

On *Zygodon rufescens* (Hampe) Broth. and *Z. fragilis* H. Rob. from Venezuelan Paramos

Graciela M. CALABRESE^a, María Jesús ELÍAS^a & Francisco LARA^{b*}

^a Departamento de Botánica, Facultad de Biología, Universidad de Salamanca, Campus Miguel de Unamuno, E-37007 Salamanca, Spain; a108566@usal.es

^b Departamento de Biología (Botánica), Facultad de Ciencias, Universidad Autónoma de Madrid, Cantoblanco, E-28049 Madrid, Spain; francisco.lara@uam.es

(Received 4 February 2002, Accepted 7 April 2003)

Abstract — *Zygodon rufescens* is reported for the first time from Venezuela. *Zygodon fragilis*, rarely collected in South America, has been rediscovered in the paramos near Mérida. Both species are described and illustrated.

Musci / Orthotrichaceae / South America / Northern Andes / New records

Resumen — Se cita por primera vez la presencia de *Zygodon rufescens* en Venezuela. *Zygodon fragilis*, una especie escasamente recolectada en Sudamérica, ha sido encontrada nuevamente en los páramos de Mérida. Ambas especies se describen e ilustran.

INTRODUCTION

During a short trip to the Venezuelan Andes (Mérida State) in Christmas of 1995, the senior author collected several epiphytic samples of Orthotrichaceae. The paramos of Santo Domingo, Mucuchies-Gavidia, La Culata, and neighbouring areas were surveyed, and some new or interesting species of *Orthotrichum* Hedw. (Lara *et al.*, 1999) and *Zygodon* Hook. & Taylor were collected.

Among the *Zygodon* species, *Zygodon reinwardtii* (Hornsch.) A. Braun is the most common and abundant on trees and shrubs in this area. However, two conspicuous species have been also found in some samples: *Z. rufescens* (Hampe) Broth. and *Z. fragilis* H. Rob., which are interesting because they have rarely been reported from South America.

Zygodon rufescens, originally described from Colombia, is also known from Ecuador (Churchill & Linares, 1995) and Bolivia, although its distribution is disjunct extending to New Zealand (Lewinsky, 1989). Despite the lack of previous records from the Venezuelan paramos, it does not seem to be a rare species. It has been collected at three of the surveyed sites, and has also appeared in one collection kept at H, mixed with *Z. fragilis* which was previously collected in the same

* Correspondence and reprints: francisco.lara@uam.es

area. Its typical brood-bodies allow it to be easily distinguished from other species of the northern Andes. There is not a recent description of South American material of *Zygodon rufescens*, so an updated description is presented below, together with drawings and photographs illustrating some relevant features of Venezuelan specimens.

On the other hand, *Zygodon fragilis* is an endemic of northern South America, originally described from Ecuador (Robinson *et al.*, 1977). It is also known from Colombia (Churchill & Linares, 1995), Perú (Churchill *et al.*, 2000), and it has been previously recorded in the Venezuelan paramos by Griffin III (1979). This moss, only frequent in one of the paramos visited, draws our attention because of its size and, especially, its peculiar way of vegetative reproduction through leaf breakage. Although the original Latin description is accurate, the new Venezuelan specimens are described and illustrated, giving some additional details.

The specimens are deposited at the Universidad Autónoma de Madrid herbarium.

Zygodon rufescens (Hampe) Broth. in Par.

Index Bryologicus, editio secunda 5: 141. 1906.

(Figs 1, 2[A-C])

Basionym: *Orthotrichum rufescens* Hampe, *Annales des Sciences Naturelles, Botanique*, sér. 5, 4: 334. 1865.

Holotype: Colombia, Bogotá, Los Laches, *A. Lindig* (BM!).

