

The identity of *Entosthodon hungaricus* (Boros) Loeske and *E. maroccanus* (Meyl.) Hébr. & Lo Giudice (= *Physcomitrium maroccanum* Meyl.)

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SUMMARY

Entosthodon hungaricus (Boros) Loeske and *E. maroccanus* (Meyl.) Hébr. & Lo Giudice have been considered as two different taxa but no comparative study has ever been carried out on them. From previous studies, it is clear that the only reliable feature to distinguish the taxa seems to be the different spore ornamentation patterns. After study of the spores by light microscopy and SEM, we conclude that there is no reason to define *E. maroccanus* as a separate taxon from *E. hungaricus* and they should be considered synonymous.

KEYWORDS: Funariaceae, *Entosthodon*, taxonomy, spores.

INTRODUCTION

Entosthodon hungaricus (Boros) Loeske was described by Boros (1924) from Hungary. It was previously known from Austria, Kazajstan (Steppae Kirghizorum), Romania, Slovakia, Ukraine (Podpera, 1954), Serbia (Boros, 1970), Spain (e.g. Casas & Brugués, 1978), Israel (Herrnstadt, Heyn & Crosby, 1991) and Germany (Ahrens, 1996).

Physcomitrium maroccanum Meyl. was described by Meylan (1937) from Morocco. Recently, it was cited from Sicily (Hébrard & Lo Giudice, 1996) and transferred to the genus *Entosthodon* (Hébrard & Lo Giudice, 1997) on the basis of its very elongated exothecial cells with incrassate walls (*Physcomitrium* shows isodiametric exothecial cells) and the papillose-reticulate ornamentation of the spore (*Physcomitrium* has uniformly and densely spinate spores).

Both species present a set of characteristics that are not found in other species of the genus *Entosthodon*. The ornamentation of the spores seems to be the only reliable feature distinguishing the taxa. It has been described as granulate in *Entosthodon hungaricus* (Boros *et al.*, 1993) and more or less reticulate and densely covered with rounded papillae in *E. maroccanus* (Hébrard & Lo Giudice, 1996). In order to clarify whether these distinctions are sufficient to separate the taxa, we carried out a microscopical and SEM study of the spores of both taxa. It was our hypothesis that these taxa have been treated as independent species previously because no comparison of this nature had been carried out before.

MATERIALS AND METHODS

We studied the type material of *E. hungaricus* deposited in BP (Comit. Békés. Planitie magna hungariae. Laxe caespitosa rarissima in pseudonatronatis parum-graminosis inter pagum Kétegyháza et stationem viae ferreae 'Ujkigyós' dict., 90 m, 23 May 1924, Boros), a specimen from Morocco and many samples of *Entosthodon hungaricus* from the Iberian Peninsula and Hungary. However, we were unable to study the lectotype material of *E. maroccanum* at MPU (Montpellier) but instead studied a specimen collected by Lo Giudice in Contrada Canalotto, Mazzarino, 8 February 1994 (MUB 7354), and material from south-eastern Spain determined as *Physcomitrium maroccanum* by Hébrard (MUB 6713). Other material studied was:

HUNGARY: Comit. Csongrád. In natronatis versus lacum Fehértó opp Szeged, ca 86 m, 13 March 1950, Timár (BCB 2345); Com. Pest. Ad margines lacu Kis Pjocra prope peg Kecskenet, ca 120 m, 2 May 1957 (BCB 2346); Comit. Pest, in natronatis rip. lacus inter Szabadszallas et Fülöpszallas, 15 May 1951, Boros (BCB 35125).

MOROCCO: carretera de Arroût a Kebdani, poco antes de cruzar el oued Kert, 30SVD7877, 180 m, 11 March 1997, Cano, Gallego, Garilleti, Lara & Ros (MUB 7353).

SPAIN: Navarra, Los Arcos, 24 February 1975, Fuertes & García-Gómez (MACB 61426); Huesca, La Cartuja, Los

Monegros, 14 March 1978, *Casas* (BCB 2343); Madrid, Aranjuez, Laguna del Salobral, 30 February 1984, *Guerra* (MUB 2294); Alicante, Elche, Laguna del Hondo, carretera perpendicular al canal de riegos de Levante, XH 9927, 0 m, 20 March 1993, *Cano & Ros* (MUB 5675); Granada, saladares de Cúllar-Baza en dirección a Galera, WG 3866, 900 m, 3 February 1990, *Guerra, Ros & Gil* (MUB 7201); Murcia, carretera Cartagena-Los Urrutias, XG 8876, 0 m, 27 February 1997, *Ros & Schumacker* (MUB 6713).

