

# Two new combinations in *Didymodon* (Pottiaceae) from South America

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**ABSTRACT.** *Barbula santessonii* E. B. Bartram and *B. fusca* Müll. Hal., two neglected South American species are transferred to the genus *Didymodon* Hedw. Both species are described and distinguished from closely related species with which they may be confused. Each species is illustrated for the first time and its distribution mapped. *Barbula fuscoviridis* Broth. ex Thér. is synonymized with *Didymodon fuscus*.

**KEYWORDS.** Chile, *Didymodon fuscus*, *Didymodon santessonii*, *Barbula*, Pottiaceae, taxonomy



In 2001 a field trip was made to Chile with the aim to study the bryophyte flora with special interest in the Pottiaceae. During this trip the second author collected, in the north and central areas of the country, several samples of the genus *Didymodon* Hedw. Among them, we found two specimens that could not be attributed to any species of *Didymodon* known to us. Later, while studying material of *Didymodon* for a taxonomic revision of the genus in South America, we had the opportunity to study the type material of most of the *Didymodon* species described from South America and numerous *Didymodon* specimens from Chile deposited at MO. Examination of the type specimens revealed that the two unknown specimens collected in Chile were *Barbula santessonii* E. B. Bartram and *B. fusca* Müll. Hal. The types of these two taxa have axillary hairs of 3–4 cells, with 1–2 brown basal cells, characteristic of

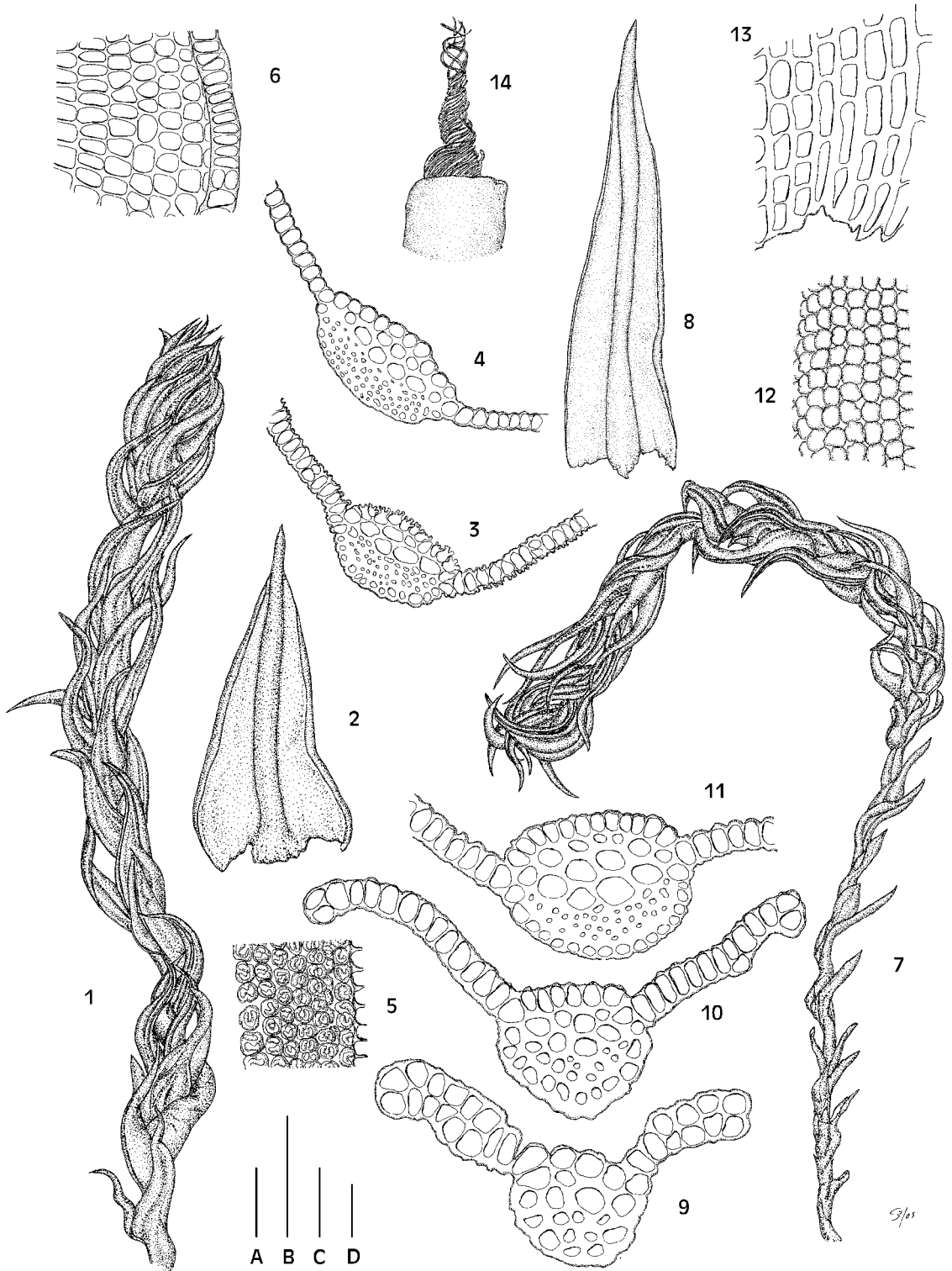
the genus *Didymodon*, to which both species are here transferred.