Tufts loose, olive green in the upper part and brown below. Plants robust, (0.5)1.0-2.0 cm tall. **Stems** erect, branched, with rhizoids ascending along the stem. **Rhizoids** smooth to roughened. **Leaves** twisted when dry (Fig. 1A), squarrose and flexuose when moist (Fig. 1B), 1.7-2.1 mm long and 0.4-0.5 mm wide, lanceolate to linear-lanceolate (Fig. 1C), more or less decurrent, with acuminate apex, margin plane, entire at base and papillose-crenulate above. **Leaf laminal cells** rounded, 7-10 µm in diameter, with thickened walls, papillose, with (2)3-4(5) papillae per cell; papillae generally single and blunt. **Basal leaf cells** rectangular, 13-21 µm long and (6)8-10 µm wide, except those towards margins that are shortly rectangular to almost quadrate, 9-12 µm long, smooth. **Costa** ending before apex, 36-38 µm wide in the basal part, smooth on the dorsal side, with some papillae towards apex. **Brood-bodies** club-shaped, reddish-brown, with transversal and longitudinal septa, (75)90-100(180) µm long and 30-42(60) µm wide (Fig. 2); very conspicuous due to size and colour, as well as abundance and location, since they are abundant on the stems and often remain attached to the leaf surface.

Generally sterile, however the *Gavidia* specimen has a single capsule without peristome. **Seta** ca. 3 mm long, sinistrorse in the basal part and dextrorse in the distal one. **Capsule** obovate, with 8 longitudinal ribs through the whole capsule length.

New records. — **Venezuela:** Mérida, Páramo de Mucubají, entre Laguna Grande y la Laguna Negra, con *Espeletia schultzii* y *Ruizlopezia floccosa*, 3400-3500 m,

