

## THE BRYOPHYTE FLORA OF THE VOUGA REGION (AVEIRO, BEIRA LITORAL)

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A list of 298 bryophytes (216 mosses and 82 hepatics including hornworts) from the Aveiro District (Beira Litoral) is presented. Thirty eight *taxa* are new records for this province.

For each one, a brief ecological characterization and distribution in the region are given (UTM system). The presence of *Andreaea heinemannii* Hampe & Müll. Hal. subsp. *crassifolia* (Luisier) Sérgio, *Hypnum uncinulatum* Jur., *H. imponens* Hedw., *Gyroweisia reflexa* (Brid.) Schimp., *Micromitrium tenerum* (Bruch & Schimp.) Crosby, *Pseudotaxiphyllum laetevirens* (Dixon & Luisier ex F. Koppe & Düll) Hedenäs, *Sphagnum molle* Sull. *Thamnobryum maderense* (Kindb.) Hedenäs, *Anthoceros agrestis* Paton and *Cryptothallus mirabilis* Malmb. are highlighted.

Key words: Mosses, hepatics, Beira Litoral, Iberian Peninsula.

Sérgio, C. & Silva, I. (2007). Flora briofítica da região do Vouga (Aveiro, Beira Litoral). *Portugaliae Acta Biol.* **22**: 159-188.

É apresentada uma lista de 298 briófitos (216 musgos e 82 hepáticas, incluindo antocerotas) da região do Vouga (Aveiro, Beira Litoral). 38 *taxa* são novas referências para esta província.

São dadas, para cada espécie, uma breve caracterização ecológica e distribuição naquela região (sistema UTM). Destacamos a presença de *Andreaea heinemannii* Hampe & Müll. Hal. subsp. *crassifolia* (Luisier) Sérgio, *Hypnum*

*uncinulatum* Jur., *H. imponens* Hedw., *Gyroweisia reflexa* (Brid.) Schimp., *Micromitrium tenerum* (Bruch & Schimp.) Crosby, *Pseudotaxiphillum laetevirens* (Dixon & Luisier ex F. Koppe & Düll) Hedenäs, *Sphagnum molle* Sull. *Thamnobryum maderense* (Kindb.) Hedenäs, *Anthoceros agrestis* Paton e *Cryptothallus mirabilis* Malmb.

Palavras chave: Musgos, hepáticas, Beira Litoral, Península Ibérica.

## INTRODUCTION

The ecological importance of bryophytes, including their role in succession, production of phytomass and nutrient cycling is repeatedly reported. They may also serve as potential indicators of environmental changes before the habitat or the ecosystem itself is affected due to its close relationship with climatic features or particular microhabitats. On the other hand, the knowledge of hotspots for bryophytes can be important for the general biodiversity diagnosis in Portugal (SÉRGIO *et al.*, 2000). Therefore, a first study based on predictive tools for the functional classification of Portuguese bryophytes diversity was presented by SÉRGIO & DRAPER (2002). In that work, the reported bryophyte biodiversity in the studied area, Aveiro District, varies from 2 to 200 species and with the present study we have set up more ca 100 *taxa* in only one UTM square (10x10 km). In fact, the distribution and the ecology of bryophytes in Portugal is far from completely known, particularly in some regions, namely in the region of Vale do Vouga.

The present study was based on material available at LISU herbarium which was retrieved from the Vouga River area, although field sampling was not carried out with a systematic method. A first approach is therefore presented about the sites with the highest diversity, as well as the important species for conservation purposes. As a final result, an updated list of the species found or referred for the area is provided.

However, given the lack of information on the bryoflora of the region and the amount of material available at LISU, we think that this work may be important to increase knowledge on biodiversity and chorology in Portugal. Furthermore, these data allow the updating of the threat status of species recently presented in the Red List for the Iberian Peninsula (SÉRGIO *et al.* 2006).

## STUDY AREA

The study area corresponds to the Aveiro district (Beira Litoral), covering a large coastal strip between a continental mountain range and the ocean, in the centre of Portugal. It presents landscapes heterogeneity and a strong Atlantic influence, as it is typical for this northeast region of the country.

The Aveiro district covers an area of about 3000 km<sup>2</sup> and includes 19 municipalities. The corresponding geographic position in UTM coordinates may be seen in figure 1.

The Aveiro district has a special geology, that include two different units. As shown in figure 2, they correspond to the West Sedimentary Border, a coastal border primarily consisting of sedimentary rocks, and to an inner zone of plutonic eruptive rocks, belonging to the structural unit called Ancient Iberian Massif and formed by the Schist-Greywacke Complex. A strip of sedimentary and metamorphic rocks marks the transition between the two units (NEVES *et al.* 1989; BRUM FERREIRA 1981; MENEZES *et al.*, 2003).