***Didymodon santessonii*** (E. B. Bartram) *comb. nov.*

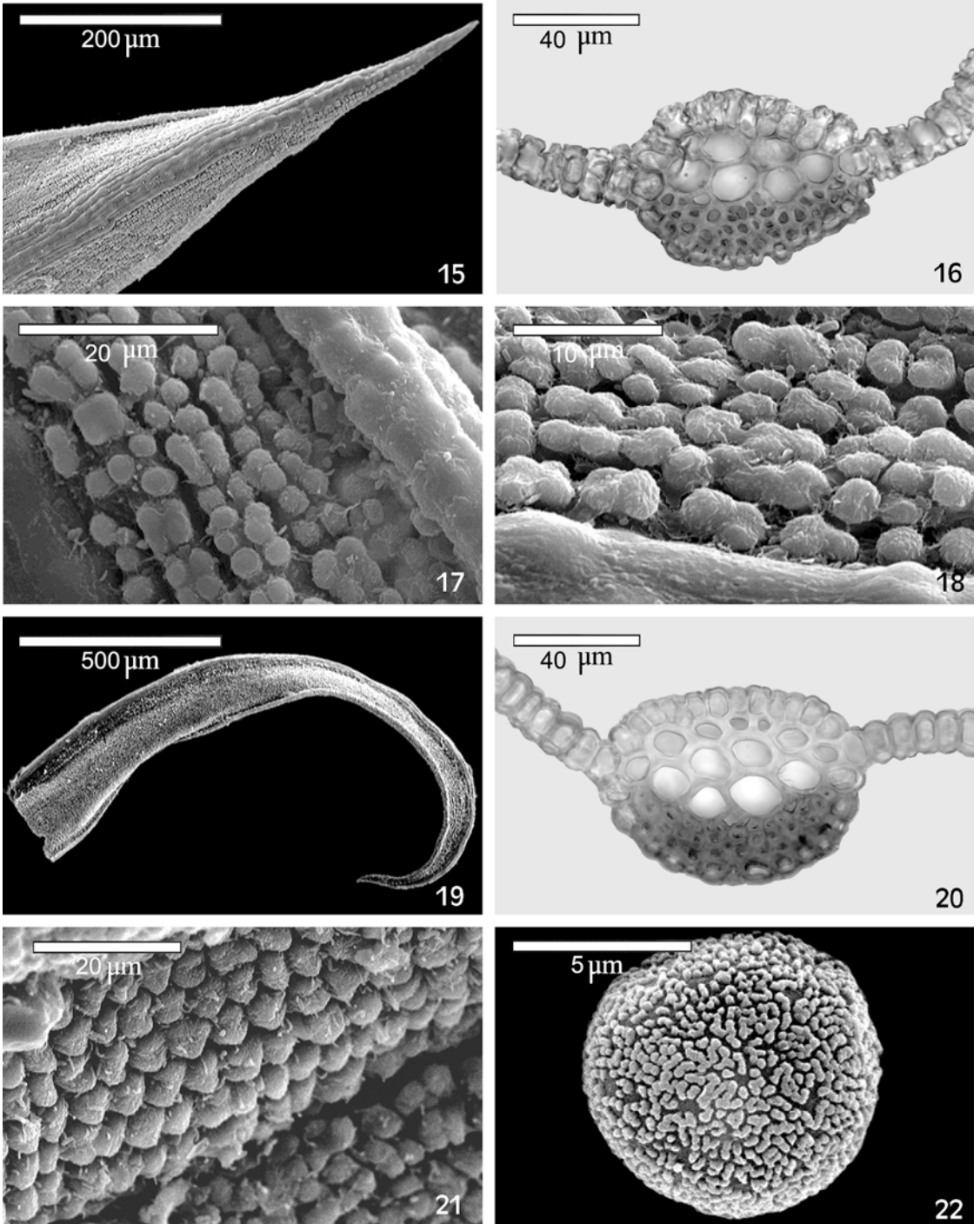
**Figs. 1–6, 15–18**

*Barbula santessonii* E. B. Bartram, Svensk Bot. Tidskr. 46: 245. 1952. TYPE: [CHILE.] “Prov. Valparaíso, Lago Peñuelas,” 28 Aug 1940, R. Santesson M 153 (s!, holotype; FH!, isotype).

**Description.** Plants 0.2–0.7 cm, growing in dense turfs, red or brown-green. Stems erect, simple, without hyalodermis, central strand differentiated, sclerodermis scarcely developed. Leaves incurved or appressed at base, the upper spirally twisted around the stem when dry, erect-patent to patent when moist, triangular or ovate-triangular, ventral surface keeled, 0.75–1.6 × 0.3–0.6 mm; lamina unistratose, some-



**Figures 1–14.** *Didymodon santessoni* and *D. fuscus*. 1–6. *Didymodon santessoni* (from *Cano 48*, MUB). 1. Habit. 2. Leaf. 3. Transverse section of costa at mid-leaf. 4. Transverse section of costa near base. 5. Laminar cells at midleaf. 6. Basal laminar cells. 7–14. *Didymodon fuscus* (7–13 from *Cano 6*, MUB; 14 from *Cano 326d*, MUB). 7. Habit. 8. Leaf. 9, 10. Transverse sections of costa near apex. 11. Transverse sections near base. 12. Laminar cells at midleaf. 13. Basal laminar cells. 14. Capsule. Scale bars: A = 0.4 mm (Figs. 1, 14); B = 0.5 mm (Figs. 2, 8); C = 0.1 mm (Fig. 7); D = 20  $\mu$ m (Figs. 3–6, 9–13).



**Figures 15–22.