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Sporophyte-bearing specimens of *Pleurochaete squarrosa* in Zamora, Spain

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Abstract — We report the occurrence of sporophytes in samples of *Pleurochaete squarrosa* (Brid.) Lindb. from several localities of Zamora province (NW Spain). The frequence and abundance of fructifications in this area are remarkable for a moss species which sexual reproduction is very rarely observed in Europe. The peristome, observed with scanning electron microscope (SEM), is also described. It is shown to consist of 16 deeply cleft teeth, instead of the 32 teeth that are usually reported in the descriptions of this species.

***Pleurochaete* / sporophytes / peristome / Spain / Zamora**

Resumen — Se informa de la presencia de esporófitos en muestras de *Pleurochaete squarrosa* (Brid.) Lindb. procedentes de varias localidades de la provincia de Zamora (NO de España). Se señala la frecuencia y abundancia de fructificaciones en esta área en una especie de musgos cuya reproducción sexual es apenas conocida en Europa. Se describe asimismo el perístoma, observado al microscopio electrónico de barrido (SEM). Hemos observado que consta de 16 dientes, si bien profundamente divididos, y no de 32, como se indica normalmente en las descripciones de esta especie.

***Pleurochaete* / esporófitos / perístoma / España / Zamora**

INTRODUCTION

The moss *Pleurochaete squarrosa* (Brid.) Lindb. is a xerophilous and photophilous species, terricolous and indifferent to soil pH. Its distribution has got a sub-mediterranean optimum, even though the species is widespread in Eurasia (extending to Britain, Ireland, southern Sweden, the Himalayas and SW China) and SE North America, and has some isolated outposts in tropical East and Central Africa, and Central and South America (Giacomini, 1950; Ochyra & Szmadja, 1983). It is very abundant in the Iberian Peninsula, especially in open formations of evergreen or marcescent oaks (*Quercus ilex* L. and *Q. faginea* Lam.), and it is assumed to play an important role in soil recovering in burnt areas (Heras *et al.*, 1994).

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It usually propagates from detached leaves through regeneration. In spite of the fact that fructification was rarely seen in North America (Haring, 1938), Quaterman (1956) regularly observed plants bearing archegonia and antheridia, in Middle Tennessee. In Europe, the absence of sporophytes (Machado, 1928; Boros, 1968), or their rarity (Augier, 1966; Smith, 1978) has been repeatedly reported. Casares-Gil (1932) collected specimens with sporogonia near Barcelona, even though he still considered this species as almost sterile.

We have been collecting this moss in numerous localities for many years, without ever having seen it fructified. Nevertheless, while completing the bryophyte flora of the Arribes del Duero area (Fig. 1), in Zamora province, NW of Spain, we found plants of *P. squarrosa* with sporophytes in the following localities:

Spain, Zamora: Pino, 780 m, 29TQG415079, on granitic sand soil, *F. Fernández,* 29.3.1999 (MACB76373); Presa de Bemposta, 400 m, 29TQF121753, on granitic sand soil, *F. Fernández & B. Estébanez*, 2.6.2000 (MACB76374, MACB76375); Fermoselle, near the bridge over the river Tormes, 440 m, 29TQF187735, on granitic sand soil, *F. Fernández & B. Estébanez*, 2.6.2000 (MACB76376) (Fig. 1).

DESCRIPTION OF THE LOCALITIES

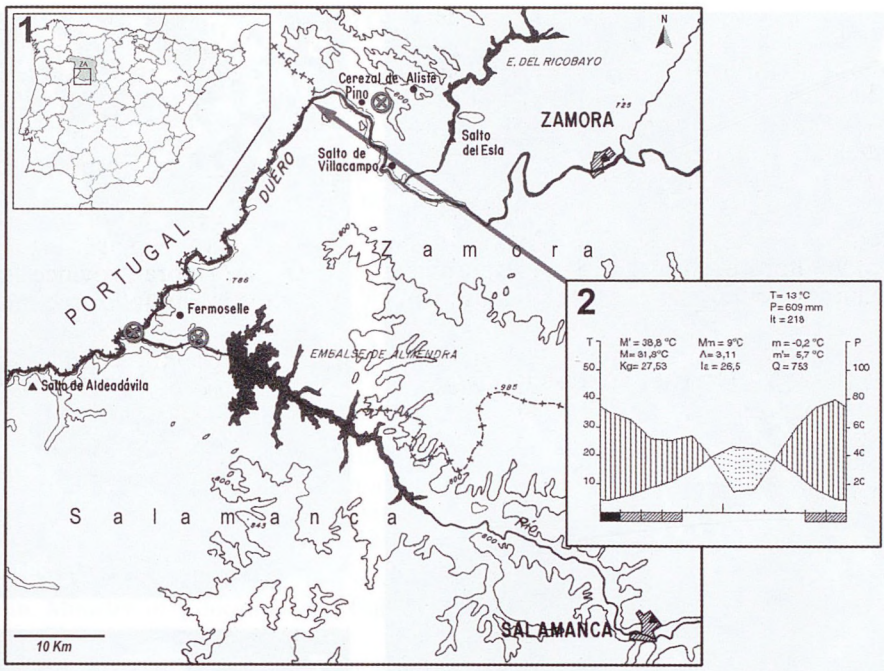
"Arribes del Duero" is the local name for a complex of valleys and gorges formed by the river Duero and its subsidiaries, excavating the granitic plateau in NW Spain, on the border with Portugal (Fig. 1). These valleys are subject to a sub-humid mediterranean climate (Fig. 2).