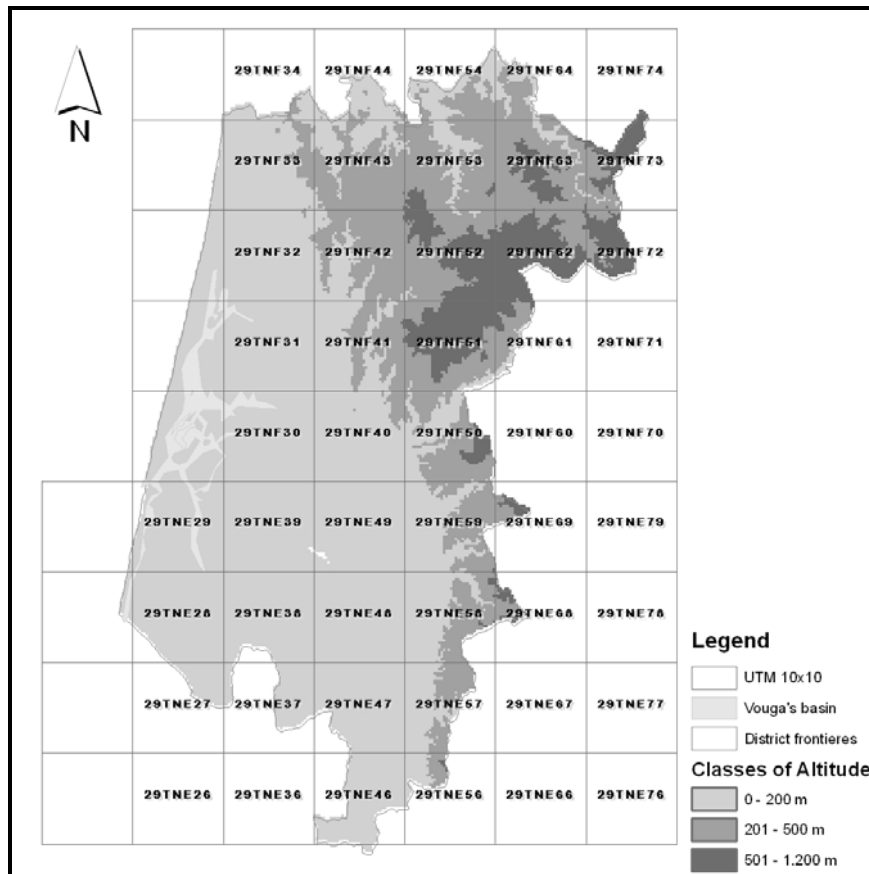


Figure 1 – Location of Aveiro District area with grid squares (UTM 10x10 Km). Tree altitudinal range, from 0-200 m, 201-500 and 501-1200. Based on Atlas do Ambiente Digital – Instituto do Ambiente, Portugal.

The boundaries of the Aveiro district closely coincide with the river Vouga basin, except for the river source. According to MARQUES DA SILVA (1990), the Vouga basin (40° 15' N - 40° 57' N, 7° 33' W - 8° 48' W) is a wide hydrological complex of tributary rivers and streams running to a lagoon which communicates with the ocean, the Aveiro lagoon (Ria de Aveiro). The most important tributaries are, to the right, the rivers Mel, Sul, Teixeira, Mau and Caima, and to the left the rivers Marnel and Águeda, being also the sub-affluents Alfusqueira and Cértima worth mentioning.

Before the confluence with the Caima river, the Vouga basin presents rough areas, with narrow and steep valleys. The hydrography of the Vouga river determines the altitudinal heterogeneity of the study area – on the north by the mountain ranges of Leomil, Montemuro and Lapa (Pico do Facho, 953m), Arada (Pico do Chão, 1120m) and Freita (1101m), and on the south by the borders of the mountain ranges of Caramulo (Pico do Caramulinho, 1074m) and Buçaco (548m) (MARQUES DA SILVA, 1990).

As shown in figure 1, the coastal strip, that corresponds to half of the district, has an average altitude below 200m. Inland, the altitudes may be over 1000m, at the Freita and Arada mountain ranges.

The climate has a strong Atlantic influence, as it is typical of this northeast region of the country (RIBEIRO *et al.*, 1988). According to AMORIM GIRÃO (1922), because the Vouga basin comprises 3 climatic regions – inner upland region, mountainous midland, and west flat region, open to the sea – it displays some climatic variety, which is nevertheless regulated by the proximity of the Atlantic Ocean. The most important climatic elements are the high humidity levels, and the small temperature amplitudes, both diurnal and annual, as well as the frequency of the predominant north and northwest winds (NEVES *et al.*, 1989).

All the region is characterized by an annual average temperature below 15°C, with a moderate summer temperature (below 20°C) and small annual amplitude (less than 12°C) (RIBEIRO *et al.*, 1988; NEVES *et al.*, 1989). Average annual rainfall is higher than 1000mm (Fig. 3) and local precipitation varies from 900mm, south of the Aveiro lagoon mouth, to 2500mm in the highest point (Serra da Freita).

Taking all the climatic and geomorphologic variables into account, and according to the biogeographic classification of the Iberian Peninsula by RIVAS-MARTÍNEZ (1984; 1990), Beira Litoral is integrated in the Eurosiberian Region and, more specifically, the Cantabro-Atlantic Sub-Province, Galaico-Portuguese Sector.

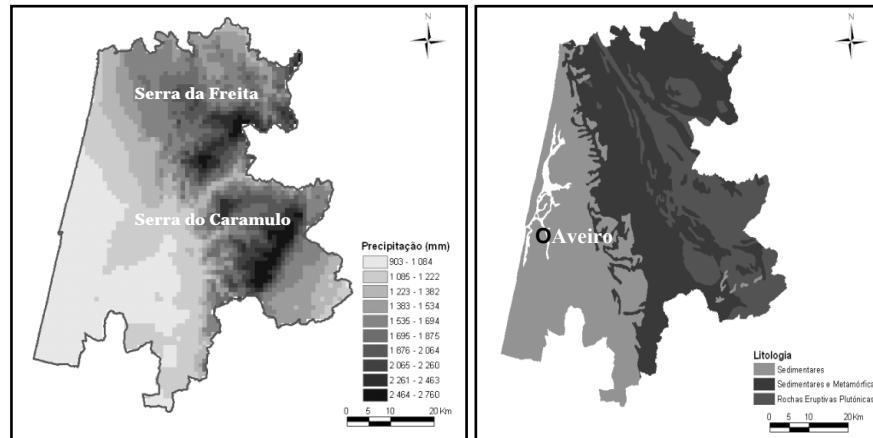


Figure 2-3 – 2. Map of soils of the Aveiro district and areas bordering the Caramulo range  
 3. Rainfall in the Aveiro district and areas bordering the Caramulo range (adapted from Atlas do Ambiente, in MENEZES *et al.*, 2003).