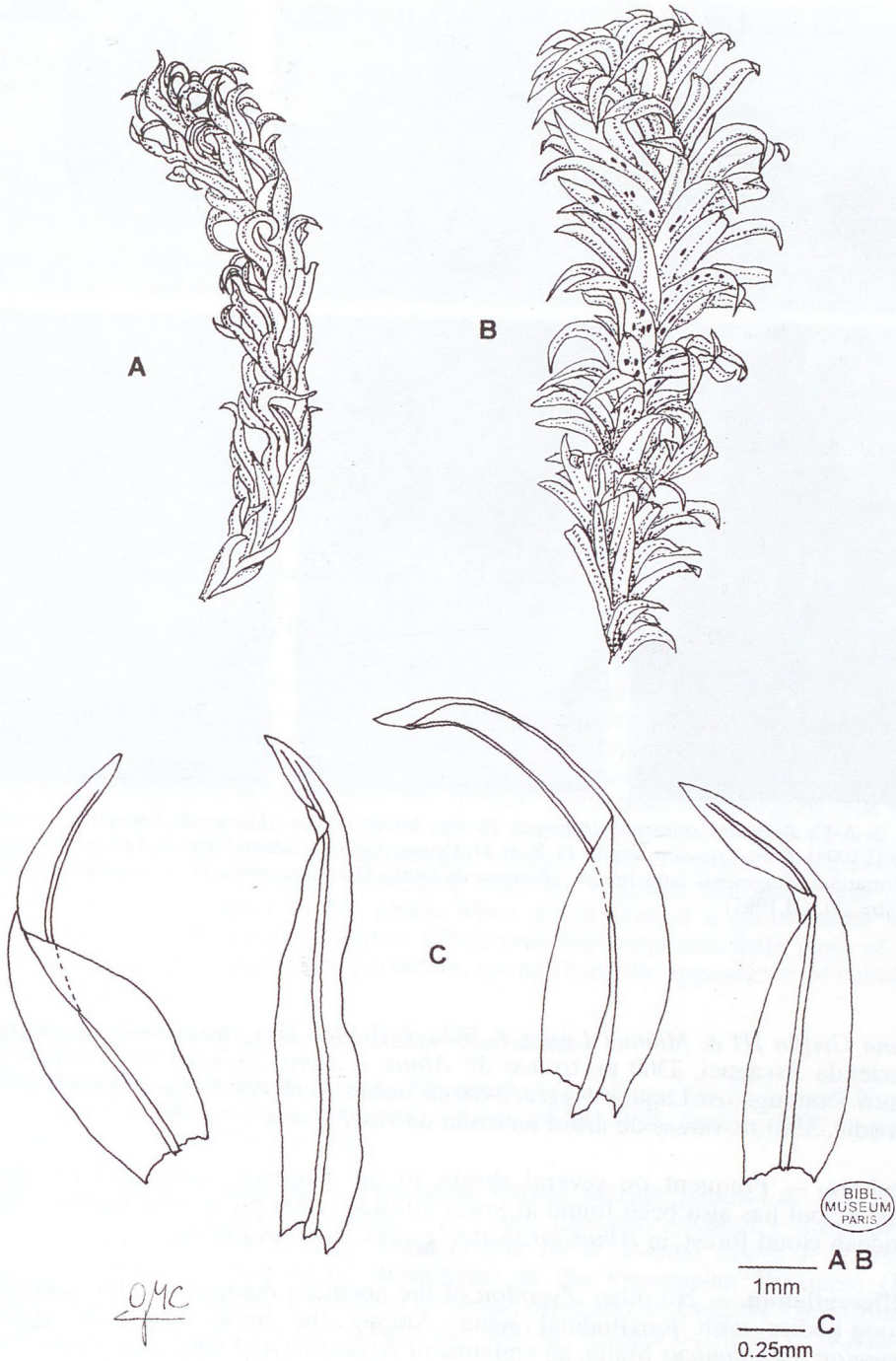


Fig. 1. *Zygodon rufescens* (Hampe) Broth. (Hacienda Escaguei, F. Lara, 28.XII.1995). A: Habit when dry. B: Habit when moist. C: Leaves.

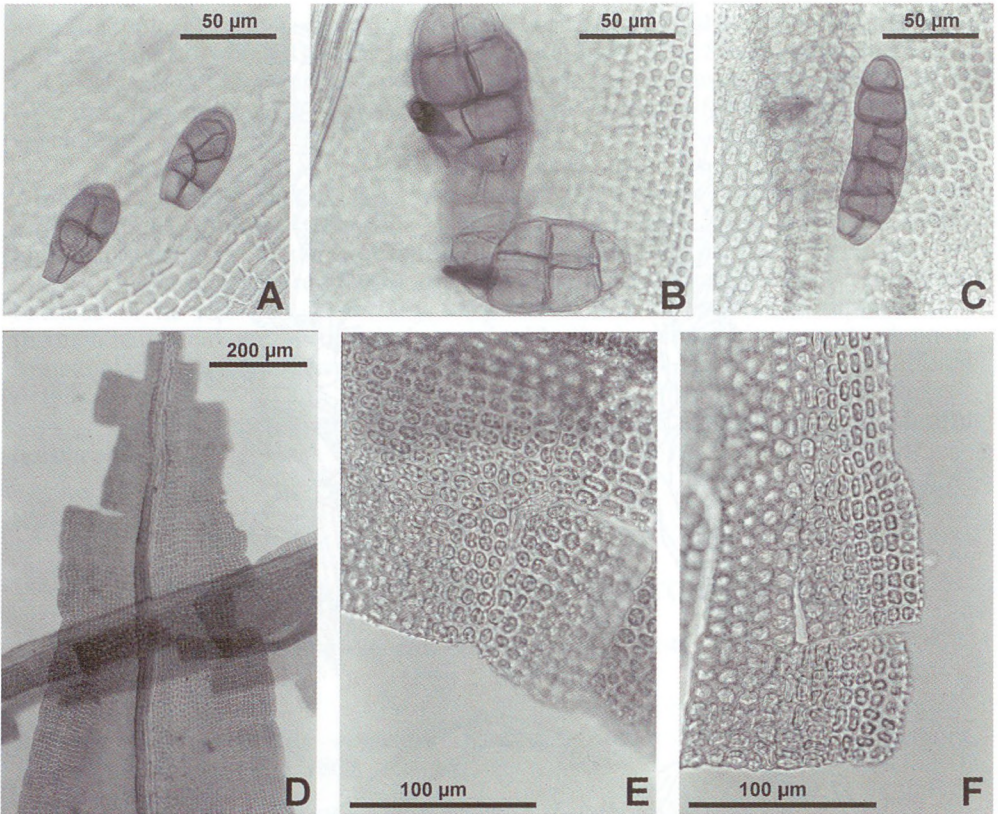


Fig. 2. **A-C:** *Zygodon rufescens* (Hampe) Broth., brood-bodies. (Hacienda Escaguei, F. Lara, 28.XII.1995). **D-F:** *Zygodon fragilis* H. Rob. **D:** Upper part of fractured leaf. **E, F:** Early steps of leaf marginal fragments detachment. (Páramo de Santo Domingo, sobre *Hesperomeles glabrata*, F. Lara, 29.XII.1995).

