

## **New data on the presence of *Porella pinnata* L. (Porellaceae, Jungermanniales, Hepaticae) in Portugal**

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(Received 3 June 2009, accepted 30 September 2009)

**Abstract** – *Porella pinnata* L. was considered an extinct species in the Portuguese Red List of Bryophytes. However, recent field work and revision of some old material of the Herbarium PO confirmed the presence of this species in different regions of Northern Portugal. The newly found populations represent the first report in more than 80 years, after the ancient gatherings made by A. Luisier and A. Machado in the beginning of the twentieth century.

***Porella pinnata* / conservation / rare species / aquatic habitats / Portugal**

### **INTRODUCTION**

*Porella pinnata* L. is a species having a worldwide distribution. Although reports from some areas have resulted erroneous (Fontinha *et al.*, 2000; Ros *et al.*, 2007), it is a widespread species in Central-Western and Southern Europe (Söderström, 2002, 2007, Ros *et al.*, 2007). In Spain it has been indicated in numerous localities but is mainly restricted to the NW Iberian Peninsula (Allorge, 1935; 1937; Casas de Puig, 1951; Simó & Vigón, 1977; Vigón Arvizu, 1979, 1981; Casas, 1993, 2002; Reinoso Franco & Viera Benítez, 1994). In Portugal, it was first reported by Luisier (1910) in Minho Region and in the same region by Machado (1925). Herbarium material collected by Machado in 1913 in Douro Litoral Province (Santo Tirso) was not included in his publications perhaps because it was studied later. The find of this species in Coura River (Vieira *et al.*, 2005), after more than eighty years since Machado's report, reinstated it in the Portuguese flora, in which it had been considered extinct (Sérgio *et al.*, 1994; Sérgio *et al.*, 2001).

This paper reports recent additional finds of *Porella pinnata* in Portugal. In fact, recent field work and revision of herbarium material yielded several other localities for this species and expanded its known distribution range in the country, including two localities that corresponded to two Portuguese regions, Beira Alta and Trás-os-Montes e Alto Douro, where this species was not known.

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## SPECIMENS STUDIED

### Old material:

**Minho:** Guimarães, nas margens do rio Selho, NF58, 1907, *A. Luisier* (LISU 148055); Guimarães, rio Selho, NF58, 1908, “ad muros juncta rivulum, solum inundata”, *A. Luisier* (LISU 53160); Paredes de Coura, Formariz, rio Coura, 29TNG3440, 08-1923, *A. Machado* (PO 211-B).

**Douro Litoral:** Santo Tirso, Quinta da Palmeira. 29TNF4278, 08-1913, 40m, *A. Machado* (PO 4642-B).

### New material:

**Minho:** Paredes de Coura, Rubiães, Rio Coura (Ponte de Rubiães). 29TNG3038, 130 m, 2-7-2004, *C. Vieira* (PO 6719-CIBIO, LISU 208125); Arcos de Valdevez, Eiras, Ribeira do Padroso (Ponte da Ervideira), 29TNG4343, 240 m, 20-08-2004, *C. Vieira* (PO 7612-CIBIO); Paredes de Coura, Cristelo, Rio Coura, 29TNG3840, 370 m, 30-08-2004, *C. Vieira* (PO 7658-CIBIO); Melgaço, Veigas de Remoães, Rio Minho, 29TNG5962, 30 m, 24-06-2005, *C. Vieira* (PO 9804-CIBIO); Valença, Arão, Outeiro, 29TNG5228, 5 m, 28-06-2005, *C. Vieira* (PO 9913-CIBIO); Tregosa, Ponte do Vale, Rio Neiva, 29TNG2510, 40 m, 07-07-2005, *C. Vieira* (PO 10039-CIBIO).

**Trás-os-Montes:** Valpaços, Santa Valha. Rabaçal, 29TPG4316, 400 m, 27-07-2004, *A. Albuquerque* & *P. Rodríguez-González* (LISU 196187).

**Beira Alta:** Barca D'Alva, Sapinha, 29TPF7341, 316 m, 24-06-2003, *C. Garcia*. (LISU 208227).

## RESULTS AND DISCUSSION

The representative map of *P. pinnata* collections in mainland Portugal (Fig. 1) shows that this species is mainly dispersed in the Eurosiberian area, although extending southwards to Spanish boundary near Douro river.

In Portugal, populations of *P. pinnata* were found restricted to rocks and exposed tree roots at elevations between 5 and 400 m, subject to periodic inundation on the banks of rivers that had moderate water velocity and turbulence. It was most frequently found in clearly well-oxygenated water, usually in the middle and terminal river reaches where the fluvial substratum was still rocky, but where the water had accumulated minerals dissolved from the soil, rocks and leaf litter. It also seemed to prefer shaded conditions created either by hanging vegetation or granite rock crevices, on fresh soil under riparian trees such as *Alnus glutinosa* (L.) Gaertn., *Fraxinus angustifolia* Vahl, *Betula* sp. and *Salix* spp. The bryophyte species most often associated with *P. pinnata* were *Chiloscyphus polyanthos* (L.) Corda, *Fontinalis antipyretica* Hedw. and *F. squamosa* Hedw. var. *dixonii* (Cardot) A.J.E. Smith, *Platyhypnidium lusitanicum* (Schimp.) Ochyra et Bednarek-Ochyra and *Thamnobryum alopecurum* (Hedw.) Gangulee.