#### METHODOLOGY

This work is based on the analysis of material retrieved by different collectors from the Aveiro district between 1972 and 2006, and included in the herbarium of the Museu Nacional de História Natural, Jardim Botânico (LISU). The retrieval did not follow specific procedures, and the present study is not intended to provide a survey of the bryoflora of that region.

A list of the reported and studied *taxa* from Aveiro District is presented in alphabetic order, first the mosses then the hepatics. The organization and abbreviations used are explained in Annexe 1.

The taxonomy and nomenclature for hepatics (liverworts and hornworts) generally follows GROLLE & LONG (2000). The criteria of European moss lists (HILL *et al.*, 2006) are mostly followed for mosses. As basis for the country distribution we use the catalogue of SÉRGIO & CARVALHO (2003). *Taxa* not observed but reported to the region are also listed, printed in plain instead of bold format.

For the threat status information we used the IUCN Red List criteria (IUCN 2001, 2005), with the adaptations for to the Iberian Peninsula suggested by SÉRGIO *et al.*, (2006): Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Near Threatened (NT). Two new subcategories are established, one included in DD (Data Deficient) designated as DD-n (Data deficient-new), in the case of new species to the Iberian Peninsula which are generally poorly known or insufficiently investigated to be evaluated; the second new subcategory, the Attention category (Att) is included when the *taxon* is regarded as not threatened (LC) but may be endemic to the Iberian region, with particular phytogeographic importance, or threatened in Europe. Whenever

possible, notes are provided on the habitat occupied by each species in the Aveiro district. Based on altitudinal and geographical position of each specimen, the variation of altitude of each *taxon* is specified according to 3 classes (0-200; 201-500 and 501-1100 m). Distribution information is presented based on a UTM grid (10x10 km), indicating where the species have been found and the number of localities or specimens studied. Finally, two classes of collection periods are presented:  $\leq 1974$  and  $\geq 1975$ .

The different chorological types follow in generally DÜLL (1983, 1984 and 1985), however were grouped into eight main categories for statistical and graphical reasons. **a+ss** – arctic-alpine; subarctic-subalpine (subarctic-alpine, dealpine, subarctic); **so** – suboceanic; **b** – boreal (subboreal, subcosmopolite-boreal, subcosmopolite-subboreal); **oc** – oceanic (euoceanic, oceanic-subtemperate, oceanic-subalpine); **om+mo** – oceanic-mediterranean (suboceanic-mediterranean, suboceanic-submediterranean); **m+sm** – mediterranean; submediterranean-suboceanic; submediterranean; **t** – temperate (temperate-subalpine); **c+sc** – continental and subcosmopolite elements.

Most of the material studied is in the herbarium of LISU and some in COI collection, and corresponds approximately to 1500 specimens.

## RESULTS AND CONCLUSION

Studies on bryodiversity are quite important as useful tools for a more extensive evaluation of the ecological and climatic conditions of our country, and serve as basis for conservation and ecological impact studies.

The list presented in Annexe 1, aims at updating the bryoflora of the Aveiro district. In this work, 298 species – 82 hepatics and 216 mosses – have been recorded (Fig. 5).

It is worth noting that 23 of these species are included in the Red List (SÉRGIO *et al.*, 2006), one being classified as Regionally Extinct (RE), *Anthoceros agrestis* Paton; one Critically Endangered (CR), *Fossombronia foveolata* Lindb.; 2 as Endangered (EN), *Hypnum uncinulatum* Jur. and *Hypnum imponens* Hedw.; 3 as Vulnerable (VU), *Riccia huebeneriana* Lindenb., *Sphagnum molle* Sull., *Ditrichum cylindricum* (Hedw.) Grout and *Isothecium algarvicum* W. E. Nicholson & Dixon; 3 as Near Threatened (NT), *Scapania subalpina* (Nees ex Lindenb.) Dumort., *Kurzia pauciflora* (Dicks.) Grolle and *Riccia subbifurca* Warnst. ex Cruz.; 4 as Data deficient (DD), *Cephaloziella rubella* (Nees) Warnst., *Cephalozia connivens* (Dicks.) Lindb., *Gyroweisia reflexa* (Brid.) Schimp. and *Brachythecium campestre* (Müll. Hal.) Schimp.; 4 as Data deficient-new (DD-n), *Cryptothallus mirabilis* Malmb., *Micromitrium tenerum* (Bruch & Schimp.) Crosby, *Pseudotaxiphyllum laetevirens* (Dixon & Luisier ex F. Koppe & Düll) Hedenäs and *Thamnobryum maderense* (Kindb.) Hedenäs; and, finally, 3 as Attention category (Att), *Marsupella profunda* Lindb., *Campylostelium strictum* Solms, *Ephemerum minutissimum* Lindb. and *Andreaea heinemannii* Hampe & Müll. Hal. subsp. *crassifolia* (Luisier) Sérgio.

Among the listed species, 17 were not sampled and correspond only to bibliographic data, such as *Hypnum imponens* Hedw., *Sphagnum molle* Sull., *Scapania subalpina* (Nees ex Lindenb.) Dumort., and *Cephalozia connivens* (Dicks.) Lindb. On the other hand, it is important to mention that for 12 species the only data available are from publications of samplings performed before 1974, and no further reports exist for the region. These data are essential for the evaluation of species decline.

