because we were not able to find the locality on which this record is based. Since Madeiran climatic conditions support the growth of warm-temperate and tropical taxa, this disjunct distribution between Neotropical and Macaronesian floras is not surprising. In addition, only in the Macaronesian Islands does subtropical vegetation appears at this latitude, linking tropical Africa with Europe (Frahm 1995).

SYNTRICHIA BOGOTENSIS (Hampe) R. H. Zander, Bull. Buffalo Soc. Nat. Sci. 32: 267. 1993.

Barbula bogotensis Hampe, Ann. Sci. Nat., Bot., sér. 5. 3: 349. 1865. TYPE: [COLOMBIA] "Bogota, Guadalupe,

2,900 m, in nemorib., Aug. 1863" A. Lindig s.n. [BM!, lectotype (designated here); BM! and PC!, isolectotypes].

Tortula bogotensis (Hampe) Mitt., J. Linn. Soc. Bot. 12: 171. 1869.

This species is characterized by orange to reddish or red-brown hair points, that are occasionally sharply toothed at their bases; plane leaf margins (Figs. 2A,C) that are only sometimes slightly recurved near the middle of the leaf; a transverse section of the costa with 1–3(4) rows of stereids and the absence of hydroids; upper and middle laminal cells 12–26 μm wide (Fig. 2E) with (4)6–18(20) bifurcating non-pedicellate papillae per cell that are 2.5 μm high; and a peristome basal membrane with 1–2(4) cell rows and 50–95 μm in height. Detailed descriptions of *S. bogotensis*, with illustrations, are given by Mishler (1994) and Allen (2002). The Madeiran specimens have no sporophytes, but show all the gametophytic characters of the American specimens.

Two of the four specimens from MADJ were collected on trees (*Tilia* sp.) at 600–1,300 m, and two were collected at about 1,800 m, probably on soil, although the labels of the specimens do not describe their substrate. On the label of B72688 from s, neither the ecology nor the elevation is mentioned. The other sample from s (B72687) was an epiphyte on *Ocotea foetens* (Aiton) Baill. All specimens of *Syntrichia bogotensis* found in Madeira grow at lower elevations than those from tropical America where, according to Delgadillo et al. (1995) and Churchill et al. (2000), localities can reach more than 4,000 m. Other bryophytes, such as *Plagiochila papillifolia* Steph. (that has a neotropical distribution and was recently reported for



FIGURE 1. World distribution map of *Syntrichia bogotensis* based on literature reports and new records.

Macaronesian Islands) also appear at lower elevations than in tropical America (Heinrichs et al. 2002) because the highest elevation on Madeira Island is 1,861 m.

Some of the morphological characters shown by *Syntrichia bogotensis*, such as the size and papillosity of the upper and middle laminal cells and the color and ornamentation of the hair-point are also found in *S. andicola* (Mont.) Ochyra and *S. norvegica* F. Weber. These three species also share an obvious and particular character within the genus, which sets apart this group of taxa from the rest of the species of *Syntrichia* (Gallego 2002; Mishler 1994)—namely the costa structure on the upper third of the leaf, where the dorsal stereids disappear. The transverse section of the costa is composed of the following: ventral epidermis, guide cells, and leaf cells similar to those of the lamina (Fig. 2B). On the other hand, in the middle and lower part of the leaf, the costa is composed of ventral epidermis, guide cells, and dorsal stereids (Fig. 2D).

Syntrichia norvegica has longer hair-points that are not toothed at the base, leaf margins recurved from the base to upper third of the leaf (Fig. 2F), and a higher peristome membrane than *S. bogotensis*. This former species is a terricolous and saxicolous taxon which appears in Europe, Asia, Ma-

caronesia (only in Madeira), North and South Africa, and North (Düll 1984) and Central America (Düll 1992; Mishler 1994), but not in neotropical areas (Churchill et al. 2000; Delgadillo et al. 1995). It is relatively common in the Mediterranean region (Gallego 2002), where it grows at high elevations (1,800–3,500 m).

Syntrichia bogotensis is closely related to *S. andicola*, a tropical alpine species widely distributed in the Neotropics from Mexico to Argentina, that occurs on soil at higher elevations (above 3,000 m). The sporophytes of both species are similar, but the gametophytes basically differ in the curvature of the leaf margins and ornamentation of the leaf apex—*S. andicola* has strongly revolute margins from the leaf base to the upper third and a usually dentate apex. According to Mishler (1994), there is a geographical and ecological differentiation between *S. bogotensis* and *S. andicola*, since the former grows on wood at lower elevations (1,800–3,000 m). The main differences between *Syntrichia bogotensis*, *S. andicola*, and *S. norvegica* are shown in Table 1.

Other *Syntrichia* taxa that have been recorded from Madeira are: *S. calcicola* J. J. Amann, *S. fragilis* (Taylor) Ochyra, *S. laevipila* Brid., *Syntrichia montana* Nees, *S. norvegica*, *S. ruralis* (Hedw.) F.