The spores used in this study were obtained from mature sporophytes of field collections and dried herbarium specimens. Spores to be used for SEM were critical point dried using 100% acetone and CO₂ as the transition fluid. The specimens were sputter coated (*ca* 250 Å) with gold and viewed with a Jeol JSM 6100 microscope at an accelerating voltage of 15 KV.

RESULTS

The leaves in all the material studied were ovate-oblong to ovate-lanceolate, entire or faintly dentate with the costa ending some distance below the apex or excurrent. Variability of leaf forms is found even in the same plant, and there is no other difference between the gametophytic features shown by the material identified as *E. hungaricus* and that determined as *E. maroccanus*. With reference to sporophyte characteristics, in both taxa the operculum was rostellate, the calyptra mitrate, the capsule ovate or pyriform, sometimes cyathiform when dry and empty and the peristome rudimentary or absent.

The only reliable criterion used to separate *E. maroccanus* from *E. hungaricus* in previous studies was the presence in *E. maroccanus* of a papillose-reticulate (Hébrard & Lo Giudice, 1996) type of spore ornamentation. We were able to observe under scanning electron microscope and light microscope that samples identified as *E. maroccanus* show the same variability as those determined as *E. hungaricus*.

Under the light microscope, the processes appear more or less isodiametric (Fig. 1a–g) or irregular in shape, spaced (Fig. 1e) or densely arranged (Fig. 1b, g), small or large (Fig. 1e), sometimes branched (Fig. 1h–k) and often anastomosed forming a vermiculate or irregularly striated pattern, or a kind of open reticulum (Fig. 1l). Moreover, the spore size is extremely variable, 18–42 µm in diameter. Under the scanning electron microscope (Fig. 2), it can be seen that the apparently larger processes result mainly from anastomosis and juxtaposition of smaller perinic particles, as can be observed in many spores of perinate mosses. Such high diversity in the perinic pattern of species of Funariaceae is common and only rarely can a species or a group of species be separated on the basis of spore morphology (e.g. *Pottia starckeana* agg. in Ros *et al.*, 1996).

DISCUSSION

After a careful study of the available material of both taxa, we conclude that no gametophytic and sporophytic character can be used to differentiate the taxa.

We observed that *E. hungaricus* shows a wide diversity in the shape, size and distribution of the perinic processes which define ornamentation in this and other moss families (Boros *et al.*, 1993). This variability and the unusual ornamentation of *E. hungaricus* spores has already been reported by Fife (1985) whose micrographs show a smooth spore with few and small processes.

In sum, there is no reason to maintain *E. maroccanus* as an independent taxon from *E. hungaricus* on the basis of the spore ornamentation pattern and, consequently, we propose that both taxa should be considered synonymous and that the name *E. hungaricus* takes priority.

Entosthodon hungaricus (Boros) Loeske., *Repert. Spec. Nov. Regni Veg. Sonderbeih.* 3(2): 115. 1929.

Funaria hungarica Boros, *Magyar Bot. Lapok* 23: 73. 1924.

Physcomitrium maroccanum Meyl., *Bull. Soc. Hist. Nat. Afr. Nord.* 28: 426. 1937. **syn. nov.**

Entosthodon maroccanus (Meyl.) Hébr. & Lo Giudice, *Bull. Soc. Linn. Provence* 48: 145. 1997. **syn. nov.**

E. hungaricus was originally considered a typical species of the central European steppes, with an Aral-Caspian distribution (Gams, 1934). Later, it was found in southern Europe (Spain) on saline soils, and this study extends its range to basic soils in Sicily and North Africa.

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TAXONOMIC ADDITIONS AND CHANGES: *Entosthodon hungaricus* (Boros) Loeske (syn. *E. maroccanus* (Meyl.) Hébr. & Lo Giudice).

