

Sphagnum majus subsp. *norvegicum* and *Sphagnum subtile*, New to the Iberian Peninsula

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Abstract. *Sphagnum majus* subsp. *norvegicum* and *S. subtile* are reported for the first time in the Iberian Peninsula from a mountain mire in northwestern Spain. Chemical parameters, algae, bryophytes, and vascular plants were determined. Chemical data and vegetation served to classify the mire as a poor fen although some of its plant species can be regarded as weakly minerotrophic.

The *Sphagnum* flora of the Iberian Peninsula is quite imperfectly known, and only general treatments on European taxa are available. Only Casares' (1925) work deals with the genus in the Iberian Peninsula, but today it is out of date. There are no modern treatments of the Iberian species of the genus except the distribution of the taxa of sect. *Sphagnum* (Casas et al. 1992). Since no other section has been thoroughly studied, the verified Iberian members of the genus and their distribution remain unknown. The treatment of the group by Daniels and Eddy (1985) is too general concerning the geographical distribution in the Iberian Peninsula. Casas' (1991) checklist of the Spanish mosses is the only modern reference work for the area regarding sphagna.

In the past few years, collections of *Sphagnum* were made in Zamora Province, northwestern Spain. Among these collections, one sample of *Sphagnum majus* (Russ.) C. Jens. subsp. *norvegicum* Flatberg and one of *S. subtile* (Russ.) Warnst. were collected from a small mire in the Segundera Mountains, the first collection of these mosses for the Iberian Peninsula.

SPAIN. ZAMORA PROVINCE. Porto, turbera de Valdecasares, 1800 m, 42°06'N, 6°52'W, Aldasoro, 9-IX-1993 (*S. majus* subsp. *norvegicum*: IBA 5162; *S. subtile*: IBA 5161).

The mire is located on the glaciated high plain of the Segundera Mountains which contains several small basins and valleys on acidic rocks of metamorphic and plutonic origin. These formations are composed of orthose-rich gneisses and some granodiorites. The low water solubility of these rocks leads to a very low ionic content in the flowing water of the area. The climate is continental-montane, with a period of freezing from December to March

and dry warm summers, consistent with the general features of the Mediterranean-montane area. The annual mean temperature is 5.9°C and the total cumulative yearly precipitation mean is 1,752 mm. The coldest month is February with daily mean of -2.9°C and absolute minimum of -16°C. The highest temperatures are recorded in July and August when they rise to a mean of 21°C and maximum of 32°C. The Valdecasares mire lies on a slope which drains a small area where great amounts of snow are accumulated during the winter. The vegetation cover of the area is mainly constituted by heaths and mountain meadows, with *Erica australis* and *Nardus stricta* as dominant species. In the mire, only dispersed *Erica tetralix* shrubs grow.

METHODS

Water samples were collected with PVP bottles at *S. majus* subsp. *norvegicum* sites in August 1993. They were filtered through 45 µm Whatman GFC filters and analyzed immediately after collection. Conductivity and pH were measured in the field with a WTW conductivity meter and a WTW pH meter, respectively (corrected for temperature). Alkalinity was also measured in the field by HCl titration with the pH meter. Analysis of nutrients, calcium, and silica were made according to Golterman and Clymo (1969), Rodier (1981), and Strickland and Parsons (1965). The chemical composition of the surface water is shown in Table 1. These data point to a slightly acidic, oligotrophic, and weakly mineralized habitat.

The *S. majus* subsp. *norvegicum* plants grew at the level of the water surface in small depressions at the center of the mire with slowly running water, whereas *S. subtile* occupied the drier margins, at the part of the mire transitional to the mineral ground.

Additional bryophyte species at the *S. majus* subsp. *norvegicum* site were *Philonotis seriata* Mitt., *Scapania undulata* (L.) Dumort., *Sphagnum den-*

ticulatum Brid., and *S. subsecundum* Nees. The first two indicate a spring fen. Algae species were *Cylindrocystis brebisonii* Menegh. (44 cells/ml), *Eunotia exigua* (Bréb.) Grunow (325.3 cells/ml), *E. pectinalis* (Kütz.) Rabenh. (50.1 cells/ml), *Microcystis* sp. (90.9 cells/ml), and *Ochromonas* sp. (170.9 cells/ml).