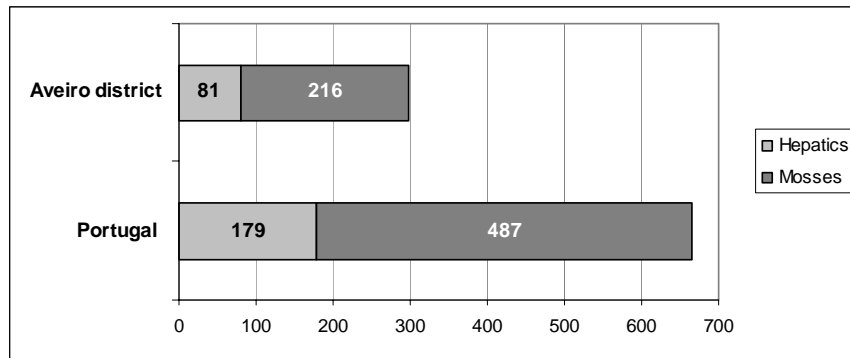


Figure 4 – Total number of mosses and hepatics in the studied area, as compared to the values published in the Iberian Peninsula Red List for Portugal (SÉRGIO *et al.*, 2006).

The study area corresponds to the first localities of *Micromitrium tenerum* (Bruch & Schimp.) Crosby, *Pseudotaxiphyllum laetevirens* (F. Koppe & Düll) Hedenäs and *Cryptothallus mirabilis* Malmb., species reported for Portugal after 1994.

Thirty-eighth new *taxa* are indicated for Beira Litoral, quite relevant information contributing to the update and to the enlargement of the distribution area known for many species in this country. Among such species, *Pseudotaxiphyllum laetevirens* (F. Koppe & Düll) Hedenäs should be highlighted, as it was only known in Madeira and Azores and, recently, in the south of the Iberian Peninsula (GUERRA *et al.*, 2001). Another species, *Micromitrium tenerum* (Bruch & Schimp.), Crosby is considered important in European conservation policy and is also included in a conservation plan in the United Kingdom (CHURCH, 2001). In the same situation are *Gyroweisia reflexa* (Brid.) Schimp and *Pallavicinia lyellii* (Hook.) Carruth. The latter species is clearly declining in England, possibly as a consequence of drainage of watercourses (CHURCH, 2001 and <http://home.clara.net/adhale/bryos/eurordb.htm>).

In view of the New Red List of the Iberian Peninsula (SÉRGIO *et al.*, 2006), the species presented in Annexe 1 correspond to about 27% of the total number of species in the Iberian Peninsula, and about 45% of the species in Portugal (Fig. 4), which indicates that the bryoflora of the region is quite rich, especially when

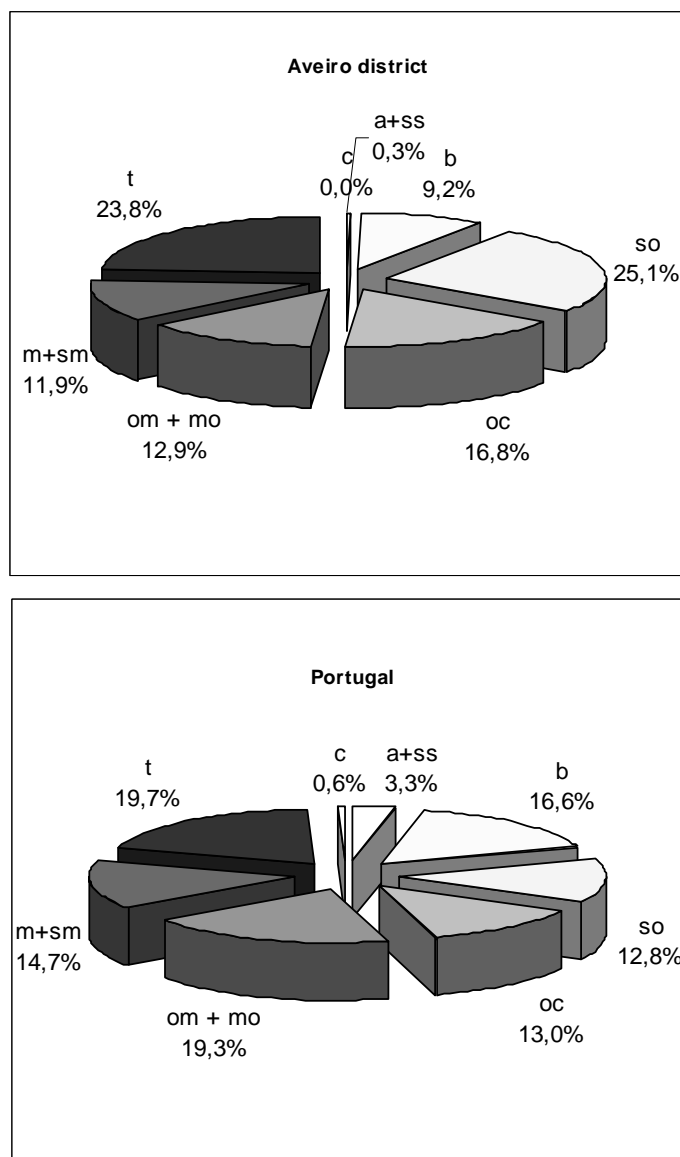


Figure 5 – Percentage of different chorological types of bryophytes (mosses and hepatics) in the studied area in Portugal. **a+ss** – arctic-alpine with ubarctic-subalpine; **so** – suboceanic; **b** – boreal; **oc** – oceanic; **om+mo** – oceanic-mediterranean; **m+sm** – mediterranean; and submediterranean; **t** – temperate; **c+sc** – continental and subcosmopolite elements.



considering that it corresponds just to a 3000 km<sup>2</sup> area. However, when compared to the surface of the Serra da Estrela Natural Park, which is about one third of the Aveiro district area, these values are less impressive. This is natural because Serra da Estrela is the region with the highest specific richness in Portugal, with about 500 bryophyte *taxa* (GARCIA *et al.*, 2007).

