

Fissidens sublimbatus, New to Morocco and the Canary Islands

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Abstract. *Fissidens sublimbatus* is reported new to Morocco and the Canary Islands (Spain). Differences with *F. arnoldii*, *F. bambergeri*, *F. crispus*, and *F. megalotis* subsp. *helictocaulos* are given. A map showing the world distribution of the species is included.

Fissidens sublimbatus Grout, heretofore known as an endemic of western North America (Arizona, California, Colorado, Nevada, New Mexico, Oklahoma, Texas, Utah, and Wyoming in the United States, Baja California Norte in Mexico, and Alberta in western Canada; Pursell 1997), was recently discovered in Morocco. Additionally, the species has been found in the Canary Islands. The overall distribution of the species is given in Figure 1. *Fissidens sublimbatus* thus is a western North American-western European disjunct. A number of common moss species with broad distributions in these areas, all growing in dry places, are known to have a similar distribution pattern along with rarer species such as *Claopodium whippleanum* (Sull.) Renaud & Cardot (Düll 1985, 1992), *Crossidium seriatum* Crum & Steere (Cano et al. 1992), *Phascum vlassovii* Laz. (Jiménez et al. 1989). Two additional montane species, just recently discovered, also show the same kind of disjunction i.e., *Schistidium cinclidodonteum* (Müll. Hal.) B. Bremer in the High Atlas of Morocco (Ros et al. 2000) and *S. occidentale* (E. Lawton) Churchill in the Sierra Nevada of southern Spain (Casas 2000).

The Moroccan collections were made in the Rif cordillera and in the High Atlas. At the first station the collections were made in the Jbel Bouhalla region, an area that rises to 2,170 m and is one of the few places in northern Africa where *Abies pinsapo* Boiss. subsp. *maroccana* (Treb.) Emb. & Maire occurs. These collections were found growing in protected crevices, on talus and rocks in evergreen

Quercus and coniferous forests between 1,275 and 1,700 m. At the lower elevation the species occurs in a forest of *Q. faginea* Lam. and *Q. rotundifolia* Lam. while at 1,595 m and above it occurs in a forest of *Abies pinsapo* subsp. *moroccana*, sometimes mixed with *Pinus pinaster* Aiton, *P. nigra* Arnold, and *Cedrus atlantica* Manetti. The specimen from the High Atlas was found in the Jbel Toubkal region at 2,700 m on a granitic ledge where the cormophytic vegetation is composed of xerophytic thorny shrubs. This collection was previously cited by Ros et al. (2000) as *Fissidens crispus*, but a careful study of the specimen has shown that it corresponds in fact to *F. sublimbatus*.

Other bryophytes found at the Moroccan Rifean sites include the terricolous species *Athalamia hyalina* (Sommerf.) Hatt., *Didymodon fallax* (Hedw.) Zander, *Distichium capillaceum* (Hedw.) Bruch & Schimp., *Reboulia hemisphaerica* (L.) Raddi, *Scorpiurium circinatum* (Brid.) Fleisch. & Loeske, *Timmia bavarica* Hess., *Weissia controversa* Hedw., and *W. longifolia* Mitt. Saxicolous species found at the sites include *Antitrichia californica* Sull., *Fabronia pusilla* Raddi, and *Leptodon smithii* (Hedw.) Weber & Mohr. In the High Atlas, *F. sublimbatus* grows with *Bryum alpinum* With., *Reboulia hemisphaerica* (L.) Raddi and *Riccia crozalsii* Levier.

In the Canary Islands, *F. sublimbatus* has been collected on five islands: Fuerteventura, Gran Canaria, Hierro, Lanzarote, and Tenerife. Most collections are from Gran Canaria, indicating that the species is common there but less so on the other is-