** *Didymodon santessoni* and *D. fuscus*. 15–18. *Didymodon santessoni* (from Cano 87, MUB). 15. Leaf apex. 16. Transverse section of the costa at midleaf. 17, 18. Laminal cells at midleaf. 19–22. *Didymodon fuscus* (from Cano 326d, MUB). 19. Leaf. 20. Transverse section of costa at midleaf. 21. Laminal cells at midleaf. 22. Spore.

times bistratose in small patches above midleaf, orange to yellowish or red with KOH; apex acuminate; margins entire below, papillose-crenulate above, recurved throughout, unistratose. Costa broad, 50–130  $\mu\text{m}$  wide at leaf base, excurrent; ventral cells of the costa (in the upper middle of the leaf) quadrate, papillose, without a patch of translucent cells immediately below the apex; dorsal cells of the costa (in the upper middle of the leaf) elongate, smooth; transverse section semicircular to elliptic, with 2 layers of guide cells, with 2–7 cells in each layer, without ventral stereids, 3–4 layers of dorsal stereids, without hydroids; ventral surface cells layer bulging, papillose, dorsal surface cells layer differentiated, smooth. Upper and middle laminal cells quadrate to transversely elongate, 3.5–10  $\times$  5–10  $\mu\text{m}$ , strongly papillose, thick-walled; basal cells quadrate or shortly rectangular, 6.5–30  $\times$  6.5–18.5  $\mu\text{m}$ , not differentiated, smooth, thick-walled. Gemmae absent. Dioicous. Sporophyte unknown.