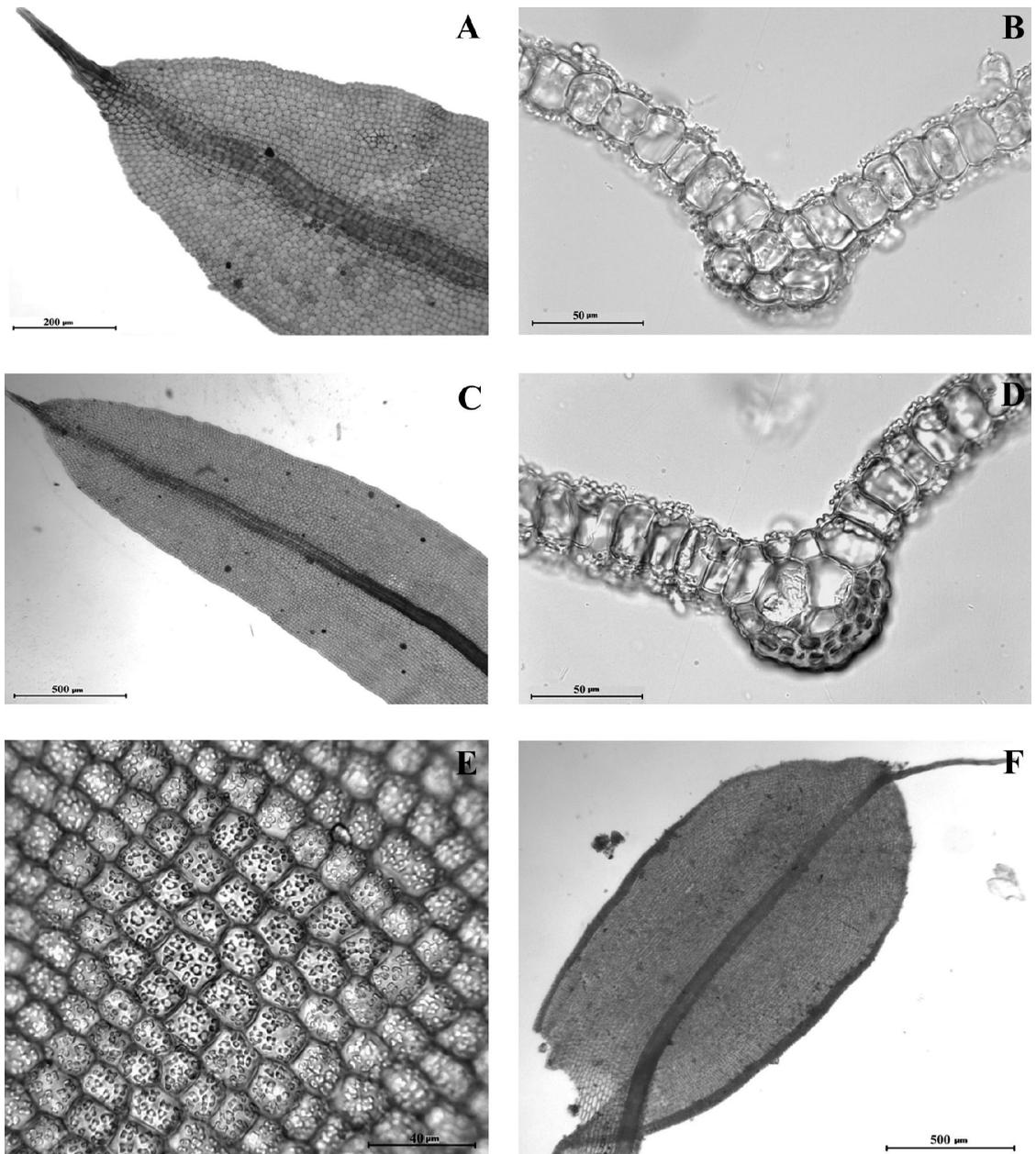


FIGURE 2. *Syntrichia bogotensis* and *S. norvegica*. A–E. *S. bogotensis* (from s B72688). — A. Upper third of leaf. — B. Transverse section of costa in upper third of leaf. — C. Upper and middle leaf. — D. Transverse section of costa at mid-leaf. — E. middle laminal cells. — F. *S. norvegica* (from MUB 8345). Leaf. Scale bars: A = 200 μm ; B, D = 50 μm ; C, F = 500 μm ; E = 20 μm .

Weber & D. Mohr var. *ruralis*, *S. ruralis* var. *ruraliformis* (Besch.) Delogne, and *S. princeps* (De Not.) Mitt. *Syntrichia calcicola* and *S. montana* were reported by Düll (1992) and Smith (1978), respectively, from Madeira. The report of *S. calcicola* has not been confirmed and the record of *S. montana* has been disregarded by Smith (2004) himself.

