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Ephemerum cohaerens (Hedw.) Hampe and *E. spinulosum* Bruch & Schimp. (Ephemeraceae, Bryopsida), new to the Iberian Peninsula

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Résumé – *Ephemerum cohaerens* et *E. spinulosum* sont ici signalés pour la première fois pour la bryoflore ibérique. Les sites et leur écologie sont décrits, et une clef d'identification de toutes les espèces du genre *Ephemerum* connues dans la Péninsule Ibérique est incluse.

***Ephemerum* / Musci / Péninsule Ibérique / distribution / écologie / clef**

Abstract – *Ephemerum cohaerens* and *E. spinulosum* are reported for the first time for the Iberian bryophyte flora. Site descriptions and notes on species ecology are provided, as well as an identification key to all *Ephemerum* species known to occur in the Iberian Peninsula.

***Ephemerum* / Musci / Iberian Peninsula / distribution / ecology / key**

Resumen – Se citan por primera vez para la flora briofítica ibérica *Ephemerum cohaerens* y *E. spinulosum*. Se ofrecen las descripciones de las localidades y notas sobre su ecología, al mismo tiempo que se incluye una clave de identificación para todas las especies de *Ephemerum* conocidas en la Península Ibérica.

***Ephemerum* / Musci / Península Ibérica / distribución / ecología / clave**

INTRODUCTION

The prospection of the exposed mud in a reservoir in the Basque country (Northern Spain) (Fig. 1) after the exceptionally wet and cool summer of 2002, led to collecting two species in the genus *Ephemerum* that had not been formerly recorded for the Iberian Peninsula, *E. cohaerens* (Hedw.) Hampe and *E. spinulosum* Bruch & Schimp. The study of communities of ephemeral bryophytes like these had already yielded interesting results before (Heras & Infante, 1989, 1998).

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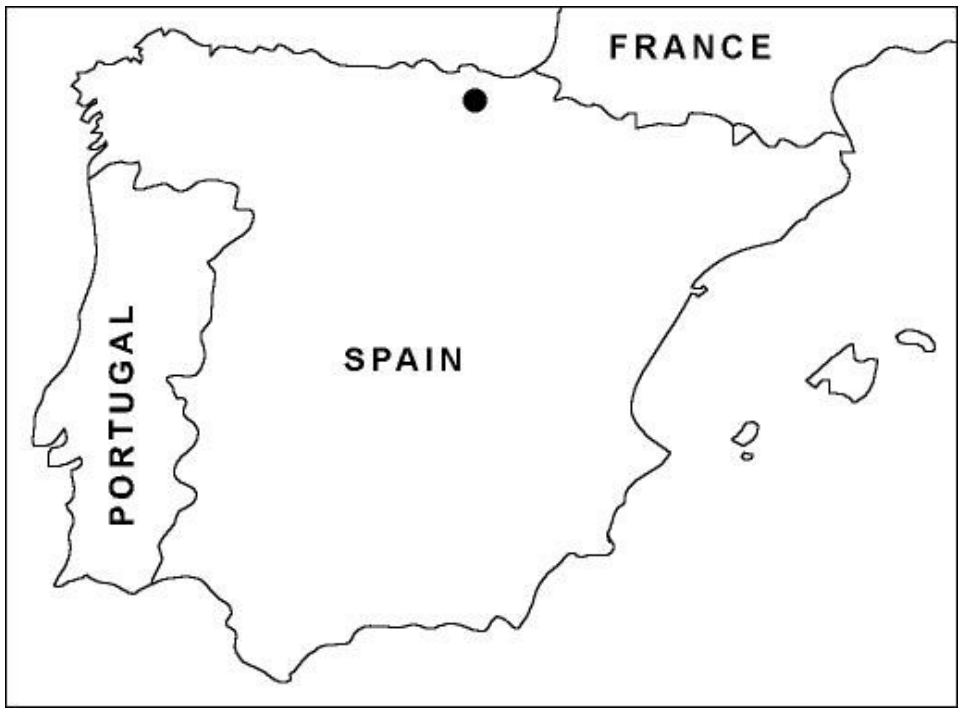

Fig. 1. Distribution of *Ephemerum cohaerens* and *E. spinulosum* in the Iberian Peninsula.