**Additional specimens examined.** CHILE. COQUIMBO: Choapa, Huentelauquén, *Mahú* 22970 (MO); Los Vilos, *Mahú* 23824 (MO); Limarí, Parque Nacional Fray Jorge, La Escondida, *Mahú* 21939 (MO). O'HIGGINS: Cardenal Caro, Quebrada El Roble, al N de Pichilemu, *Mahú* 13424 (MO). VALPARAÍSO: Olmué, *Cano* 48 (MUB 16423); pr. El Cajón, *Cano* 87 (MUB 16424); San Antonio, El Quisco, Punta de Tralca, ladera Sur de la Quebrada Guallelemu, *Mahú* 11015 (MO); recinto del Baucó del Estado, *Mahú* 11745 (MO).

**Habitat.** On rocks and soils in open places; 50–380 m.

**Discussion.** *Barbula santessonii* was described by Bartram (1952), based on a single specimen collected by R. Santesson from Valparaíso Province (Chile). After its description the taxon remained poorly known, and only Seki (1974) reported a new locality from Lago General Carrera in Aisén Province. Since then, no further data has been published other than listing the name in works such as Greene (1986) and He (1998). Therefore, the taxon was considered to be insufficiently known by Crosby et al. (1999). The distribution of the species is given in **Fig. 23**.

*Didymodon santessonii* is characterized by its triangular or ovate-triangular leaves spirally twisted around the stem when dry, an acuminate leaf apex, excurrent costa, transverse section of the costa

without ventral stereids and the strong papillosoity of the laminal cells.

The most closely related species is *Didymodon vinealis* (Brid.) R. H. Zander. Characters like the position of the leaves when dry, color of the lamina with KOH, shape of the leaves, and size and shape of the lamina cells are common to both species. However, *Didymodon santessonii* differs from *D. vinealis* by having the costa more longly excurrent, leaf margins recurved throughout and transverse section of the costa with bulging ventral surface cells, while in *D. vinealis* the costa is percurrent or shortly excurrent, leaf margins are recurved from base to  $\frac{1}{2}$  or  $\frac{3}{4}$  of the leaf length and ventral surface cells of the costa are not bulging. The best feature to separate the two species is the presence of a patch of translucent cells near the apex on the ventral surface of the costa in *D. vinealis*, which is absent in *D. santessonii*.

Because of the leaf shape and excurrent costa, *Didymodon acutus* (Brid.) K. Saito could be confused with *D. santessonii* but may be distinguished by its leaves appressed when dry, margins recurved near the base or to the proximal  $\frac{1}{3}$  of the leaf and transverse section of the costa with one layer of guide cells.