According to the results displayed in figure 5, when comparing the phytogeographic data of the Iberian Peninsula with those of Portugal and of the Aveiro district we observe a more significant presence of elements with Oceanic or Suboceanic characteristics than in the rest of the Peninsula, and a greater heterogeneity among classes. This is explained by the predominance of the Mediterranean climate in the Peninsula as a whole. These data are in agreement with those presented by SÉRGIO & DRAPER (2001) who showed that the Oceanic influence in the Peninsula ends close to the limits of the Aveiro district. There are no elements with Alpine or Subarctic-subalpine trends, as a result of geomorphologic restrictions, namely the low altitude of the mountain ranges in the inner and northern parts of the district, as well as no elements of the Continental and Sub-cosmopolite classes.

The results of biodiversity through georeferencing information, supported by species richness on UTM grid basis, of all the surveyed species are presented in figure 6. However, and as mentioned before, there was not a standard sampling methodology, which prevents from obtaining an effective floristic richness pattern of the region as a whole. Nevertheless, the highest numbers of *taxa* were found in Pateira de Fermentelos (UTM NE48, NE49.), an alluvionar region, and in the Vouga valley (Fig. 6), with 40 to 80 *taxa*, some of them red-listed (SÉRGIO *et al.*, 2006). The species richness (hot-spots) indicated in figure 6 seems to be positively correlated with more forested areas and higher altitude, as in Sever do Vouga (UTM NF50) with 80 to 170 *taxa*, also Serra da Freita (UTM NF52, NF62) and Serra do Arestal (UTM NF51). However, the vicinities of Águeda (UTM NE58, NE59) and Vagos (UTM NE28, NE29) also correspond to very important areas. These areas, located in the final part of the Vouga River, have a Holocenic origin and a strong oceanic influence. In this lagoon-derived region, some interesting and very rare plants in Portugal are found: species of *Sphagnum* communities like *Fossombronia foveolata* Lindb., *Riccardia chamaedryfolia* (With.) Grolle, *Kurzia pauciflora* (Dicks.) Grolle, *Amblystegium serpens* (Hedw.) Schimp., *Sphagnum molle* Sull., *Sphagnum compactum* Lam. & DC., *Sphagnum subnitens* Russow & Warnst. (Fig. 6C), *Aneura pinguis* (L.) Dumort., *Calypogeia sphagnicola* (Arnell & J. Perss.) Warnst. & Loeske.) Crosby, *Cephalozia connivens* (Dicks.) Lindb. and *Cephalozia lunulifolia* (Dumort.) Dumort. Also in the drawdown zone of this large pond, on alluvionar mud some others interesting bryophytes are present such as *Micromitrium tenerum* (Bruch & Schimp, *Riccia huebeneriana* Lindenb., *Pseudephemerum nitidum* (Hedw.) Reim. and *Entosthodon fascicularis* (Hedw.) Müll. Hal.

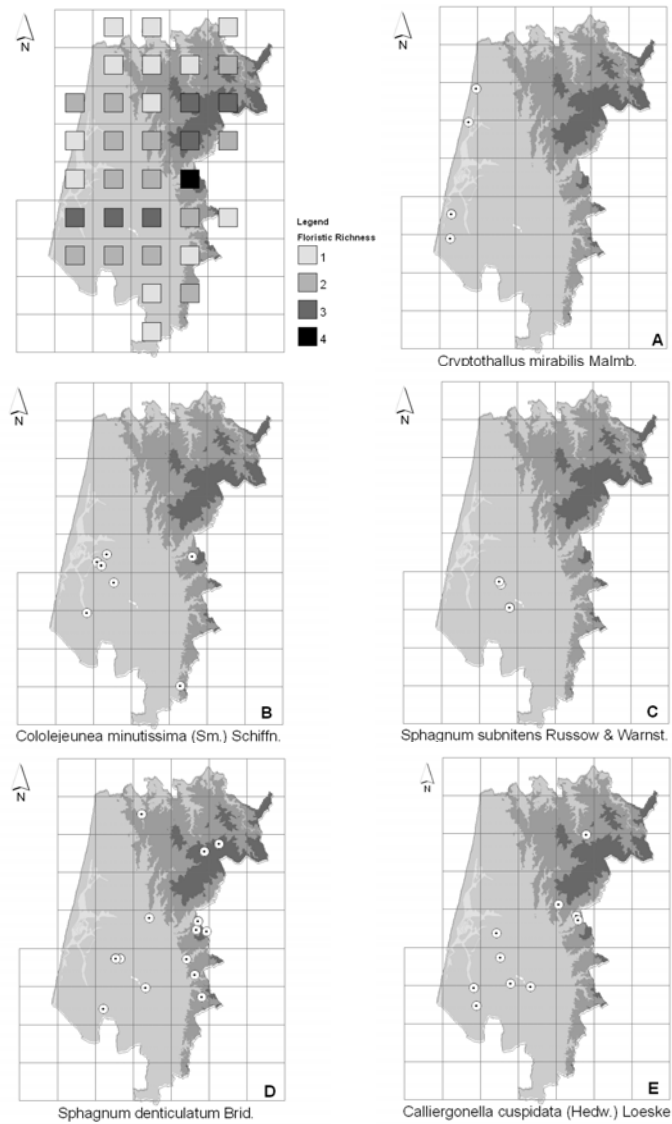


Figure 6 – Species classes diversity according in each grid-square (UTM 10x10 km) studied, 1-1-9 species; 2-10-39 species; 3-40-79 species; 4-80-170 species. A-E- Distribution patterns in Aveiro District of 5 species.