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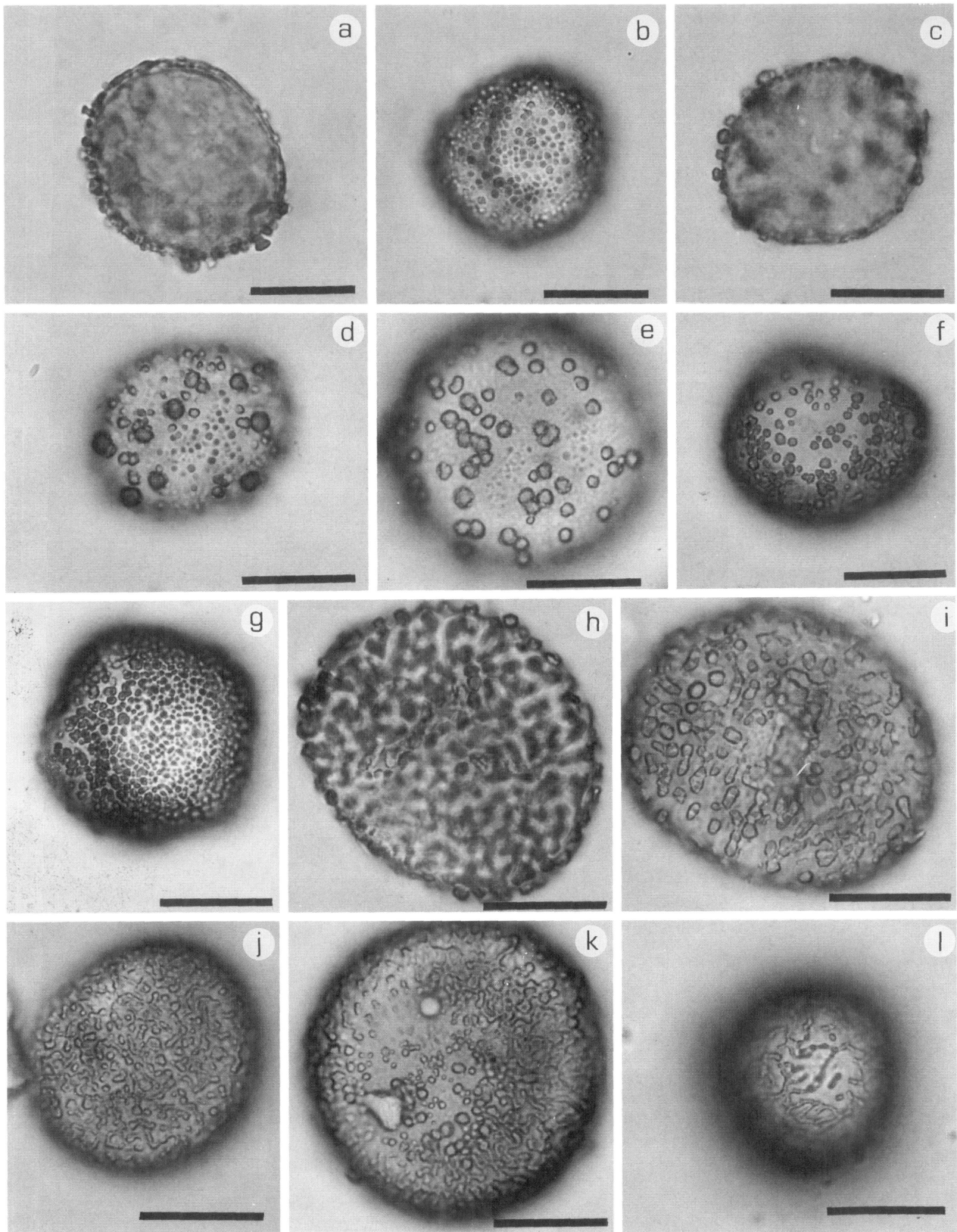


Figure 1. Light micrographs of spores of *E. hungaricus* (Boros) Loeske. *a, b* from Italy (*MUB* 7354), *c* from Hungary (*BCB* 2345), *d* from Hungary (*BCB* 2355), *e* from Hungary (*BCB* 35125); *f, g* from Spain (*MUB* 2294), *h, i* from Hungary (*BCB* 2346), *j* from Spain (*BCB* 2343), *k* from Spain (*MUB* 5675), *l* from Spain (*MUB* 6713). Scale bar for all spores (a–l) = 15 μ m.