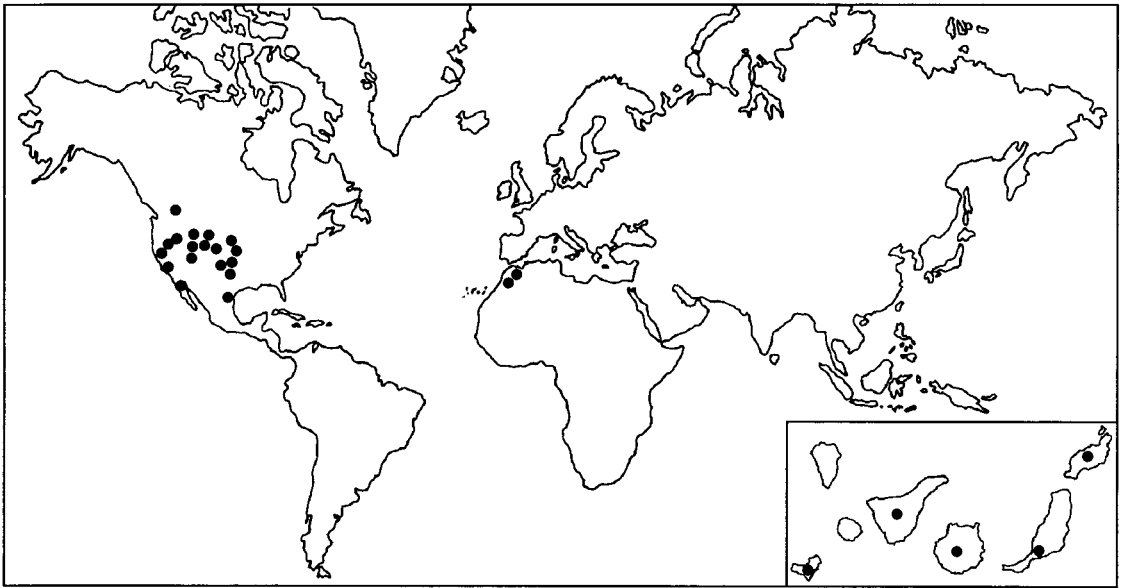


FIGURE 1. Distribution map for *Fissidens sublimbatus* Grout in the world. Insert: detail of the distribution of the species on the Canary Islands.

lands. Localities range from 50 to 1,450 m, although most are below 500 m on dry, gravelly to loamy soil, under shrubs or overhanging rocks in communities of xerophytes (*Euphorbia balsamifera* Aiton, *E. canariensis* L., *E. obtusifolia* Poir., *Lau-naea arborescens* (Batt.) Murb., *Plocama pendula* Aiton, *Kleinia neriifolia* Haw., *Periploca laevigata* Aiton, *Rubia peregrina* L., and *Asphodelus aestivus* Brot.). These exposed sites can be damp in winter, but become dry during March. The rare localities at 500–1,000 m are on damp soil on banks in open pine forest (*Pinus canariensis* Sprengel, *Cistus monspeliensis* L.) or open laurel forest (*Picconia excelsa* (Aiton) DC., *Laurus azorica* (Seub.) Franco, *Ilex canariensis* Poir., *Hypericum canariense* L.). The highest localities (>1,000 m) are on Gran Canaria on dry loamy soil under low shrubs (*Teline congesta* Webb & Berth., *Salvia canariensis* L., *Sideritis dasygnaphala* (Webb & Berth.) Clos and *Aeonium percarneum* (Murray) Pit. & Proust). Since *F. sublimbatus* grows in rather exposed sites, accompanying bryophytes are few, *Bryum radiculosum* Brid. being the most common.

In North America, *F. sublimbatus* is more or less restricted to drier areas where it occurs on soil shaded by rocks and overhangs, and occasionally on limestone and sandstone in gullies.

Fissidens sublimbatus is most closely related to *F. crispus* Mont., a highly variable species widely distributed in the Americas. The Afro-Asian *F. schmidii* Müll. Hal. (*F. bryoides* var. *schmidii* (Müll. Hal.) Chopra & Kumar), which is probably the same as *F. crispus*, has been reported from

northern Africa. The latter species and *F. sublimbatus* are characterized by small (6–10 μm), bulging laminal cells that are usually arranged in rows and which in transverse section are at least twice as deep as wide, and a limbidium that is edged with short, chlorophyllose cells in the proximal parts of the vaginant laminae. In *F. crispus*, however, the limbidial cells can be uni- to tristratose and the limbidium is present on all laminae of most leaves, while in *F. sublimbatus* the limbidium can be absent from some leaves, restricted to the vaginant laminae, or present to some degree on all laminae, but its cells are always unistratose. *Fissidens sublimbatus*, however, can be further distinguished by its smaller size, a shorter costa (ending 2–5 cells below the leaf apex or percurrent in perichaetial leaves), and a dorsal lamina that typically ends well above the insertion. The stems of *F. sublimbatus* are often dimorphic, the infertile ones being the larger (to ca 6 mm long \times 1.5 mm wide with as many as 22 pairs of leaves). Fertile stems are usually shorter with fewer leaves. Leaves vary from ovate to ovate-lanceolate, rounded to obtuse-apiculate, the apiculus formed by a single, clear, sharp cell.

