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On the presence of *Orthotrichum patens* Bruch & Brid. in the Iberian Peninsula

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Abstract – *Orthotrichum patens* Bruch & Brid., considered to be a rare moss in the Iberian Peninsula, is reported from two localities in Northern Spain (Asturias and Navarra). After revision of the herbarium material corresponding to previous records of this species in the Iberian Peninsula, we conclude that most of them (Asturias, Álava, León and La Rioja provinces) are erroneous. However, two early records (Sierra Nevada and Sierra de Ancares) remain uncertain since the corresponding herbarium material has not been found. We also provide details of two new localities of *Orthotrichum patens* in Romania and two in Turkey, where the species has been poorly recorded. Finally, we discuss the characters that allow the discrimination of *Orthotrichum patens* from related species, especially from O. stramineum Hornsch., the moss that has most often been confused with it in Spain.

Mosses / Spain / Romania / Turkey / European rare species / *Orthotrichum alpestre* / *Orthotrichum handiense* / *Orthotrichum scanicum* / *Orthotrichum pulchellum* / *Orthotrichum stellatum* / *Orthotrichum stramineum*

INTRODUCTION

Orthotrichum patens Bruch & Brid. is a moss with a European distribution that extends beyond the continental limits only in the south-east, where it reaches Turkey (Lewinsky, 1993; Kürschner & Erdağ, 2005). It grows as an epiphyte on the bark of several tree and shrub species in temperate-humid forests not subject to summer drought. Although it is widespread in central Europe, it is considered to be an infrequent moss (Garilleti *et al.*, 2002) and figures in the red lists of several European countries (*i.e.*, Werner, 2003; Kučera & Váňa, 2003; Sabovljevic *et al.*, 2004). It is also included in the European Red Data Book (ECCB, 1995), listed among the "Taxa apparently threatened but presenting taxonomic problems". In the Mediterranean area there are only some old records of the species in Greece and Sardinia, which must be considered doubtful (Düll, 1985; Lara *et al.*, 2003).

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Table 1. Previous records of *Orthotrichum patens* in the Iberian Peninsula and the results of the revision of the herbarium specimens.

Reference	*Locality*	*Sheet*	*Revision*
Colmeiro, 1867	Granada: Sierra Nevada, Güéjar	Not found	—
Casas, 1975	Logroño: Entre Montenegro y Villoslada de Cameros	BCB 4001	***O. stramineum***
Fernández Ordóñez & Simó, 1976	León: Pinar de Lillo	FCO-Briof. 00565	***O. stramineum***
Fernández Ordóñez, 1981	Oviedo: Orlé	FCO-Briof. 02508	***O. stramineum***
Fernández Ordóñez, 1981	Oviedo: Bueres	FCO-Briof. 02507	***O. stramineum***
Fernández Ordóñez, 1981	León: Zona del Pinar de Lillo	FCO-Briof. 02509	***O. stramineum***
Casas *et al.*, 1987	León: Sierra de Ancares, Valle del Cuiña	Not found	—
Heras *et al.*, 2000	Álava: Cigoitia, macizo de Gorbea, Mairuelegorreta	VIT 583/87	***O. alpestre***

In the Iberian Peninsula, *Orthotrichum patens* was first cited by Colmeiro (1867) from material collected by Lange in 1852 in Güéjar Sierra (Granada). The record was repeated later by Höhnel (1895) in his study on Sierra Nevada. For more than a century this moss was not found subsequently in any other locality, until it was finally recorded by Casas (1975) in the Sierra de la Demanda (La Rioja). Since then five new localities have been added: two in León (Fernández Ordóñez & Simó, 1976; Fernández Ordóñez, 1981; Casas *et al.*, 1987), two in Asturias (Fernández Ordóñez, 1981) and the fifth in Álava (Heras *et al.*, 2000). In the original red list of Iberian bryophytes (Sergio *et al.*, 1994) the species was considered as "rare" in Spain, whereas in the recently updated one (Sérgio *et al.*, 2006) *Orthotrichum patens* is included in the "data deficient" category.

After the discovery of the species in two new localities in northern Spain, we tried to check the previous records of *Orthotrichum patens* in the Iberian Peninsula, and the results are listed in table 1. In addition, in the course of prospecting trips through Romania and Northern Turkey, we found four new localities for this moss, which is considered to be "threatened" in SE Europe (Sabovljevic *et al.*, 2001).