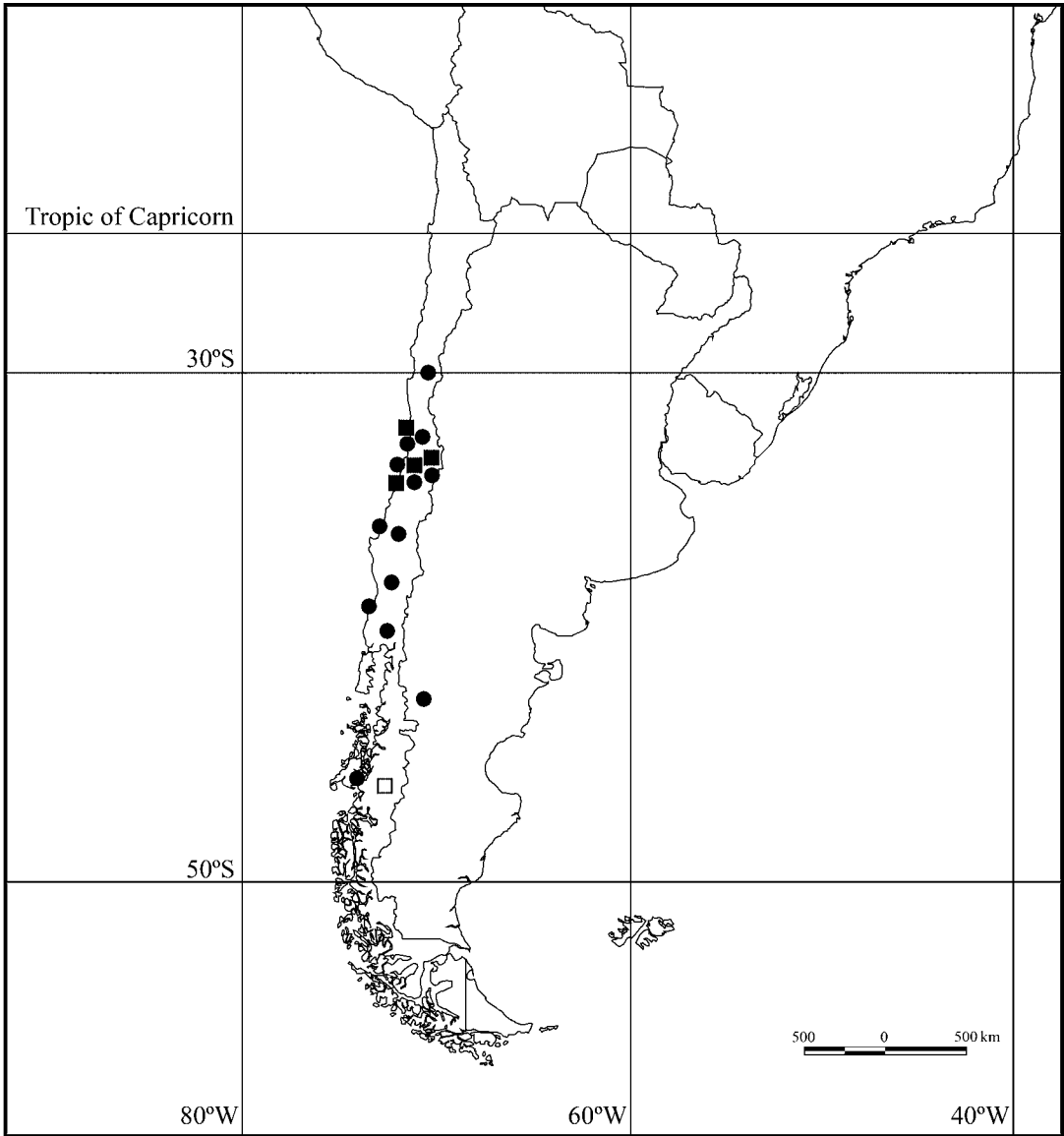
***Didymodon fuscus* (Müll. Hal.) comb. nov.**

**Figs. 7–14, 19–22**

*Barbula fusca* Müll. Hal., Syn. Musc. Frond. 1: 610. 1849. TYPE: "Chile", *Pöppig s.n.* (BM-HAMPE!, lectotype designated by Sollman (1983); BM-HOOKER!, L, isolectotypes).

*Barbula fuscoviridis* Broth. ex Thér., Revista Chilena Hist. Nat. 25: 293. 1921, *syn. nov.* TYPE: [CHILE.] "Angol," Sep 1917, *Campo* 8 (PC!, lectotype designated here).

**Description.** Plants 0.4–2.6 cm, growing in dense turfs, red or reddish brown, rarely brown-green. Stems erect, generally branched, without hyalodermis, central strand differentiated, sclerodermis scarcely developed. Leaves twisted, the upper generally crisped when dry, erect-patent to patent, rarely spreading, when moist, lanceolate to long-lanceolate, ventral surface sometimes keeled, 1.1–3  $\times$  0.35–0.67 mm; lamina unistratose, sometimes regularly or irregularly bistratose in distal  $\frac{1}{3}$  of leaf, orange-yellowish or irregularly red above midleaf with KOH; apex acute; margins entire, recurved from base to or near the apex



**Figure 23.** Distribution of *Didymodon fuscus* (dots) and *D. santessonii* (squares). Open symbols indicates literature reports, and solid ones represent studied material.