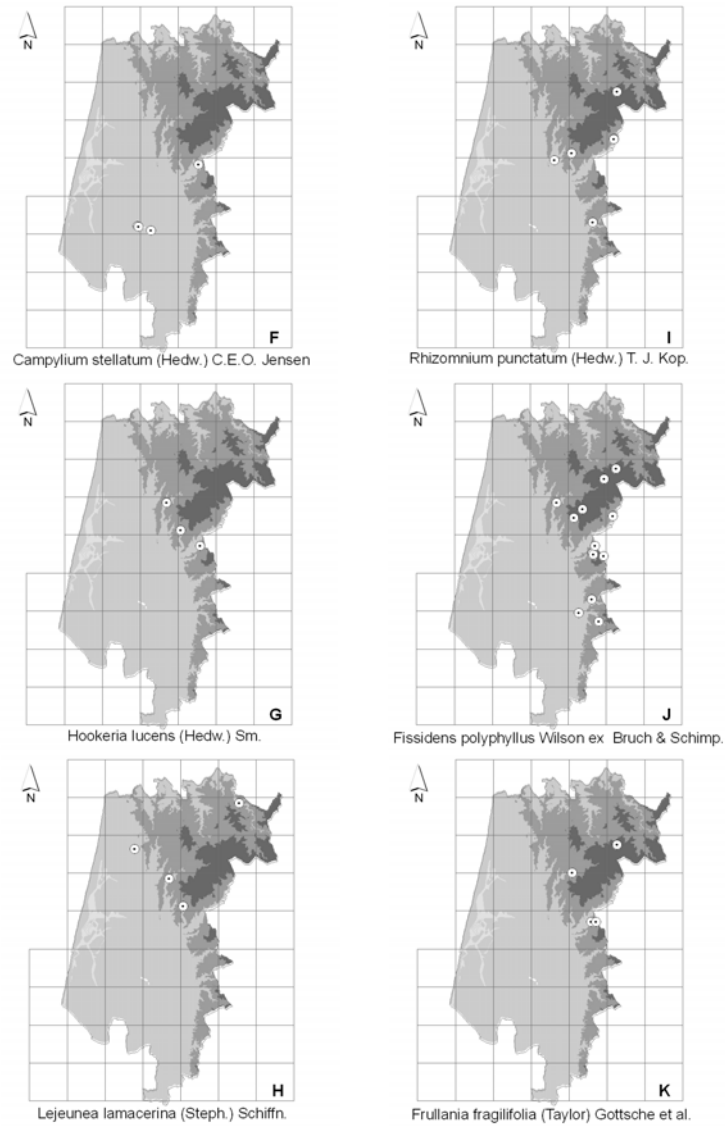


Figure 7 – F-K- Distribution patterns in Aveiro District of 6 species.

The discovery of *Cryptothallus mirabilis* Malmb. in Portugal (SÉRGIO & SÉNECA 1997, SÉRGIO *et al.*, 2005) in the Aveiro region corresponds to the first reliable record of the species in southern Europe, and represents an important extension of the geographic range of this liverwort. The majority of

localities in Portugal are in littoral zones of the final section of the Vouga River, at low altitude (Fig. 6A) and generally in *Pinus pinaster* Aiton plantations.

It is worth highlighting the phytogeographic interest of some of the species recorded for Madeira and Macaronesia which appear in this Portuguese region, due to favourable climatic conditions. Such is the case of *Lejeunea lamacerina* (Steph.) Schiffn., *Saccogyna viticulosa* (L.) Dumort., *Hypnum uncinulatum* Jur. and *Hookeria lucens* (Hedw.) Sm. (Fig. 7G) which are considered relicts, because of their distribution (SÉRGIO, 1989). Further species worth mentioning are *Fissidens polyphyllus* Wilson ex Bruch & Schimp. (Fig. 7J) and *Cololejeunea minutissima* (Sm.) Schiffn. (Fig. 6B), which also reflect the oceanic trends of the region.

It should also be noted that all these species were reported based on irregular studies. In fact, it cannot be said that the bryoflora of the region is completely known. The whole region needs to be further investigated.

The strong industrialization of the region, together with the increased industrial and urban areas, are cause of concern for conservation actions of certain areas and vulnerable habitats such as Pateira de Fermentelos and the final section of the Vouga valley, where water and air pollution may become threatening agents for many species. However, and as mentioned, it was possible to find a significant number of new *taxa* and species not previously reported for the region. On the other hand, new localities were identified for many species classified as vulnerable or threatened in the New Iberian Peninsula Red List (SÉRGIO *et al.*, 2006).

