

***Hygrohypnum styriacum* (Limpr.) Broth. in the Pyrenees, a new record to the moss flora of France**

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Abstract – *Hygrohypnum styriacum* (Limpr.) Broth. is reported new to France and the Pyrenees. It was recorded in the eastern part of the mountain range (Pyrénées-Orientales). Its ecological requirements and the new locality are briefly described.

Bryophytes / Pleurocarpous mosses / Amblystegiaceae / *Hygrohypnum luridum* / Pyrénées Orientales / Réserve de Eyne

Résumé – *Hygrohypnum styriacum* (Limpr.) Broth. est signalé pour la première fois en France et dans les Pyrénées. Cette espèce a été observée dans la partie est de cette chaîne de montagne (Pyrénées-Orientales). Ses affinités écologiques et la nouvelle localité sont brièvement décrites.

Bryophytes / mousses pleurocarpes / Amblystegiaceae / *Hygrohypnum luridum* / Pyrénées Orientales / Réserve de Eyne

INTRODUCTION

Hygrohypnum styriacum has been traditionally included in the family *Amblystegiaceae*, and the polyphyly of the genus has been suggested in Oliván *et al.* (2007b). According to these authors *Hygrohypnum luridum*, the type of the genus, and *H. styriacum* are the only species to keep in the genus *Hygrohypnum*.

Hygrohypnum styriacum is an amphi-atlantic species with a marked boreal-montane-(sub)alpine character (Düll, 1985). The species is known to occur in North America, along the Rocky Mountains, which is its main distribution centre worldwide (Jamieson, 1976). In Europe, the species is very rare in northern countries (North Sweden and Norway, Eastern Iceland), and a doubtful record is known from southern Norway (Hordaland) (Söderström, 1996). It is also known from a single locality in North Britain (Corley & Rothero, 1992; Hill *et al.*, 1994), and has been recorded in Eastern Alps, Tatra and Carpathian (Jamieson, 1976). The easternmost records in the Alps are in Uri Canton (Switzerland; NISM, on line). The European southernmost record lies in Sierra Nevada (Spain) (Rams & Oliván, 2006; Oliván *et al.*, 2007a).

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In the course of a bryological survey of one of the Réserves naturelles Catalanes (Pyrénées-Orientales, France), the Réserve de Eyne, we had the opportunity to observe several interesting species. Among them, *Hygrohypnum styriacum* was unknown in the Catalan countries (Casas *et al.*, 2001; Thouvenot, 2002), in the Pyrenees (Oliván *et al.*, 2007a) and in France (Düll, 1985; Augier, 1966).

Nomenclature of liverworts and mosses follows, respectively, Ros *et al.* (2007) and Hill *et al.* (2006). All the samples were collected by the author and are deposited in the private herbarium of V. Hugonnot and in MACB.

NEW LOCALITY

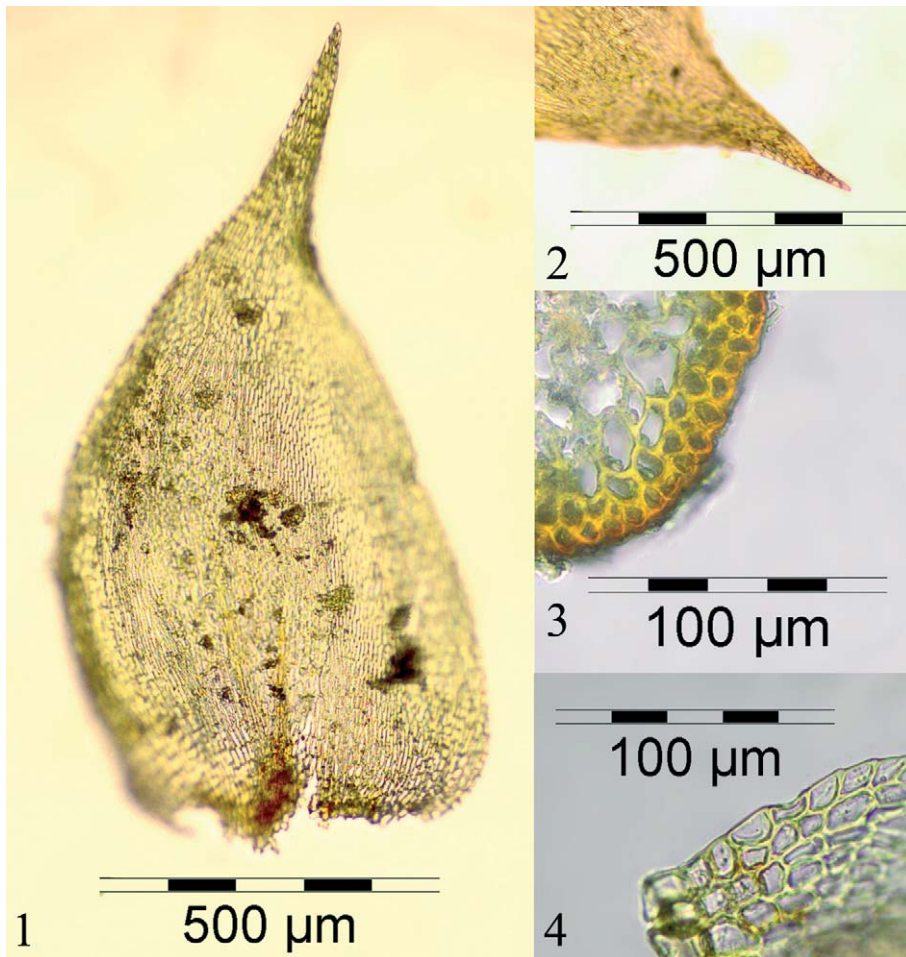
France: Cerdagne. Réserve naturelle de Eyne, ruisseau de la Coma d'Eina: 42°25'34,84" N, 02°08'39,57" E, 2420-2450 m. 9 July 2010, V. Hugonnot.