of the leaf, unistratose or often bistratose in 2–4 rows of cells in the upper 1/3 of the leaf. Costa 50–125  $\mu\text{m}$  wide at leaf base, percurrent or excurrent; ventral cells of the costa (in the upper middle of the leaf) quadrate or shortly rectangular, bulging, seldom weakly papillose; dorsal cells of the costa (in the upper middle of the leaf) quadrate or rectangular, smooth; transverse section rounded to semicircular; with (2–)3(–4) layers of guide cells, with 3–6 cells in each layer, without ventral stereids, 3–4 layers of dorsal

stereids, without hydroids; ventral surface cells layer bulging, smooth or seldom weakly papillose, without a patch of translucent cells below the apex, dorsal surface cells layer differentiated, smooth. Upper and middle laminal cells quadrate to shortly rectangular, 2.5–10  $\times$  5–12  $\mu\text{m}$ , ventrally strongly bulging, smooth, generally thick-walled; basal cells rectangular to shortly rectangular, 12.5–50  $\times$  5–12.5  $\mu\text{m}$ , not differentiated, smooth, generally thick-walled. Gemmae absent. Dioicous. Seta 0.8–2 cm long, reddish

brown or yellowish orange. Capsule erect, cylindrical or elliptical, 1.1–2.5 × 0.4–0.7 mm, brown. Peristome of 32 filiform teeth, papillose, spirally twisted, 0.6–1.25 mm long, yellowish brown. Operculum rostrate, 0.8–1.25 mm long. Calyptra 2.5–3.3 mm long. Spores 7–14 µm in diameter, weakly papillose, yellowish brown.

**Additional specimens examined.** ARGENTINA.

CHUBUT: Patagonia, Estancia Miguens, *Halle s.n.* Expediitio suecica 1907–1909, n. 303 (BM). CHILE. AISEN: Patag. occ. in valle flumini Aysén, Feb 1897, *Dusén s.n.* (BM, NY). ARAUCANÍA: Cautín, Temuco, Cerro Ñielol, 26 Jul 1984, *Müller s.n.* (MO); Cautín, Parque Nacional Conguillío, El Salto, *Mahú 23712* (MO). BÍO-BÍO: Road from Tomeco to Florida, 2 km N from road 0–50, *Ireland & Bellolio 32045* (MO, NY); Salto del Laja, *Mahú 9400* (MO); Talcahuano, *Cano 6* (CONC, MUB 16425). COQUIMBO: Cuesta de Caviolén, *Cano 135* (MUB 16418); pr. Hurtado, *Cano 166b* (MUB 18817), *174a* (MUB 18818); Cavilólén, Paradero 4, Quebrada El Brayal, *Mahú 11841* (MO); Choapa, Cerro Santa Inés, 15 May 1982, *Moreno s.n.* (MO); Pichidangui, *Cano 123* (MUB 16422). LOS LAGOS: Llanquihue, Lago Llanquihue, ca. 23 km N of Puerto Varas, *Landrum 45* (MO); Valdivia, Isla Mancera, *Mahú & Harnell 24061* (MO). MAULE: Empedrado, in the Cordillera de la Costa, ca. 43 km SE of Constitución, *Landrum 341* (MO). O'HIGGINS: Rancagua, a 15 km de mina La Juanita, *Cano 326d* (CONC, MUB 16421). SANTIAGO: Baños de Colina, *Cano 29* (MUB 18820); Caleu, 50 m al O de Antarivel, *Mahú 8618* (MO); Rapel, Las Balsas, *Mahú 10318* (MO); Cuesta Barriga, Fundo Santa Mónica, *Mahú 5115* (MO). VALPARAÍSO: Embalse Los Aromos, *Cano 100a* (MUB 16420); Parque Nacional La Campana, *Cano 54* (CONC, MUB 18819); El Quisco, Punta de Tralca al N de la Quebrada Guallelemu, *Harnell & Mahú 10321* (MO); Los Perales, Sep 1934, *Bertho s.n.* (MO).

**Habitat.** On rocks, artificial walls, soil and talus, generally in open places. Sometimes, as an epiphyte on the base of tree trunks; 0–1650 m.