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**Annexe 1**

<b><i>Taxon in bold</i></b>	<i>Taxon</i> confirmed by herbarium material.
<i>Taxon not in bold</i>	<i>Taxon</i> not confirmed by herbarium material in this study.
●●	First report or first locality/localities to Portugal.
●	New species to Beira Litoral.
◦	Report based only in material collected before 1974
**	Endemic species in Iberian Peninsula.
[ ]	Date in bibliographic references.
CR, EN, VU, NT, DD, Att	IUCN criteria based in the Red List of Iberian Bryophytes, SÉRGIO <i>et al.</i> , <i>in press</i> )
(n°)	Number of localities or locations (specimens)
Classes of collection dates	≤ 1974 – □ ; ≥ 1975 – ■

**Mosses**

- Amblystegium serpens* (Hedw.) Schimp. - Very wet banks; 0-200 m; **NE39**; (1); ■.
- \*\* Att *Andreaea heinemannii* Hampe & Müll.Hal. subsp. *crassifolia* (Luisier) Sérgio - Exposed and humid granite rocks; 201-500 m; **NF51**; (1); ■.
- Andreaea megistospora* B. M. Murray - Exposed and humid granite rocks; 501-1100 m; **NF62**; (1); ■.
- Andreaea rothii* F. Weber & D. Mohr subsp. *falcata* (Schimp.) Lindb. - Exposed granite rocks, vertical rocks; 501-1100 m; **NF51**, **NF52**, **NF62**; (4); □ ■.
- Andreaea rothii* F. Weber & D. Mohr subsp. *rothii* F. Weber & D. Mohr - Exposed and humid rocks, rarely on soil; 201-1100 m; **NF52**, **NF62**, **NF63**; (7); ■.
- Anomobryum julaceum* (Schrad. ex P.Gaertn. et al.) Schimp. var. *julaceum* - Man-made rocky banks, walls; 201-500 m; **NF50**; (1); ■.
- Atrichum angustatum* (Brid.) Bruch & Schimp. - Wet soil, rocky banks; 201-500 m; **NF43**, **NF44**, **NF50**; (4); □ ■.
- Atrichum angustatum* (Brid.) Bruch & Schimp. var. *rhystophyllum* (Müll.Hal.) P.W. Richards & E.C. Wallace - Wet soil banks; 0-200 m; **NE49**; (1); ■.
- Atrichum undulatum* (Hedw.) P. Beauv. - Humid and wet rocky banks, rarely on soil; 0-1100 m; **NE58**, **NE59**, **NF41**, **NF51**, **NF61**, **NF62**, **NF63**; (9); ■.
- Aulacomnium palustre* (Hedw.) Schwägr. - **NE46**. [CASAS *et al.*, 1989].

Species known only in one locality in Beira Litoral (Pampilhosa, Ervideira, 1915).

*Barbula convoluta* Hedw. - NE39. [SÉRGIO, C. 1969].

*Bartramia pomiformis* Hedw. - Soil, rocky banks and rock fissure; 0-1100 m; NE49, NF50, NF61, NF62; (5); □ ■.

• *Brachythecium albicans* (Hedw.) Schimp. - Permanently wet soils; 0-200 m; NF20; (1); ■.

• <sup>DD</sup> *Brachythecium campestre* (Müll.Hal.) Schimp. - Rocky banks; 0-200 m; NF52, NF61; (2); ■.

• *Brachythecium glareosum* (Bruch ex Spruce) Schimp. - Rocky banks in water; 201-500 m; NF51; (1); ■.

• *Brachythecium plumosum* (Hedw.) Schimp. (*Sciuro-hypnum plumosum* (Hedw.) Ignatov & Huttunen) - Humid rocks in banks; 201-500 m; NF50, NF52; (2); ■.

• *Brachythecium rivulare* Schimp. - Dripping rocks, humid soil in river bank; 0-500 m; NE59, NF50, NF51, NF52, NF53; (5); ■.

*Brachythecium rutabulum* (Hedw.) Schimp. - Shaded rocks in humid soil in river banks; 0-500 m; NE29, NE39, NF21, NF22, NF50, NF63, NF64; (7); ■.

*Brachythecium velutinum* (Hedw.) Schimp. (*Brachytheciastrum velutinum* (Hedw.) Ignatov & Huttunen) - Tree trunks and shaded banks; 0-500 m; NE29, NE39, NF20, NF30, NF50; (6); ■.

*Bryum alpinum* Huds. ex With. - Exposed wet rocks in banks, moist soil in rock crevices; 0-1100 m; NF31, NF50, NF52; (7); ■.

*Bryum argenteum* Hedw. - Granite and soil, on man-made substrata; 0-500 m; NF30, NF50; (4); ■.

*Bryum canariense* Brid. var. *provinciale* (H. Philib.) Husn. - Granite and soil, on Pinus plantation; 0-200 m; NF31; (1); ■.

*Bryum capillare* Hedw. - Rocky banks, soil and walls, tree trunks; 0-500 m; NE29, NE39, NE48, NE49, NF30, NF31, NF40, NF50, NF51; (26); ■.

*Bryum dichotomum* Hedw. - Soil, banks and tree trunks; 0-200 m; NE39, NE49, NF50; (4); ■.

*Bryum donianum* Grev. - Rocky banks, soil; 0-500 m; NF50, NF63; (3); □ ■.

• *Bryum elegans* Nees - Rocky banks, walls; 0-200 m; NF50; (1); ■.

*Bryum gemmiferum* R. Wilczek & Demaret - Exposed rocks and soil in banks; 0-200 m; NE49; (1); ■.

• *Bryum platyloma* Schwägr. - Rocky banks, walls; 201-500 m; NF50; (2); ■.

According to recent taxonomic criteria, this species was included in *Bryum capillare* Hedw. (HILL *et al.*, 2006) but we regard it as a distinct *taxa*.

*Bryum pseudotriquetrum* (Hedw.) P.Gaertn. *et al.* - Humid soil banks and wet crevices; 0-1100 m; NE39, NE48, NF40, NF50, NF51, NF52, NF61; (9); ■.