REVISION OF IBERIAN MATERIAL AND NEW RECORDS FOR SPAIN

Six of the eight herbarium sheets corresponding to the previous records of *Orthotrichum patens* in Spain were examined. In all the six cases the original determination is erroneous (Table 1), since five of the samples belong to *Orthotrichum stramineum* Hornsch., while the last one corresponds to *O. alpestre*

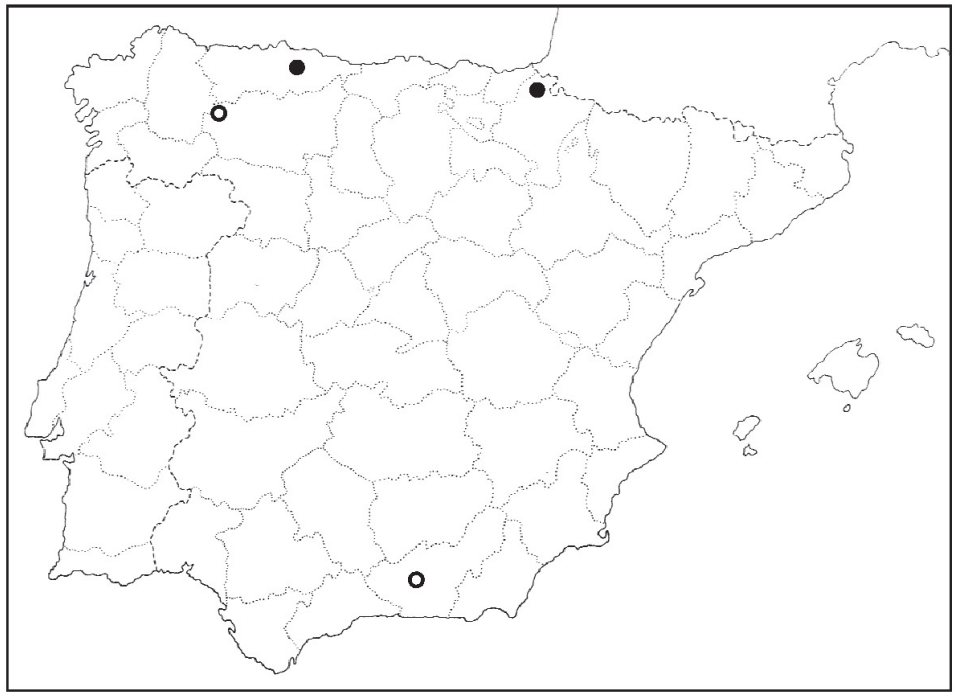


Fig. 1. Known distribution of *Orthotrichum patens* in the Iberian Peninsula. Empty circles represent the previous records which could not be confirmed.

Hornsch. *ex* Bruch, Schimp. & W. Gümbel. The presence of this species in Sierra Nevada (Granada) and Sierra de Ancares (León) could not be confirmed. However, *Orthotrichum patens* is actually present in the north of the Iberian Peninsula since we have found it in two localities: northern Navarra and central-eastern Asturias. As a result of this update, the Iberian distribution of this species hardly changes compared with that previously known (Fig. 1).

New localities

SPAIN. ASTURIAS: Concejo de Siero, Carbayín Alto (Parroquia de Santiago de Arenas), Les Vilorteres, 43º20'48'' N, 5º37'51'' W, 360 m, on a low branch of *Castanea sativa*, *F. Lara*, 5 December 2004 (Authors' herbarium at Universidad Autónoma de Madrid). **NAVARRA**: Yanci, San Juan Xar, 43º12'27'' N, 01º42'44'' W, 130 m, on *Carpinus betulus*, *B. Albertos*, *R. Garilleti et al.*, 26 August 1996 (Authors' herbarium at Universidad Autónoma de Madrid).

Orthotrichum patens is confirmed to be a rare species in the Iberian Peninsula. The only two specimens safely identified as this species originate from the part of the Iberian area subject to a clearly Atlantic climate, and although the discovery of this moss outside the Eurosiberian Region seems unlikely (considering its total known distribution), its potential occurrence in areas subject to a tempered Mediterranean climate cannot be rejected *a priori*. As for the two unconfirmed records, that situated in the Sierra Nevada seems to be the most unlikely from an ecological point of view. Recent studies (Rams, *pers. com.*) suggest that the species is absent in the area. On the other hand, the new record

of *O. patens* in Asturias was found in a quite strongly modified forest (an abandoned culture of *Castanea sativa* Mill. next to a local road), suggesting that the natural condition of the habitat is not a critical factor for this species. Therefore a wider extension of its distribution through the lowlands of the Iberian Atlantic area is likely.