In Europe, Corley *et al.* (1981) accept five species in genus *Ephemerum* (*E. cohaerens, E. recurvifolium* (Dicks.) Boulay*, E. serratum* (Hedw.) Hampe*, E. sessile* (Bruch) Müll. Hal. and *E. stellatum* Philib.). Nevertheless, it is necessary to stress that another taxon, *E. minutissimum* Lindb., which in different papers has been considered to be included in *E. serratum*, or considered a variety (*i.e.* Smith, 1978), is accepted by some in the specific rank (*i.e*. Sérgio, 1982; Risse, 1996). Recently, the presence of *E. spinulosum* (Holyoak, 2001) has been detected in Ireland, so raising the number of European taxa in the genus to seven.

In the Iberian Peninsula, five species have been previously recorded (*E. minutissimum, E. recurvifolium, E. serratum, E. sessile* and *E. stellatum*) (Sérgio, 1982; Sérgio *et al.*, 1987). All of them are present in Portugal, whereas *E. stellatum* has not been found so far in Spain. The totality of *Ephemerum* species are considered as "Rare" in the Red List of Bryophytes of the Iberian Peninsula (Sérgio *et al*., 1994).

Ephemerum cohaerens (Hedw.) Hampe

Diagnostic characters — Leaves with nerve, (1.02) 1.2 (1.5) mm long, shorter than in the rest of nerved leaf species (*Ephemerum recurvifolium*, *E. sessile* and *E. spinulosum*), broadly lanceolate, with characteristic asymmetrical shoulders, nerve ending in or before the apex. Margin clear and irregularly dentate, even spinose-

dentate, particularly on the shoulders. Basal cells hexagonal-rectangular, characteristically wide (long/wide: 1.7-3); upper cells smaller and shorter. Capsule with short but unmistakable pedicel; stomata scattered over its whole surface and centred apicule. Spores irregular and roughly verrucose. **Iconography**: Bryan, 1999.
World distribution — *Ephemerum cohaerens* spreads through North America, at moderate altitudes (up to 500 m), from Ontario, Québec and Minnesota in the North to Florida, Louisiana and Texas in the South (Bryan, 1999). In Europe it has been found in Great Britain and Ireland, where it is considered to be very rare or critically endangered (Smith, 1978; Church *et al*., 2001), and in Central Europe, from Northern Italy to Poland. It is also known from China and Japan (Bryan, 1999). In Europe, *Ephemerum cohaerens* seems to be in decline and is considered "Endangered" (Schumacker & Martiny, 1995).
Presence in the Iberian Peninsula — Spain. Álava, Villarreal de Álava, Urrunaga reservoir, river Iñola inlet, by Gomílaz bridge. 30TWN2864, 545 m. *P. Heras & M. Infante 12/10/2002*, VIT 30187; *M. Infante & P. Heras 20/10/2002*, VIT 30195. Both specimens with sporophytes.
Ecology — The usual ecology of this annual, subneutrophilous, hygrophilous and photophilous species (Dierßen, 2001), includes mud and clayey soils barely colonized by vascular plants, not or slightly calcareous, by the edge of ponds, lakes and reservoirs, or alluvial beaches, rarely in arable fields or bare soil in disturbed pastures (Schumacker & Martiny, 1995).

In the only Iberian locality, *Ephemerum cohaerens* grew on wet mud with *Verbena officinalis* L., *Cynodon dactylon* (L.) Pers. and *Mentha pulegium* L., in the upper fringe of the area usually covered by the waters in the winter. Other bryophytes recorded are *Ephemerum spinulosum, Pottia intermedia* (Turner) Fürnr., *Physcomitrella patens* (Hedw.) Bruch & Schimp., *Pseudoephemerum nitidum* (Hedw.) Loeske, *Bryum* sp. and *Dicranella howei* Renauld & Cardot. It is important to remark that *E. cohaerens* was much scarcer than *E. spinulosum* in this locality.