Dana Griffin III & Manuel López F. 762a, 6-II-1985 (H), mixed with *Z. fragilis*. Hacienda Escaguei, 2300 m, tronco de *Alnus*, F. Lara, 28-XII-1995. Páramo de Santo Domingo, ca Laguna Negra, 3400 m, sobre *Berberis*, F. Lara, 29-XII-1995. Gavidia, 3390 m, ramas de árbol en orilla de río, F. Lara, 1-I-1996.

Ecology. — Frequent on several shrubs in the paramos area, between 3390-3500 m, but has also been found at lower altitude (2300 m) in zone upslope from Andean cloud forest, in *Alnus jorullensis* Kunth. riparian forests.

Differentiation. — No other *Zygodon* of the northern Andes has large, coloured brood-bodies with longitudinal septa. Among the South-American species, *Zygodon magellanicus* Malta, an endemic of Argentina and Chile, has brood-bodies similar to those of *Z. rufescens*; however, its habit is quite different, with smaller, erect and strongly keeled leaves when dry, and patent, not squarrose nor flexuose leaves, when moist.

Zygodon fragilis H. Rob.

Lindbergia 4:111-112. 1977.

(Figs 2 [D-F], 3)

Holotype: Ecuador. Prov. Carchi. Páramo El Ángel, in the puss on road El Ángel-Tulcán, very humid *Espeletia*-páramo, 3750-3850 m (0° 41' N, 78° 54' W), *Holm-Nielsen, Jeppesen, Løjtnant & Øllgaard N° 5419*. Epiphyte in cloud forest (AAU).

Tufts loose, light green in the upper part, where the leaf base stands out due to its pallid and bright colour; reddish brown in the middle and lower parts due to the presence of abundant tomentum. **Plants** vigorous, 1.0-3.5 cm tall. **Stems** erect, branched, with rhizoids ascending along the stem. **Rhizoids** smooth to roughened. **Leaves** irregularly contorted when dry (Fig. 3A), spreading and flexuose when moist (Fig. 3B), 1.7-2.2(2.7) mm long and 0.6-0.8 mm wide, oblong-lanceolate, decurrent, with acute to shortly acuminate apex, margin plane, crenate –furthermore papillose-crenulate– in the upper part and entire at base (Fig. 3C). **Leaf laminal cells** sub-quadrangle to ellipsoidal, most of them *ca* 12 µm in diameter, with more or less thick-walled, papillose, (4)5-6(9) simple or branched papillae per cell, blunt or sub-acute; ellipsoidal cells more frequent towards the costa, 12-18 µm long and 9-12 µm wide. **Basal leaf cells** elongate to rectangular with rounded-angle lumina, and strongly thickened walls, (18)24-48 µm long and 6-9 µm wide, smooth or, in the case of distal cells, slightly papillose; marginal cells differentiated, shortly rectangular to quadrangle. **Costa** ending before apex, (45)51-60 µm wide at base, smooth on the dorsal side or with scattered papillae in the upper half. Leaves rarely remain intact (Figs 2D, 3C), breaking into numerous quadrangle to rectangular fragments that act as vegetative **propagula** (the typical brood-bodies of other *Zygodon* species are absent in this species). Pre-formed fragments in intact leaves can be distinguished in most cases due to their areolation, consisting of cells with more uniform shape and size (*ca* 12 µm in diameter), perfectly aligned and frequently with thinner walls. At leaf margin, borders of the fragments are more evident with their outer border coinciding with the rounded marginal teeth (Fig. 2E-F). The usual aspect of the plants when dry is that of a robust moss with crisped, irregularly fractured leaves. Often only the costa and little parts of the lamina of the upper leaves are persistent, giving them the appearance of subulate leaves (Fig. 3C).