NEW LOCALITIES FROM ROMANIA AND TURKEY

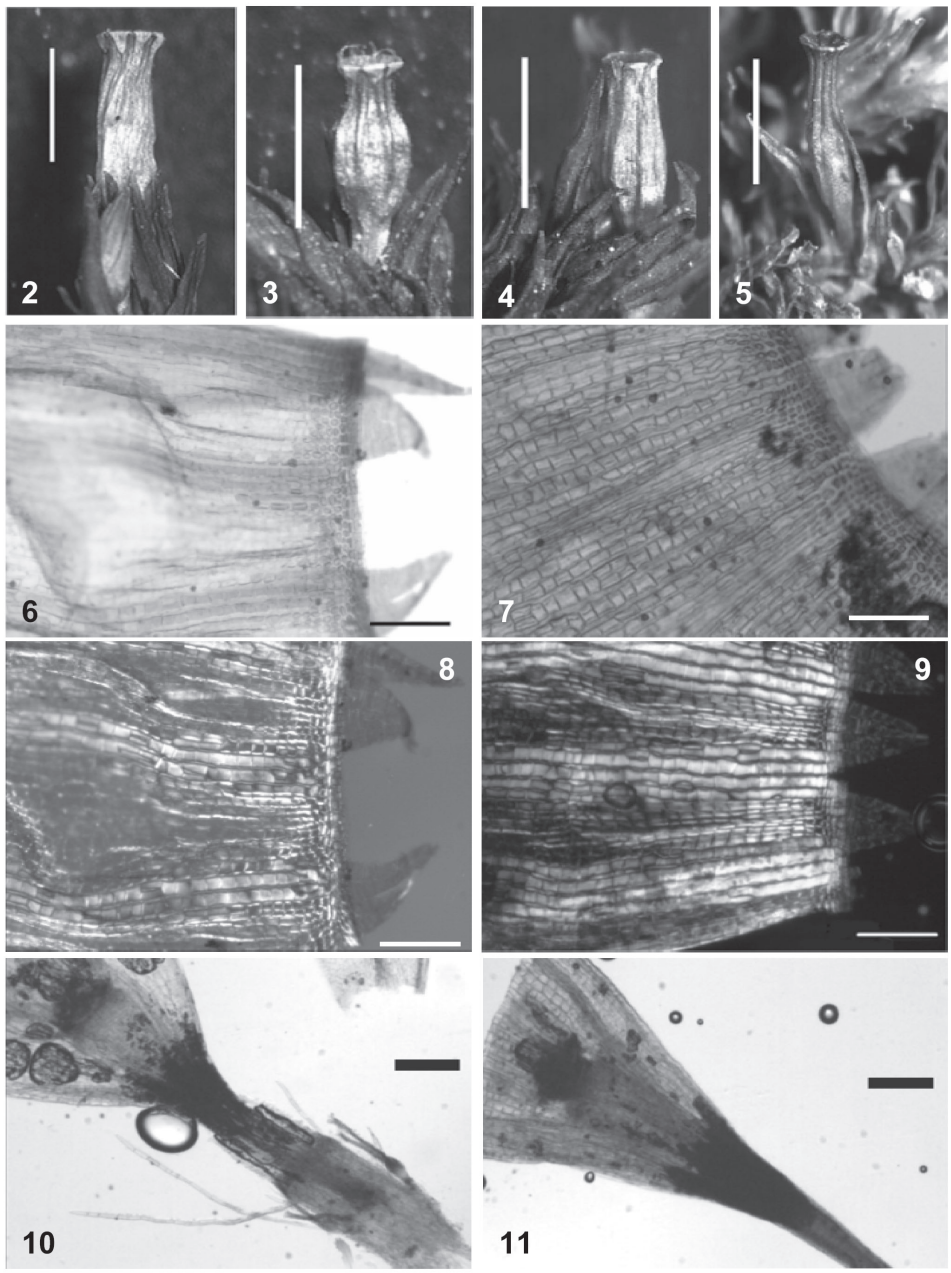
Orthotrichum patens has been cited in most countries of south-eastern Europe (Sabovljevic *et al.*, 2001), including Romania and Turkey. However, the few available records suggest that this species is rather scarce in the whole of this area. The following four new records (two in the Romanian Transylvania and two in north-eastern Anatolia) are intended to contribute to a better knowledge of the range of this rare species.