Specimens examined.—*Syntrichia bogotensis*: PORTUGAL. MADEIRA. Pico Ruivo, sopé ladeando a Fonte ou nascente que abastece a casa do Pico Ruivo, *Nóbrega*, 11.07.1984 (MADJ 5663); Ribeira do Poço, Serra da Água, *Nóbrega & Paulo*, 6.11.1985 (MADJ 5058); Guada do Pico Ruivo, *Nóbrega*, 13.03.1990 (MADJ 6489); Margem direita da Ribeira Seca do Faial, 1,300 m, *Nóbrega*, 23.10.1990 (MADJ 6704); Sao Jorge, Cova do Sino, *Nóbrega*, 22.08.1945 (s B72688); *Nóbrega 45* (s B72687). *Syntrichia fragilis*: PORTUGAL. MADEIRA. S. Vicente, Ribeira

TABLE 1. Diagnostic characters and habitat of *Syntrichia norvegica*, *S. bogotensis*, and *S. andicola*.

Taxon	Leaf margins	Leaf apex	Peristome membrane	Habitat
<i>S. norvegica</i>	Recurved ½ to ¾ of the leaf length, rarely plane	Usually without teeth	8–10(12) cell rows; 250–350 µm length	Mainly on soil and rocks. At medium to high elevations (1,800–3,500 m)
<i>S. bogotensis</i>	Plane	Occasionally with teeth	1–2(4) cell rows; 50–95 µm length	Mainly on trees. At medium to high elevations (600–4,250 m)
<i>S. andicola</i>	Recurved to ¾ of the leaf length	Usually with teeth	1–2(3) cell rows; 50–70 µm length	Mainly on soil. At high elevations (2,700–4,900 m)

da Passo, *Nóbrega 1677* (LISU 149223). *Syntrichia laevipila*: MADEIRA. Serra de Água, valley of the Ribeira Brava, *Arts 15936* (LISU 181467); Machico, im Garten des Cafés von Machico, *Schwab 255* (LISU 162381); Agua do Vento, Ribeira de Ponta do Sol, *Nóbrega, 5.04.1988* (MADJ 6174); Levada das Rabacas, Ponta do Sol, *Nóbrega, 6.06.1993* (MADJ 7727). *Syntrichia norvegica*: MADEIRA. Ribeiro Frio, *Barreto, 1938* (Herb. H.N. Dixon 108 in BM). *Syntrichia ruralis* var. *ruralis*: MADEIRA. Entre Pico Arieiro e o Pico do Gato, ao longo da vereda que vai para o Pico Ruivo, *Fontinha & Nóbrega, 22.08.1990* (MADJ 6647); Pico Ruivo, 1,800 m, *Cano 1333* (MUB 15628). *Syntrichia ruralis* var. *ruraliformis*: MADEIRA. Fustete, Pico Grande, *Nóbrega, 10.1944* (INA); Pico Arieiro, 1,730 m, *Cano 1322* (MUB 15620). *Syntrichia princeps*: MADEIRA. Pico Ruivo-Pico do Arieiro, *Nóbrega, 11.07.1984* (MADJ 5656).

KEY TO THE MADEIRAN TAXA OF *SYNTRICHIA*

1. Costa in upper third of leaf without dorsal steroids; hair point orange to reddish or red-brown 2
1. Costa in upper third of leaf with dorsal steroids; hair point hyaline, sometimes brown at base 3
 2. Leaf margins plane, sometimes slightly recurved near middle; leaf apex tapered to hair point or to short apiculus, occasionally sharply toothed at base; basal membrane of peristome formed of 1–2(4) rows of cells, 50–95 µm high *S. bogotensis*
 2. Leaf margins recurved from base to middle or upper third, rarely plane; leaf apex tapered to hair point, not toothed at base; basal membrane of peristome formed of 8–10(12) rows of cells, 250–350 µm high *S. norvegica*
3. Leaves fragile, usually broken, with mucro; peristome basal membrane formed of 5–10 rows of cells, 100–300 µm high *S. fragilis*
3. Leaves firm, not broken, with hair point; peristome basal membrane formed of 10–42 rows of cells, 250–1,400 µm high 4
 4. Costa without hydroids; leaves not constricted in middle 5
 4. Costa with hydroids; leaves constricted in middle (sometimes *S. princeps* weakly or not constricted) 7
5. Leaf margins recurved from base to upper third, rarely to middle; middle laminal cells 12.5–15.0(17.5) × 12.5–15.0(17.5) µm; juxtacostal basal cells forming clearly differentiated hyaline area up to 19–25(33)% of leaf length *S. calcicola*
5. Leaf margins recurved from base to apex, sometimes near apex; middle laminal cells (5.0)7.5–10.0(15.0) × 5.0–10.0(12.5) µm; juxtacostal basal

- cells forming clearly differentiated hyaline area up to 27–45% of leaf length 6
6. Leaf apex not hyaline, generally rounded, not tapering into hair point *S. ruralis* var. *ruralis*
6. Leaf apex usually hyaline and acuminate, tapering into hair point *S. ruralis* var. *ruraliformis*
7. Hair point smooth, sometimes weakly spinulose; margins bordered or not, when bordered formed by 2–5 columns of thicker walls and less papillose cells, sometimes smooth, brown or yellowish; sometimes with brood leaves on stem apex or at base of upper leaves, often forming a rosette in upper leaves; dioicous or autoicous *S. laevipila*
7. Hair point spinose to strongly spinose; margins unbordered; without vegetative diaspores; dioicous or synoicous *S. princeps*

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