Fruiting *P. squarrosa* was found in the bottom of the valleys, where the proximity of the river favours warmer and more humid conditions.

Both macroclimatic and microclimatic conditions of these localities are very similar to those of the locality where Casares-Gil (1932) first recorded fertile *P. squarrosa* for the Iberian Peninsula (Pantano de Valvidrera, Barcelona): the climate is also sub-humid mediterranean, and the collection site is close to a dam.

These fruiting populations in Zamora were growing in steep slopes, on half-shaded granitic sands among trees and bushes (*Quercus ilex* L., *Juniperus oxycedrus* L., *Rosa* sp., etc.). Sporophytes were mostly present in rather tall plants that were forming well-developed turfs (Fig. 3). Bryophyte cover was very high, mostly consisting of *Pleurochaete squarrosa* turfs. In mild shade situations *Pseudoscleropodium purum* (Hedw.) M. Fleisch., *Homalothecium sericeum* (Hedw.) Bruch & Schimp. and *Brachythecium albicans* (Hedw.) Schimp., were found growing together with it. Some other species were usually found in sites exposed to direct sunlight: *Homalothecium aureum* (Spruce) H. Robins, *Bartramia stricta* Brid., *Ceratodon purpureus* (Hedw.) Brid., *Bryum capillare* Hedw., *Syntrichia ruralis* (Hedw.) F. Weber & D. Mohr, and some species of *Didymodon* (*Didymodon ferrugineus* (Schimp. ex Besch.) Hill *D. rigidulus* Hedw., *Didymodon vinealis* (Brid.) R.H. Zander var. *flaccidus* (Bruch & Schimp.) R.H. Zander) (Fernández Mendoza, 2000).

The habitat and growth form of *P. squarrosa* in this Spanish populations are very similar to those of the fertile populations reported by Quaterman (1956) in Tennessee cedar glades.