Mosses associated with *S. subtile* were *Aulacomnium palustre* (Hedw.) Schwaegr., *Calliergon stramineum* (Brid.) Kindb., *Polytrichum formosum* Hedw., *Sphagnum angustifolium* (Russ.) C. Jens., *S. capillifolium* (Ehrh.) Hedw., *S. flexuosum* Dozy & Molk., and *S. russowii* Warnst. Vascular plants were mainly *Carex curta* Good., *C. echinata* Murray, *C. nigra* (L.) Reichard, and *Viola palustris* L.

DISCUSSION

The mire could be considered as a poor fen because of the low conductivity, nutrient, and calcium levels. In Fennoscandia, *S. majus* subsp. *norvegicum* occurs both in minerotrophic and ombrotrophic mires. In the former it prefers soligenous fens (Flatberg 1987), which agrees with its habitat characteristics in Spain. However, *S. subtile* and some other species, such as *S. subsecundum*, *Carex curta*, and *Viola palustris* are more minerotrophic (Andrus 1980; Moen 1985; Reinikainen et al. 1984; Vitt & Slack 1975). Also the algal species exhibit different requirements: *Cylindrocystis brebisonii* and *Eunotia exigua* are oligotrophic (Flensburg 1967) while *Microcystis* is more eutrophic (Bozniak & Kennedy 1968; Eloranta 1974). So, despite its low ionic concentration, the mire has some species usually regarded as indicative of richer habitats.

Morphological and distributional notes on S. subtile.—The Iberian *S. subtile* plants are typical specimens and fit well with the descriptions in Andrus (1980) and McQueen (1989). The stem leaves are small, 1.1 mm long × 0.6 mm wide (25% from the base), with a 0.4–0.5-mm-wide margin (65–85% of the total width) below and 28–50 mm above (30% from the apex). The stem leaf hyalocysts are short and only 0–1(–2) septate. They are very different from the hyalocysts of *S. rubellum* or *S. capillifolium*, but more fibrillose than usually reported (0–40% of the total length of the leaf in our plants), although this feature is also seen in otherwise typical North American specimens (Flatberg, pers. comm.).

Sphagnum subtile is commonly regarded as a shade-tolerant plant, typical of tree-covered—mainly conifers—mires (McQueen 1989), although it can be also found at margins of inland mires (Andrus 1980; Andrus et al. 1994). In Spain the species grows at the margins of a continental-montane mire.

The European distribution of this plant is difficult to ascertain. Malmer (1966) and Nyholm (1981)

TABLE 1. Chemical composition and nutrient concentrations of the mire surface water near the collection site of *Sphagnum majus* subsp. *norvegicum* and *S. subtile* in the Valdecazares mire, Spain.

pH	5.2
Conductivity (EC)	12 μ S/cm
Alkalinity	0.08 mEq/liter
Ca ²⁺	0.75 mg/liter
Fe ²⁺	0.05 mg/liter
Si	0.1 mg/liter
Total phosphorus	27.8 μ g/liter
PO ₄	9 μ g/liter
NO ₃	10 μ g/liter

indicate it from Sweden and Fennoscandia respectively, whereas Lange (1982) and Flatberg (pers. comm.) doubt its presence in that area. Neither are conclusive data available from the remaining European areas. The finding of this taxon in the Iberian Peninsula strengthens Isoviita's (1966) view of a southern character and rarity of this taxon.

Notes on S. majus subsp. norvegicum.—In the Iberian population the shapes of the stem and branch leaves fit subsp. *norvegicum* well (Flatberg 1987). More problematic are the pore structure and size of the branch leaf hyalocysts, which are smaller than presented in Flatberg's key. Perhaps pore morphology is modified according to habitat quality. So it would be better to assign plants with pores occupying more than 1/3(–1/4) of the cell width to subsp. *norvegicum* and those with pores less than 1/4 of the cell width to subsp. *majus* (Flatberg, pers. comm.).

France, Dept. Loire, Massif Centrale, in Monts du Forez (Bonnot 1958) is the nearest place where *S. majus* s.l. is known to occur. Moreover, ours is the southernmost point in Europe where the plant has been collected.

ACKNOWLEDGMENTS

We are indebted to J. C. Vega, A. Negro, and C. de Hoyos for the chemical analyses and determination of the algae. Drs. K. I. Flatberg, R. Gauthier, and C. B. McQueen kindly confirmed our determinations, provided unpublished information, and made useful comments on the manuscript. We are also grateful to Drs. R. E. Andrus and D. H. Vitt for suggestions and helpful comments on the original draft and to Dr. J. L. Acuña for assistance with the English.

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