ROMANIA. BIHOR: Apuseni Mts., Pietroasa, road to Poiana Florilor, 46º35'23'' N, 22º37'52'' E, ca. 450 m, on trunk of *Salix cinerea* in the edge of a beech forest, *F. Lara*, 14 August 2003 (Authors' herbarium at Universidad Autónoma de Madrid). **MARAMURES**: Rodnei N.P., Burşa, northern slope of Pietrosul Mt, 47º37'34'' N, 24º39'29'' E, ca. 1000 m, on trunk of *Populus nigra*, *F. Lara*, 16 August 2003 (Authors' herbarium at Universidad Autónoma de Madrid).
TURKEY. GIRESUN: near Tirebolu, 40º58' N, 38º50' E, 200 m a.s.l, on *Corylus maxima* in a giant filbert crop field, *E. Bermejo & F. Martínez*, 4 July 1998 (Authors' herbarium at Universidad Autónoma de Madrid). **TRABZON**: Road from Of to Uzungöl, exit to Taşhanpazari, 40º50'15'' N, 40º16'33'' E, 140 m a.s.l., on branches of *Corylus maxima* Mill., *F. Lara*, *V. Mazimpaka & R. Medina*, 9 July 2005 (Authors' herbarium at Universidad Autónoma de Madrid).

DISCUSSION

Orthotrichum stramineum is the species that most frequently has been confused with *O. patens* in Spain (Table 1). This is not surprising since the similarity of these two mosses has been recognised to such an extent that *O. patens* has even been considered a variety of *O. stramineum* (Venturi, 1887). Indeed, both species share several characters: semi-emergent capsules, double peristome with an exostome consisting of 8 pairs of recurved teeth and an endostome of 8 segments, immersed stomata broadly covered by the exothecial cells and restricted to the capsule base, and a hairy vaginula. However, these characters are also present in three other species in Europe and adjacent areas: *O. alpestre, O. stellatum* Brid., and *O. handiense* F. Lara, Garilleti & Mazimpaka, the latter endemic to the Canary Islands (Lara *et al.*, 2003).

Orthotrichum patens can be identified with certainty since it has a unique sporophyte character within this group of species: the capsule ribs are very thin because they are formed for most of their length by only two rows of differentiated exothecial cells (dark-coloured and thick-walled cells). This character is easily distinguished with a bright field microscope (Figs 6-7), but it becomes particularly evident using polarized light (Figs 8-9). Due to the delicacy



Figs. 2-11. Sporophyte characters differentiating *Orthotrichum patens* and *O. stramineum*. **2-3**: capsule shape during spore release. **4-5**: capsule shape when empty and dry. **6-7**: Exothecial bands. **8-9**: Exothecial bands under polarized light. **10-11**: shape of capsule neck. 2, 4, 6, 8 & 10: *Orthotrichum patens* (Romania, Maramures, Rodnei N.P., *F. Lara* 2003, Authors' herbarium at U.A.M.). 3: *O. stramineum* (Italia, Sicilia, Mte. Soro, *V. Mazimpaka et al.* 1998, Authors' herbarium at U.A.M.) 5, 7, 9 & 11: *O. stramineum* (FCO-Briof. 00565). Scale bars 2-5: 1 mm; 6-11: 200 μm.

Table 2. Differential sporophytic characters between *Orthotrichum patens* and *O. stramineum*.

	O. patens	*O. stramineum*
Exothecial bands	Narrow, 2 rows of differentiated cells (locally 3-4 rows)	Wide, 4-6 rows of differentiated cells
Capsule neck	Short, abruptly contracted into the seta	Long and defluent
Capsule shape (during spore release)	Ovate-cylindrical, rarely ± urceolate, not or scarcely contracted under the mouth	Urceolate in the upper part, clearly contracted immediately under the mouth
Capsule shape (when empty and dry)	Widely cylindrical to ovate-cylindrical, rarely ± urceolate, not or scarcely contracted under the mouth	Hypocraterimorphy totally contracted (up to the collapse) except at mouth.
Spore size	(14-)17-21(-25) µm	9-14(-17) µm
Endostome segments	Finelly papillose	Smooth

of the ribs, capsules of *O. patens* are only slightly constricted (or not constricted at all) below the mouth when dry and empty. The discrimination of *Orthotrichum patens* from *O. stramineum* is also supported by the shape of the capsule base, which is more or less abruptly narrowed through the neck in the first species and much more progressively in the second (Figs 10-11). Additionally, the two species differ in spore sizes and endostomial ornamentation (Table 2). Most of these characters have been used for the discrimination of the two mosses in several recent keys: Pierrot (1978), Cortini Pedrotti & Lara (2001), Frey *et al.* (2006) and Casas *et al.* (2006). The following key is intended to make the identification of the remaining species of this complex easier and more reliable.