The European *F. bambergeri* Schimp., often considered an expression of *F. bryoides* Hedw. var. *viridulus* (Sw.) Broth., also has small laminal cells (6–11 μm), a dorsal lamina that frequently ends above the insertion, and a limbidium often restricted to the vaginant laminae that can be intramarginal proximally. The laminal cells in this species, however, are not arranged in rows nor are they twice

as deep as wide, and usually are not bulging. Moreover, the costa often ends in the leaf apex.

Fissidens arnoldii R. Ruthe, known from Europe, Macaronesia, North Africa, and the Arabian Peninsula, differs from *F. sublimbatus* by its larger (8–14 μm) flat, thicker-walled laminal cells.

The African *F. megalotis* Müll. Hal. subsp. *helictocaulos* (Müll. Hal.) Brugg.-Nann. also has small, strongly bulging laminal cells, but is easily distinguished by its unequal vaginant laminae in all leaves, acute to acute-acuminate leaf apices, and a dorsal lamina that either reaches and ends at the insertion or is short decurrent.

Selected specimens examined.—MOROCCO. RIF, JBEL BOUHALLA. 35°06' N, 5°09' W, 1,235 m, *Cano & Ros* (MUB 9701); 35°08' N, 5°08' W, 1,600 m, *Cano & Ros* (MUB 9702); 1,700 m, *Cano & Ros* (MUB 9704); ALTO ATLAS, JBEL TOUBKAL. 31°03' N, 7°56' W, *Cano, Muñoz & Ros* (PAC). SPAIN. CANARY ISLANDS. FUERTEVENTURA. 28°20' N, 14°00' W, 300–500 m, *Dirkse s.n.* (PAC); 400–686 m, *Dirkse s.n.* (hb. Dirkse); 250 m, *Dirkse s.n.* (hb. Dirkse). HIERRO. 27°45' N, 18°00' W, 10–200 m, *Dirkse s.n.* (Hb. Dirkse). GRAN CANARIA. 28°00' N, 15°36' W, 1,000–1,100 m, *Dirkse s.n.* (hb. Dirkse); 400–550 m, *Dirkse s.n.* (hb. Dirkse); 200–250 m, *Dirkse s.n.* (hb. Dirkse); 200 m, *Dirkse s.n.* (hb. Dirkse). LANZAROTE. 29°00' N, 13°40' W, 200–240 m, *Dirkse s.n.* (hb. Dirkse). TENERIFE. 28°19' N, 16°34' W, 400–500 m, *Dirkse s.n.* (hb. Dirkse); 10–200 m, *Dirkse s.n.* (hb. Dirkse); 140–246 m, *Dirkse s.n.* (hb. Dirkse).

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LITERATURE CITED

- CANO, M. J., J. GUERRA & R. M. ROS. 1992. *Crossidium seriatum* (Pottiaceae, Musci) new to Europe. THE BRYOLOGIST 95: 280–283.
- CASAS, C. 2000. El género *Schistidium* Bruch & Schimp. en España. Boletín de la Sociedad Española de Briología 16: 1–9.
- DÜLL, R. 1985. Distribution of the European and Macaronesian mosses (Bryophytina). Part II. Bryologische Beiträge 5: 1–232.
- . 1992. Distribution of the European and Macaronesian mosses (Bryophytina). Annotations and Progress. Bryologische Beiträge 8/9: 1–223.
- JIMÉNEZ, M. N., R. M. ROS & J. GUERRA. 1989. *Phascum vlassovii* Laz. (Pottiaceae, Musci) en Europa. Anales del Jardín Botánico de Madrid 47: 234–235.
- PURSELL, R. A. 1997. A comparison of *Fissidens obtusifolius* and *F. sublimbatus*. Journal of the Hattori Botanical Laboratory 82: 203–212.
- ROS, R. M., M. J. CANO, J. MUÑOZ & J. GUERRA. 2000. Contribution to the bryophyte flora of Morocco: the Jbel Toubkal. Journal of Bryology 22: 283–289.

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