**Discussion.** *Barbula fusca* was described by Müller (1849) from Chile. Later it was reported from various provinces: Aisen, Los Lagos, Maule, O'Higgins, Santiago and Valparaíso (Bartram 1952; Dusén 1906; Herzog & Hosseus 1938; Thériot 1918, 1921,

1928) and from Chubut province in Argentina (Cardot & Brotherus 1923). In addition, Williams (1903) and Herzog (1916) reported the taxon from Bolivia. We were able to study the Herzog material on which this report is based [Bolivia, La Paz: Choquecota Chico, *Herzog 3182* (s)] and one of the two specimens cited by Williams [La Paz: Pelicucho, *Williams 2844* (BM, NY)]. Both were misidentified because they actually are *Didymodon laevigatus* (Mitt.) R. H. Zander. The second specimen reported by Williams [Potosí: near Ingenio, *Williams 1800*] has not been located and is also probably misidentified. *Didymodon fuscus* does not occur in the Neotropics, and therefore this latter report is not included in the world distribution of the species given in Fig. 23.

Sollman (1983) and subsequent authors (He 1998; Zander 1993) considered *B. fusca* to be conspecific with *Didymodon vinealis*. After a study of the type material of *B. fusca*, as well as numerous specimens which can be assigned to this species, we believe that this taxon is morphologically different from *D. vinealis*.

*Didymodon fuscus* may be distinguished by its bulging laminal cells, lamina sometimes bistratose in upper third of the leaf, transverse section of the costa with guide cells in (2–)3(–4) layers and ventral surface cells layer bulging. *Didymodon vinealis*, on the other hand, has papillose laminal cells, a unistratose lamina, a patch of translucent cells on the ventral surface of the costa (absent in *D. fuscus*), transverse section of the costa with guide cells in 1–2 layers and ventral surface cells layer not bulging.

*Didymodon santessonii* shares with *D. fuscus* several characters, e.g., the color of the lamina with KOH, shape and size of the laminal cells, transverse section of the costa without ventral stereids and ventral surface cells layer bulging. Furthermore both species occur in similar habitats and sometimes grow together. However, the triangular or ovate-triangular leaves, the papillosity of the laminal cells and transverse section of the costa with two layers of guide cells distinguish *D. santessonii*.

*Bryoerythrophyllum fuscinerivium* (Mitt.) R. H. Zander is similar to *D. fuscus* in the color of the plants, position of the leaves when dry and bulging laminal cells and ventral surface cells of the costa, but

it has revolute margins, two stereids band and one layer of guide cells in transverse section.

#### KEY TO SPECIES MORPHOLOGICALLY SIMILAR TO

##### *DIDYMODON VINEALIS* IN SOUTH AMERICA

1. Leaves ovate to ovate-lanceolate, with apex generally cucullate, margins revolute .....2
1. Leaves lanceolate or triangular, with apex not cucullate, acute or acuminate, margins plane or recurved .....3
  2. Transverse section of the costa with 2(–3) layers of guide cells, without ventral stereids.....*D. cardotii* (Dusén) R. H. Zander
  2. Transverse section of the costa with 1 layer of guide cells, with 2–3 layers of ventral stereids.....*D. pruinus* (Mitt.) R. H. Zander
3. Leaf margins plane, sometimes slightly recurved below midleaf; transverse section of the costa with 1 layer of guide cells and 1 layer of ventral stereids .....*D. andreaeoides* Cardot & Broth.
3. Leaf margins recurved, generally above midleaf; transverse section of the costa with 1–4 layers of guide cells, without ventral stereids.....4
  4. Upper and middle laminal cells smooth; lamina unistratose or sometimes bistratose in the upper third; transverse section of the costa with (2–)3 (–4) layers of guide cells .....*D. fuscus*
  4. Upper and middle laminal cells papillose; lamina unistratose; transverse section of the costa with 1–2 layers of guide cells.....5
5. Leaf apex acute, generally apiculate by one or more conical cells; costa percurrent or shortly excurrent, and with a patch of translucent cells below the apex on the ventral surface ..... *D. vinealis*
5. Leaf apex acuminate, not apiculate; costa excurrent as a rigid subula, and without a patch of translucent cells below the apex on the ventral surface ..... *D. santessonii*

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