Hygrohypnum styriacum was observed at the margins of melt-water channels below a vast northwards snow-bed depression. It was found growing directly on volcano-sedimentary rocks. Seepy areas were colonized by spongy masses of *Bryum schleicheri*, *Cratoneuron filicinum*, *Dichodontium pellucidum* and *Philonotis seriata*. Eroded banks of rivulets were predominantly colonized by small turfs of *Dicranella subulata*. On periodically immersed rocky detritus, *Hygrohypnum styriacum* was found growing together with *Brachythecium rivulare*, *Schistidium apocarpum* and *S. rivulare*. The bryophyte flora suggests a moderate base-enrichment by drainage from calcareous rocks of the catchment area.

The collected specimens are characterized by the following characters combination: slender plant, stem without hyaloderm (Fig. 4), leaves straight (with the acumen neither squarrose nor turned to one side) and ovate (Fig. 1), alar group composed at most of a few quadrate to rectangular cells (Fig. 3), male and female inflorescences lumped in a pseudoparous cluster. The leaf form varies from broadly ovate to ovate-lanceolate, with an entire acumen more or less channelled (Fig. 2). The acumen size may vary from 200 to more than 400 µm long. Although both male and female inflorescences have been frequently observed, sporophytes (bearing mature capsules) were rather scarce at the locality.

DISCUSSION

The unique inflorescence complex, made of an agglomeration of one male and several female buds, distinguishes immediately *Hygrohypnum styriacum* from all other members of the genus *Hygrohypnum*, with which it could potentially be confused. When reproductive structures are lacking, the determination is more difficult and must rely on a set of gametophytic characters that are described in Jamieson (1976). Among them, the form of the best developed leaves (ovate with an abrupt acumen in *H. styriacum* vs. oblong-lanceolate with or without a shorter acumen in *H. luridum*) and the areolation of



Figs 1-4. *Hygrohypnum styriacum* (Limpr.) Broth. **1.** Leaf. **2.** Apex of leaf. **3.** Alar cells. **4.** Transverse section of the stem.

the alar region (alar cells poorly differentiated in *H. styriacum* vs alar group quadrate to rectangular, clearly visible and often excavate, made of cells with incrassate walls in *H. luridum*) are the most important. Yet, *Hygrohypnum styriacum* is a rather morphologically plastic species but less than *H. luridum*. The morphological variation mostly affects leaf form, leaf stance and internodes length.

The pseudoparous nature of *Hygrohypnum styriacum* has been commented in depth by various authors (Jamieson, 1976; Corley & Rothero, 1992). In this highly specialized type of reproductive complex, a single male bud is lumped with several perichaetia within common bracts. This could first improve the fecundation efficiency, since it reduces the distance to be travelled by the antherozoids. The reproductive cost would be lowered by such an aggregation of male and female gametangia. The fecundation is likely to be very problematic for

species living in the glacier seeping areas, because they are most probably frozen during a great part of the year. It is likely that the great proximity between male and female gametangia would lead to raise fecundation efficiency even in highly unfavourable climatic conditions. This hypothesis should be verified in the field or under cultivation for a better understanding of its biological significance.

The Pyrenean habitat of *Hygrohypnum styriacum* is similar to those described in the literature. This species is typically linked to seepage channels of snow-bed and glacier in mountainous to alpine environment (Corley & Rothero, 1992; Oliván *et al.*, 2007a). It shows some affinity to neutral, mineralised and sometimes base-enriched water.

Hygrohypnum styriacum is a rare species worldwide. In Europe, it has been listed with the IUCN status R (ECCB, 1995). To date, the Pyrenean locality is unique and, in spite of a rather intensive search, no other locality of the species could be found in the same valley or in other valleys of the Pyrénées-Orientales, where a large number of potential habitats occurs. The small size of the population (less than 5 m²) makes the species highly sensitive to any change, either at a small scale (e.g., disturbance from grazing, tourist pressure) or at a wider scale (e.g., global warming). The species should urgently be the subject of a medium-term monitoring.

Due to the scattered European range, the occurrence in alpine habitats and its apparent inability to colonize new sites, *Hygrohypnum styriacum* might be considered a glacial relict. This status is paralleled by *Dichelyma falcatum* (Casas & Peñuelas, 1985), *Calliargon richardsonii* (Hugonnot, 2011a), *Hypnum sauteri* (Hugonnot, 2011b), which makes the mountain of Eastern Pyrenees a refuge for relict bryophytes.

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