Below this narrow upper fringe, where the *Ephemerum* species were found, there is a wide area dominated by *Riccia cavernosa* Hoffm., growing along with *Physcomitrella patens*, on soils more briefly emerged and relatively wetter than the *Ephemerum* fringe.

The lithogical substrate of the area includes Lower Cretacean sandstone, limolite and sandy clay, with reef limestone intercalations (IGME 1978). The resulting mud is neutral or slightly acidic.

Ephemerum spinulosum Bruch & Schimp.

Diagnostic characters — Persistent protonema, very abundant, densely covering the soil and giving it a deep green colour. Leaves with nerve, (1.15) – 1.5 (1.9) mm long, setaceous to linear-lanceolate with nerve percurrent to excurrent, spinose. Margin dentate to spinose, except in the basal third. Basal cells smooth and wider than the upper ones. Upper cells are often prorate, showing patent to squarrose spinose projections, similar to the margin and nerve projections. Capsule on a very short pedicel; stomata scattered particularly on the basal half, and centred apicule. Spores verrucose. **Iconography**: Holyoak, 2001.
World distribution — Apart from its scarcity in Europe (Ireland, Holyoak, 2001), *E. spinulosum* spreads at moderate altitudes (less than 700 m) over North America (from Ontario, Québec and Minnesota to Florida, Louisiana and Texas). Also in Eastern Indies (Cuba), Central America (Honduras), South America (Brazil) and Asia (China, Japan, Taiwan) (Bryan, 1999).

Presence in the Iberian Peninsula — *Ephemerum spinulosum* has been found in three close localities, all of them on the banks of the Urrunaga reservoir: Spain. Álava, Villarreal de Álava, Urrunaga reservoir, river Albina inlet, by the village. 30TWN2958, 540 m. *P. Heras 31/12/1988*, VIT 11514. (sub *E. serratum* var. *minutissimum* (Lindb.) Grout *in* Heras *et al*., 2000). — Spain. Álava, Villarreal de Álava, Urrunaga reservoir, river Iñola inlet, by Gomílaz bridge. 30TWN2864, 545 m. *P. Heras & M. Infante 12/10/2002*, VIT 30188; *M. Infante & P. Heras 20/10/2002*, VIT 30193, VIT 30196. All specimens with mature sporophytes. — Spain. Álava, Villarreal de Álava, Urrunaga reservoir, Mekoleta. 30TWN2764, 545 m. *P. Heras 01/11/2002*, VIT 30203. With sporophytes.

Ecology — *Ephemerum spinulosum* in North America is usually a terricolous species growing on disturbed soil by roads, arable fields and pastures; it has rarely been reported from clayey banks of lakes (Bryan, 1999; Holyoak, 2001).

From the three Iberian localities, *E. spinulosum* was especially abundant in Gomílaz.

The specimen from the river Albina inlet grew on the upper fringe of the emerged area during the summer, on soil covered by a wet pasture. Here a lower area was also observed, which was dominated by *Riccia cavernosa* and *Physcomitrella patens*, with the additional presence of *Sphaerocarpos* sp. The lithological substrate is similar to that of Gomílaz, including calcareous sandstone and sandy clays together with limestone nodules from the Upper Cretaceous (IGME, 1978).

The Mekoleta locality shows some differences in the floristic composition, since it is on a more acidic substrate (sandstone) than the others. *Ephemerum spinulosum* was here growing on the upper fringe of the emerged area, together with *Pseudoephemerum nitidum* and *Fossombronia wondraczekii* (Corda) Dumort. ex Lindb. Below this fringe, where the waters withdraw much later, a community dominated by *Riccia huebeneriana* Lindenb., with *R. glauca* L. and *Physcomitrella patens*, was developed.

This is the second time that *Ephemerum spinulosum* is recorded for Europe, so far it was only known from Ireland (Holyoak, 2001), in a similar ecology. It must be noted that the specimen VIT 11514 from river Albina locality establishes its presence in Europe at least since 1988 (the Irish locality was detected in 1999). According to local ornithologists, only 0'10% of the wintering birds in Álava comes from North America, where *E. spinulosum* is spread, making its direct introduction highly unlikely. In the case that *E. spinulosum* is not an autochthonous European species and should its introduction be linked to the waterfowl, the most logical explanation to its presence in Northern Spain is that it would have arrived from Northern Europe, where it might be more spread than already known.