1. Exothecial bands of the capsule formed mainly by only 2 rows of thick-walled cells (locally 3-4 rows); capsules not or slightly constricted below the mouth when empty and dry . . . . . ***Orthotrichum patens***
1′. Exothecial bands of the capsule formed by 4 or more rows of thick-walled cells; capsules clearly constricted below the mouth when empty and dry. 2

2. Capsules with well developed ribs only in the upper part of the urn; exostome teeth united in pairs only at their bases, irregularly recurved; lid conical-mamillate; endostome strongly papillose; plants robust, 1-2 cm tall . . . . . ***O. handiense***
2′. Capsules with well developed ribs along most of their length; exostome teeth fully united in pairs, regularly recurved; lid rostrate with plane or convex base; endostome smooth or slightly papillose; plants slender and smaller, generally < 1 cm tall. 3

3. Exostome teeth with dense papillae in their basal half, striate-papillose in the distal part; endostome segments frequently with thickened transverse walls; leaf papillae generally tall, frequently branched; calyptra frequently with thick and prominently papillose hairs . . . . . ***O. alpestre***
3′. Exostome teeth uniformly papillose; endostome segments without thickened transverse walls; leaf papillae varied; calyptra naked or with scattered and thin, non-papillose hairs 4

4. Vaginula with some long and papillose hairs; calyptra hairy; mature capsules with brown exothecial bands, slightly darker than the rest of the exothecium; capsule neck longly defluent. . . . . ***O. stramineum***
4′. Vaginula often with abundant short and smooth hairs; calyptra naked or with few short, scattered hairs; mature capsules with reddish-brown exothecial bands, in the upper third of the urn visibly darker than the rest of the exothecium; capsule neck short, not exceeding 1/3 of the urn length . . . . . ***O. stellatum***

In the European area there are only two other *Orthotrichum* species with cryptopore stomata and a recurved peristome when dry that, like *O. patens*, have exothecial bands basically formed by two rows of thick-walled cells: *Orthotrichum scanicum* Grönvall and *O. pulchellum* Brunt. The differentiation of these three mosses is based on the following key characters:

1. Capsules exserted; peristome teeth and segments deep red-orange, sharply contrasting with the pale yellow urn; calyptra not completely covering the urn . . . . . ***O. pulchellum***
1′. Capsules emergent; peristome teeth yellowish not noticeably contrasting with the urn in colour, peristome segments hyaline; calyptra completely covering the urn 2

2. Pairs of exostome teeth easily splitting into two when recurving; endostome of 16 segments, very rarely only 8, often appendiculate; capsules cylindrical, pale-yellow; vaginula naked; some leaves with apex sinuate, dentate or channelled. . . . . ***O. scanicum***
2′. Pairs of exostome teeth staying joined when recurving; endostome of 8 non-appendiculate segments; capsules widely cylindrical, brown-orange, rarely pale brown; vaginula generally with some long hairs; leaves apex acute, with margin entire . . . . . ***O. patens***

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REFERENCES

CASAS C., 1975 — Aportación al estudio de la flora briológica española. Musgos y hepáticas de las provincias de Soria, Logroño, Burgos y Segovia. *Anales del instituto botánico Antonio José Cavanilles* 32: 731-762.

CASAS C., FUERTES E. & VARO J., 1987 — Aportaciones al conocimiento de la flora briológica española. Notula VII: El valle del Cuiña, Sierra de Ancares. *Actas VI Simposio nacional botánica criptogámica*: 473-483.

CASAS C., BRUGUÉS M., CROS R.M. & SÉRGIO C., 2006 — *Handbook of mosses of the Iberian Peninsula and the Balearic Islands*. Barcelona, Institut d'Estudis Catalans, 349 p.

COLMEIRO M., 1867 — Enumeración de las Criptógamas de España y Portugal. *Revista de los progresos de las ciencias exactas, físicas y naturales, Madrid* 16-17: 54-119.