Sporophyte not seen in the Venezuelan specimens.

New records. — **Venezuela:** Mérida, Páramo de Santo Domingo, *ca* Laguna Negra, 3300 m, sobre *Hesperomeles glabrata*, *F. Lara*, 29-XII-1995. *Ibidem*, 3400 m, sobre *Berberis* sp., *F. Lara*, 29-XII-1995.

Other specimens examined. — **Venezuela.** Estado Mérida: páramo de Mucubají, entre Laguna Grande y la Laguna Negra, con *Espeletia schultzei* y *Ruizlopezia floccosa*. Alt. 3400-3500 m. Leg. *Dana Griffin III & Manuel López F. N° 762a*, 6-II-1985 (Flora of Venezuela, Bryophytes of the Venezuelan Paramos) (H). **Ecuador.** Prov. Pichincha: Cordillera Oriental, on mossy trees along Quito-Baeza highway, just west of pass in fog belt, alt. 3800 m, *William C. Steere & H. Balslev N° 25711*, 20-IX-1982 (H).

Ecology. — *Zygodon fragilis* was found exclusively near Laguna Negra, where it is a relatively frequent epiphyte on shrubs in unforested areas. Among the sam-



Fig 3. *Zygodon fragilis* H. Rob. (Páramo de Santo Domingo, sobre *Hesperomeles glabrata*, F. Lara, 29.XII.1995). **A.** Habit when dry. **B.** Habit when moist. **C.** Leaves.

ples collected it stands out due to its abundance on *Hesperomeles glabrata* Kunth (*Rosaceae*). It was found less abundantly on thin branches of *Berberis* sp. (*B. cf. prolifera* Pittier).

Differentiation. — Although similar mechanisms of leaves fragmentation are known in other mosses (for example in the Holarctic *Dialytrichia mucronata* var. *fragilifolia* Bizot & J. Roux and *Tortella nitida* (Lindb.) Broth.), it has not been

described for any other *Zygodon* species. According to Malta (1926) in *Zygodon fragilifolius* Broth. ex Malta from Eastern Central Africa, only the apex of leaves are broken.

Acknowledgements. — Special thanks are due to Dana Griffin III for the information given, to Vicente Mazimpaka and Kristin Jones for correcting the English, R. Garilleti for technical assistance and to the curator of the H herbarium. The Agencia Española de Cooperación Internacional (AECI) is acknowledged for the fellowship awarded to G. M. Calabrese.

REFERENCES

- CHURCHILL S. P., GRIFFIN III D. & MUÑOZ J., 2000 — A checklist of the mosses of the Tropical Andean countries. *Ruizia* 17: 1-203.
- CHURCHILL S. P. & LINARES C. E. L., 1995 — *Prodromus bryologiae Novo-Granatensis: introducción a la flora de musgos de Colombia. Parte 2: Grimmiaceae a Trachypodaceae*. Santa Fe de Bogotá, Biblioteca José Jerónimo Triana, pp. 455-924.
- GRIFFIN III D., 1979 — New Records for the Moss Flora of Venezuela. *The Bryologist* 82(4): 618-619.
- LARA F., MAZIMPAKA V. & GARILLETI R., 1999 — Some interesting *Orthotrichum* records from Venezuela. *Tropical Bryology* 17: 1-4.
- LEWINSKY J., 1989 — *Zygodon* Hook. & Tayl. in Australasia: a taxonomic revision including SEM-studies of peristomes. *Lindbergia* 15: 109-139.
- MALTA N., 1926 — *Die Gattung Zygodon Hook. et Tayl., eine monographische Studie*. Riga, Latvijas Univ. Botaniska Dārza Darbi N° 1, 186 p.
- ROBINSON H., HOLM-NIELSEN L. B. & LØJTANANT B., 1977 — Mosses of Ecuador II. *Lindbergia* 4: 105-116.