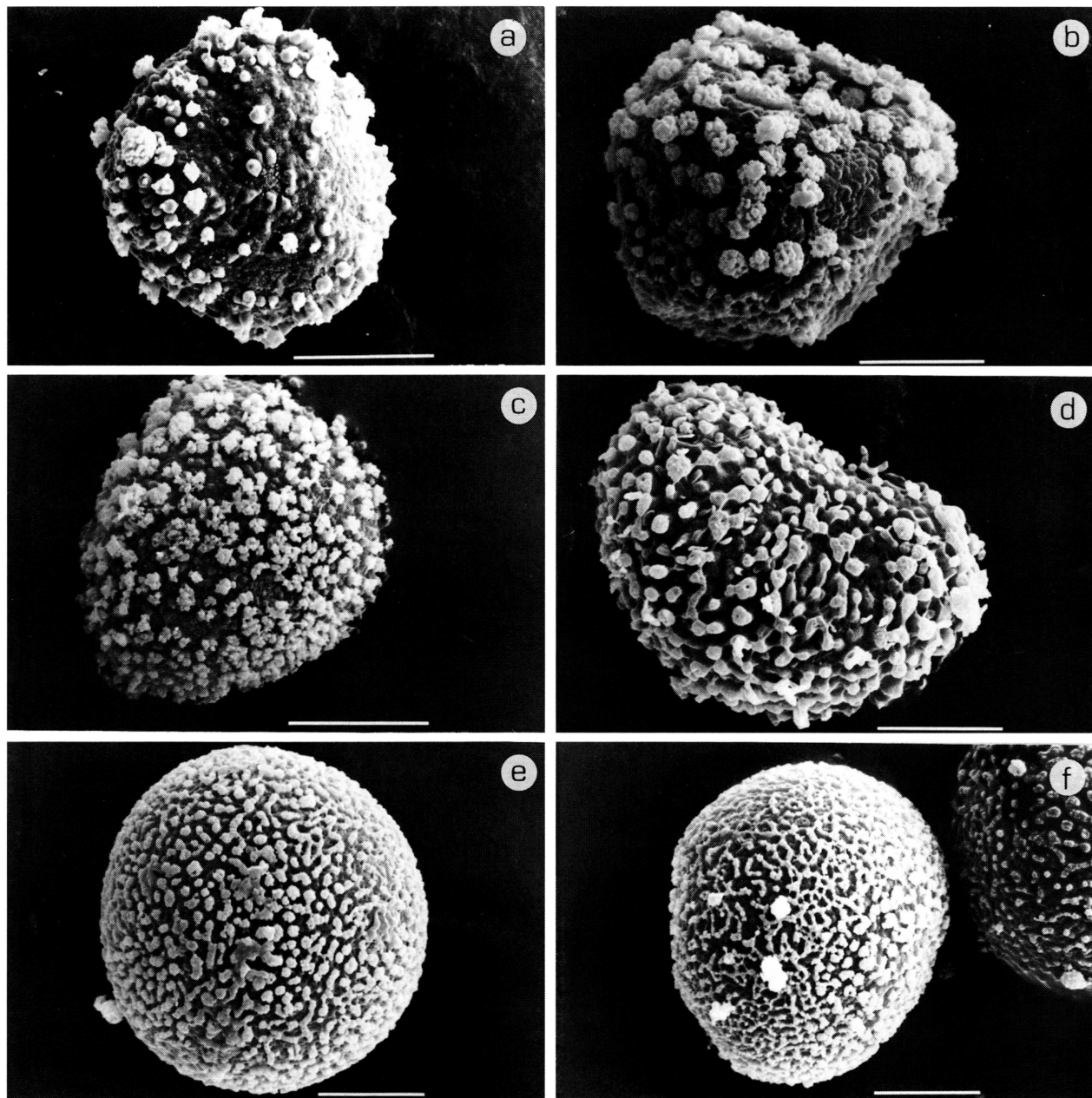


Figure 2. Scanning electron micrographs of spores of *E. hungaricus* (Boros) Loeske. *a* from Italy (MUB 7354), *b* from Hungary (BCB 35125), *c*, *e* from Spain (MUB 2294), *d* from Hungary (BCB 2346), *f* from Spain (MUB 5675). Scale bars: a–f = 10 μ m.

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