CORTINI PEDROTTI C. & LARA F., 2001 — Orthotrichales. *In*: Cortini Pedrotti C., *Flora dei muschi d'Italia. Sphagnopsida - Andreaeopsida - Bryopsida (1ª parte)*. Roma, Antonio Delfino Editore, pp. 719-761.

DÜLL R., 1985 — Distribution of the European and Macaronesian mosses (Bryophytina). Part. II. *Bryologische Beitraege* 5: 110-232.

ECCB (EUROPEAN COMMITTEE FOR CONSERVATION OF BRYOPHYTES), 1995 — *Red Data Book of European Bryophytes.* Trondheim, ECCB, 291 p.

FERNÁNDEZ ORDÓÑEZ M.C. & SIMÓ R.M., 1976 — Estudio briológico del Pinar de Lillo (León). *Acta phytotaxonomica Barcinonensia* 21: 43-51.

FERNÁNDEZ ORDÓÑEZ M.C., 1981 — Estudio de la flora briológica del valle del Nalón y puerto de Tarna. *Boletín ciencias naturales I.D.E.A.* 28: 43-218.

FREY W., FRAHM J.-P., FISCHER E. & LOBIN W., 2006 — *The Liverworts, mosses and ferns of Europe*. Colchester, Harley Books, 512 p.

GARILLETI R., LARA F., ALBERTOS B. & MAZIMPAKA V., 2002 — Datos previos para una lista roja de las especies europeas del género *Orthotrichum. Conservación vegetal* 7: 3-5.

HERAS P., INFANTE M. & UGARTE I., 2000 — Aportaciones al catálogo briológico de la comunidad autónoma del País Vasco. 2. Musgos. *Estudios del museo de ciencias naturales de Álava* 15: 53-56.

HÖHNEL F.v., 1895 — Beitrag zur Kenntniss der Laubmoosflora des Hochgebirgstheiles der Sierra Nevada in Spanien. *Sitzungsberichten der kaiserlichen Akademie der Wissenschaften in Wien* 104: 297-336.

KUČERA J. & VÁŇA J., 2003 — Check- and Red List of bryophytes of the Czech Republic (2003). *Preslia, Praha* 75: 193-222.

KÜRSCHNER H. & ERDAĞ A., 2005 — Bryophytes of Turkey: an annotated reference list of the species with synonyms from the recent literature and an annotated list of Turkish bryological literature. *Turkish journal of botany* 29: 95-154.

LARA F., BLOCKEEL T.L., GARILLETI R. & MAZIMPAKA V., 2003 — Some interesting *Orthotrichum* species from mainland Greece and Evvia. *Journal of bryology* 25: 129-134.

LARA F., GARILLETI R. & MAZIMPAKA V., 2003. — Noticias sobre el estado de *Orthotrichum handiense* en Fuerteventura (Islas Canarias). *Boletín de la sociedad Española de briología* 22/23: 11-16.

LEWINSKY J., 1993 — A synopsis of the genus *Orthotrichum* Hedw. (Musci, Orthotrichaceae). *Bryobrothera* 2: 1-59.

PIERROT R.B., 1978 — Contribution à l'étude des espèces françaises du genre *Orthotrichum* Hedw. *Bulletin de la société botanique du Centre-Ouest*, nouvelle série 9: 167-183.

SABOVLJEVIC M., CVETIC T. & STEVANOVIC V., 2004 — Bryophyte Red List of Serbia and Montenegro. *Biodiversity and conservation* 13: 1781-1790.

SABOVLJEVIC M., GANEVA A., TSAKIRI E. & ŞTEFĂNUŢ S., 2001 — Bryology and bryophyte protection in south-eastern Europe. *Biological conservation* 101: 73-84.

SÉRGIO C., CASAS C., BRUGUÉS M. & CROS R.M., 1994 — *Lista vermelha dos briófitos da Península Ibérica*. Lisbon, ICN, 45 p.

SÉRGIO C., BRUGUÉS M., CROS R.M., CASAS C. & GARCIA C., 2006 (2007) — The 2006 Red List and an updated Check List of bryophytes of the Iberian Peninsula (Portugal, Spain and Andorra). *Lindbergia* 31: 109-135.

VENTURI G., 1887 — *Orthotrichum. In*: Husnot T., 1884-1890, *Muscologia gallica*. Cahan & Paris, T. Husnot & F. Savy, pp. 154-196.

WERNER J., 2003 — Liste rouge des bryophytes du Luxembourg. Mesures de conservation et perspectives. *Ferrantia* 35 : 10-71.