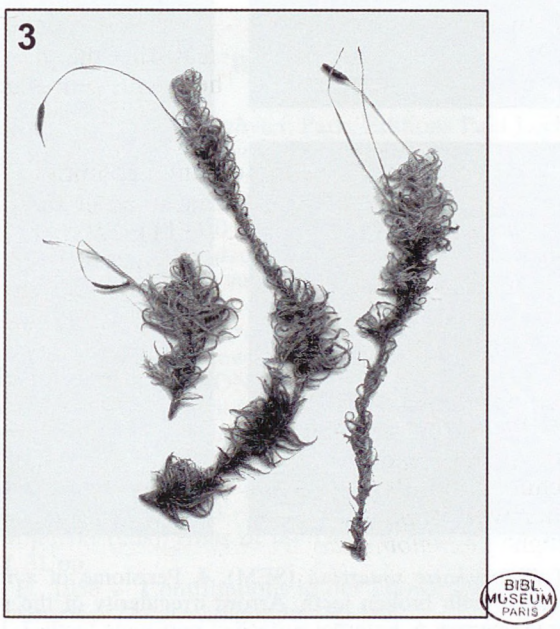
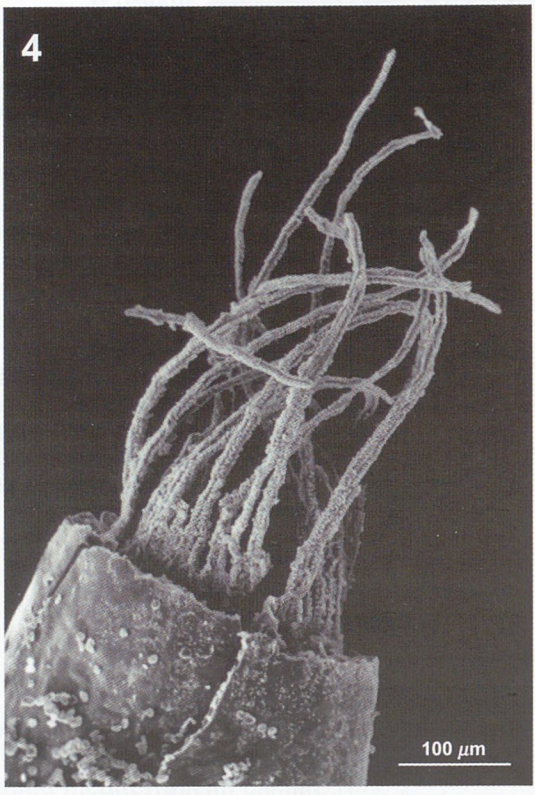
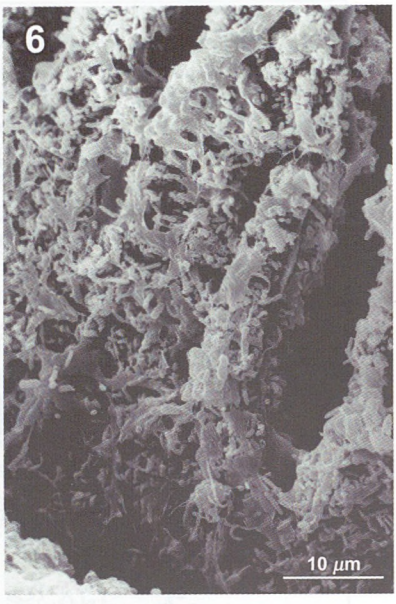
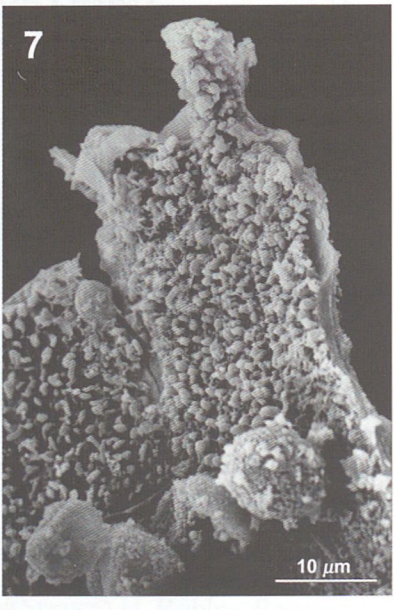
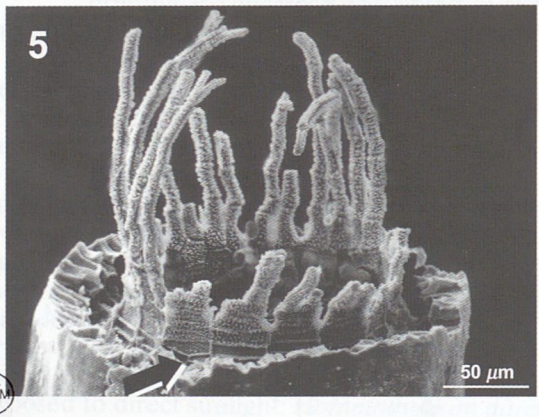


Fig. 1. Geographical situation of Arribes del Duero (Zamora). Asterisks (*) show the localities with fruiting *Pleurochaete squarrosa* listed in the text.
Fig. 2. Ombro-thermic diagram corresponding to the plateau region of "Arribes del Duero". Zamora, Salto de Castro (UTM: 29TQG3208).
Fig. 3. Sporophyte-bearing specimens of *Pleurochaete squarrosa*, Zamora, Presa de Bemposta (MACB 76374).









Figs 4-7. Peristome of *Pleurochaete squarrosa* (SEM). **4.** Peristome of a mature capsule. **5.** Peristome of an old capsule with broken teeth. Arrow: irregularity of the primary peristome layer, showing two cells in one row. **6.** External surface of peristome teeth. **7.** Internal surface of peristome teeth.

These specimens often had seta remains from previous years along the stem, in addition to sporophytes maturing in the collecting season. Sexual reproduction, therefore, could be usual in these populations.

PERISTOME DESCRIPTION

Mature capsules were critical-point-dried, sputtered with a gold layer of ca. 300 Å, and observed using S.E.M (JEOL-JSM-T-330A).

The peristome (Figs 4-7) consists of 16 long teeth (400-500 μm), deeply inserted in the capsule mouth and twisted once counterclockwise. They are deeply divided into two filiform, fragile branches (Figs 4, 5). The typically haplolepidous structure of the peristome in Pottiaceae is also clearly seen here: the external surface of each tooth shows remains of a single row of primary peristome layer cells, that are sometimes irregular (Fig. 5, arrow), and the internal surface presents remains of three rows of internal peristome layer cells for every two teeth. This structure identifies unequivocally a single tooth, and suggests that previous reports of 32 teeth based on light microscope observations (Casares-Gil, 1932; Haring, 1938; Zander, 1993) might have erroneously considered each branch to be a whole tooth.

The peristome ornamentation is verrucose on both sides. The external surface (Figs 4, 5, 6) is nearly smooth at the basal part, and is elsewhere covered with dense, tall verrucae, often fusing into intrincate patterns. The internal surface (Figs 5, 7) has lower verrucae, seldom contacting each other.

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