*Porella pinnata* can only be found in a small number of localities, in five different river basins. Being a dioecious species, its male inflorescences remain unseen in Europe, and the production of sporophytes has never been observed in Europe (Paton, 1999). Consequently it is very likely that most of the populations are maintained by asexual forms of reproduction (Paton, 1999). Likewise, the Portuguese populations were never found with sporophytes, and this might explained the low dispersion rate of the small number of existing populations.

The disappearance of aquatic and hygrophytic species in water-courses seems to be due to habitat loss directly related to the increase of dams, which cause deep changes in water depth and river canalization. Also, inappropriate management of riparian vegetation causes degradation of the natural functions of the riparian areas where *P. pinnata* populations usually can be found (Cattaneo & Fortin, 2000; Vieira, 2008). This is particularly frequent in Portuguese rivers, since many middle-sized tributary rivers have been extensively altered for the last decades by the construction of dams. Nevertheless, where the substratum conditions of *P. pinnata* microhabitat are still frequent in some margins of Portuguese rivers, the water chemical requirements may not be as suitable as they once were, since many river courses are presently under an increased influence of urban development. Field measures of water chemical conditions support the idea that *P. pinnata* is often submerged in neutral waters with low conductivity and low concentration of nitrogen and phosphorus compounds (Table 1). We presume that regression of *P. pinnata* populations may be more strongly related to these changes in water conditions. Other authors concluded about the negative effects of water pollution with nitrates and phosphates on some bryophyte species through changes in water chemistry and increased turbidity (Wilcove & Chen, 1998; Vanderpoorten & Klein, 2000).

On the other hand, Steinman & Boston (1993) reported a remarkable decline in percentage cover of this species as a result of the erosion caused by a water discharge in a small woodland stream in Tennessee (USA). Nevertheless, *P. pinnata* population's erosion due to water and solid particles impact may not be the most probable disturbance factor since the observed populations seemed to be growing in good conditions along with other species with denudated older parts of stems but branches presenting vigorous growth.

Table 1. Measurement of chemical parameters of water submerging *Porella pinnata* populations in Northern rivercourses (values from Rio Coura, Rubiães, 2-7-2004).

parameter	pH	COND ( $\mu\text{S/cm}$ )	TEMP ( $^{\circ}\text{C}$ )	$\text{PO}_4$ (mg/L)	$\text{NO}_3$ (mg/L)	$\text{NO}_2$ (mg/L)	$\text{NH}_4$ (mg/L)	$\text{SO}_4$ (mg/L)	Cl (mg/L)	Mg (mg/L)	Ca (mg/L)	K (mg/L)
Value	7.8	93.0	19.2	0.1	0.5	0.0	0.2	4.0	5.0	13.9	15.0	0.6

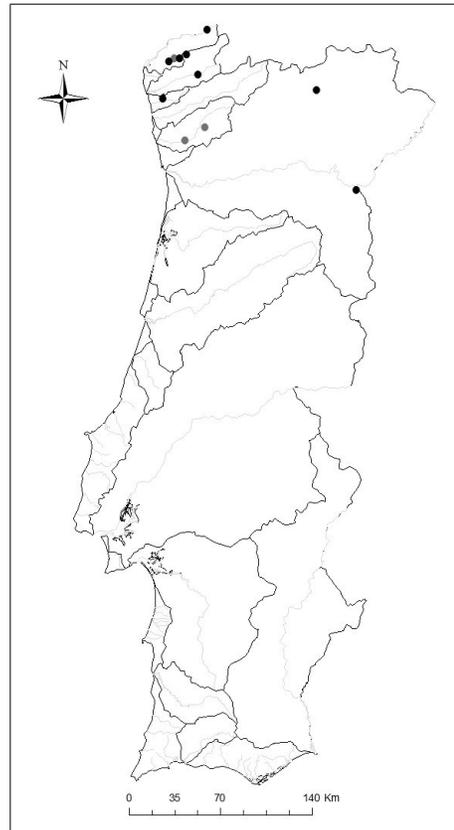


Fig. 1. Portugal map with the hydrographical basin, principal rivers (grey) and known distribution of *Porella pinnata* L. in the country. Gray symbols represent the old references; the black symbols represent the new data.

*Porella pinnata* L. has been considered an Extinct (Ex) species in Portugal, since this liverwort had not been collected for more than eighty years (Sérgio *et al.*, 1994; Sérgio *et al.*, 2001). However with the new data, *Porella pinnata* is now included in the category NT-Near Threatened in Portugal and in the Iberian Peninsula (Sérgio *et al.*, 2007) as a whole.

Currently, *P. pinnata* remains as an uncommon species with a scarce distribution in Portugal, but apparently the number of its populations seems to be underestimated. In the future we intend to continue searching for the species more cautiously, now that its habitat has been satisfactorily recognized. Despite that, in Portugal, the habitat preservation of *P. pinnata* requires management strategies, which would only work efficiently if an adequate knowledge of the species morphology, distribution patterns, and ecological and reproductive requirements becomes available.

**Acknowledgements.** This study was supported by FCT - SFRH/BD/2949/2000 and SFRH/BD/6969/2001, as well as the project PNAT/1999/BIA/15053. We thank António Albuquerque and Patricia Rodríguez-González for collecting additional material as part of the inventories for the elaboration of communitarian action in the domain of the water policies in Portugal.

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