KEY TO THE IBERIAN SPECIES OF *EPHEMERUM*, WITH NOTES CONCERNING THE DISTRIBUTION IN THE IBERIAN PENINSULA

Note: in the species with nerved leaves, the nerve is sometimes absent in the basal third, particularly in the upper leaves.

1. Leaves with a distinct nerve 2
1*. Leaves without a nerve or sometimes with a slight trace in the upper half 5

2. Upper lamina cells prorate, with patent to squarrose spinose projections . . . . . ***E. spinulosum* Bruch & Schimp.**
Only found growing on wet mud in a reservoir in Álava (Northern Spain).

2*. Upper lamina cells smooth, although the margin and/or the nerve may be dentate 3

3. Leaves broadly lanceolate to oblong-lanceolate, often with asymmetrical shoulders, nerve ending in or before the apex ***E. cohaerens* (Hedw.) Hampe**
Only found growing on wet mud in a reservoir in Álava (Northern Spain).

3*. Leaves from narrowly to linear lanceolate, nerve excurrent 4

4. Capsule obliquely apiculated, with stomata only close to the base; leaves often with reflexed apex . . . . . ***E. recurvifolium* (Dicks.) Boulay**
It grows on seasonally inundated calcareous clayey soil, in Mediterranean bush land, occasionally on the Mediterranean coastal fringe and in Southern Portugal, always at low altitudes (Casas *et al.*, 1985; Casas *et al.*, 2001).

4*. Capsule with centred apicule and stomata scattered over its entire surface; leaves with flat apex . . . . . ***E. sessile* (Bruch) Müll. Hal.**
It grows on finely grained soils, especially in temporary ponds with *Isoetes* spp. It has been found in the Southern half of Portugal and very sparsely in Spain (Extremadura, Cataluña, Ávila and Huelva) (Casas *et al*., 1989; Guerra & Wallace, 1986; Lloret *et al*., 1997; Sérgio *et al.*, 1997-98; Casas *et al.*, 1998).

5. Leaf margin entire or denticulate; median cells 50-90 μm long; leaves divergent in the shape of a star . . . . . ***E. stellatum* Philib.**
Oceanic, present only in Beira Litoral (Portugal), growing on decalcified soils along with *Riccia* and *Fossombronia* spp. (Sérgio *et al*., 1987).

5*. Leaf margin dentate; median cells 100-160 μm long; leaves not divergent . . 6

6. Leaves lanceolate, 10-20 cells wide in the widest part of the lamina; sometimes with a trace of a nerve in the upper half; spores verrucose. . . . . ***E. serratum* (Hedw.) Hampe**
It grows on sandy or clayey soils, slightly acidic, in temporary ponds with *Isoetes* spp., open bush land and barely colonized soils in *Quercus robur* forests. Known from Spain (Cataluña, Navarra and Zaragoza) and from the southern half of Portugal (Sérgio, 1982; Sérgio *et al*., 1984; Miguel & Ederra, 1989; Sérgio *et al*., 1997-98; Casas *et al.*, 1998).

6*. Leaves linear-lanceolate, 8-10 cells wide in the widest part of the lamina, always nerveless; spores finely papillose, commonly covered by a hyaline veil . . . . . ***E. minutissimum* Lindb.**
It grows on bare soil in Mediterranean bush land, olive tree fields, arable fields, temporary ponds with *Isoetes* spp. and barely colonized soils in *Quercus robur* forests. It is the most widely distributed Iberian species in the genus. It has been occasionally found in Portugal and Spain (Cataluña, Navarra, Ciudad Real, Huelva and Albacete) (Sérgio, 1982; Sérgio *et al.*, 1997-98; Sérgio *et al.*, 1999; Casas *et al.*, 1998; Miguel & Ederra, 1989; Gil & Castro, 1987; Heras *et al.*, 1986).

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