*Bryum radiculosum* Brid. - Soil, walls and man-made substrata; 0-200 m; NE28, NE29; (3); ■.



- Bryum rubens* Mitt. - Soil and exposed banks; 0-500 m; **NE29, NF50**; (3); ■.
- *Bryum subapiculatum* Hampe - Soil and man-made substrata; 0-200 m; **NE46, NF31**; (2); □ ■.
- It is the second report to Portugal. This species is only known in Serra da Estrela.
- Bryum torquescens* Bruch & Schimp. - Rocky banks, soil; 201-500 m; **NF50**; (1); ■.
- Calliergonella cuspidata* (Hedw.) Loeske - Humid soil banks and wet crevices; 0-500 m; **NE28, NE39, NE48, NF30, NF50, NF51, NF52**; (10); □ ■.
- Campylium stellatum* (Hedw.) Lange & C.E.O. Jensen - Humid soil banks in wet grasslands; 0-500 m; **NE39, NE49, NF50**; (4); □ ■.
- To this moment Pateira de Fermentelos is the only locality of the species in Portugal.
- Campylopus brevipilus* Bruch & Schimp. - Humid rock crevices; 0-1100 m; **NE38, NE39, NF50, NF52, NF63**; (8); ■.
- Campylopus flexuosus* (Hedw.) Brid. - Humid rock crevices mainly in *Pinus* plantation; 0-500 m; **NE29, NE39, NE49, NE57, NF21, NF22, NF31, NF50, NF64**; (23); □ ■.
- Campylopus fragilis* (Brid.) Bruch & Schimp. - Humid soil banks in roadsides; 0-500 m; **NF30, NF50**; (4); ■.
- Campylopus introflexus* (Hedw.) Brid. - Humid soil banks, *Pinus* plantations; 0-500 m; **NE28, NE29, NE39, NE47, NE48, NE49, NF22, NF31, NF40, NF50, NF51, NF62**; (22); ■.
- Campylopus pilifer* Brid. - Rocks, banks in roadsides, soil in *Pinus* plantations; 0-1100 m; **NE28, NE29, NE38, NE39, NE48, NF20, NF22, NF30, NF31, NF32, NF40, NF50, NF52, NF53, NF61, NF62, NF63**; (39); □ ■.
- *Campylopus pyriformis* (Schultz) Brid. - Tree stumps and woods; 0-1100 m; **NE48, NF40, NF50, NF62**; (9); ■.
- <sup>Att</sup> *Campylostelium strictum* Solms - Rocky banks and exposed crevices; 201-500 m; **NF50, NF51**; (3); ■.
- Ceratodon purpureus* (Hedw.) Brid. subsp. *purpureus* - Soil of grasslands and soil banks; 0-1100 m; **NF20, NF31, NF50, NF62**; (5); ■.
- Cirriphyllum crassinervium* (Taylor) Loeske & M. Fleisch. - Walls and soil banks; 201-500 m; **NF50**; (1); ■.
- Claopodium whippleanum* (Sull.) Renaud & Cardot - **NE57**. [ALLORGE, 1931].
- Species known only in one locality in Aveiro region (Mealhada, gathered by P. Allorge).
- Cryphaea heteromalla* (Hedw.) D. Mohr - Tree trunks and branches; 0-200 m; **NE29, NE39, NE49, NE57, NF30**; (12); □ ■.
- Cynodontium bruntonii* (Sm.) Bruch & Schimp. - Rocky banks and crevices, walls and soil; 201-1100 m; **NF50, NF62**; (4); ■.
- Dialytrichia mucronata* (Brid.) Broth. - Rocky banks and exposed walls; 0-500 m; **NE28, NE29, NE39, NE49, NF30, NF50**; (9); ■.

- Dialytrichia mucronata* (Brid.) Broth. var *fragilifolia* Bizot & J. Roux - Tree trunks, rarely on rocks; 0-200 m; **NE28**; (1); ■.
- Dicranella heteromalla* (Hedw.) Schimp. - Granitic blocks, soil in banks by rivers; 0-1100 m; **NF40, NF41, NF44, NF50, NF62**; (9); □ ■.
- Dicranella howei* Renauld & Cardot - Soil in exposed banks by rivers; 0-500 m; **NE28, NE29, NE49, NF50, NF64**; (5); ■.
- Dicranoweisia cirrata* (Hedw.) Lindb. - Tree trunks, rarely on rocks; 0-500 m; **NE39, NE57, NF20, NF31, NF40, NF50**; (9); ■.
- Dicranum crassifolium* Sérgio, Ochyra & Sénéca - Rock crevices, on soil with much humus; 0-1100 m; **NE39, NF50, NF52, NF62**; (6); □ ■.
- Dicranum scoparium* Hedw. - Soil and rock crevices, banks and tree trunks; 0-1100 m; **NE28, NE29, NE38, NE39, NE48, NE49, NE59, NF21, NF22, NF50, NF51, NF61, NF62**; (28); □ ■.
- Didymodon insulanus* (De Not.) M. O. Hill - Humid rocks and stone walls, or on man-made substrata; 0-500 m; **NE49, NF50**; (4); ■.
- Didymodon luridus* Hornsch. - Soil between paving-stones, or on man-made substrata; 201-500 m; **NE57**; (1); ■.
- Didymodon vinealis* (Brid.) R. H. Zander - Walls on man-made substrata; 201-500 m; **NF50**; (1); ■.
- Diphyscium foliosum* (Hedw.) D. Mohr - Soil, entrances to caves, in humid shaded rock banks; 0-1100 m; **NF50, NF51, NF52, NF62**; (11); □ ■.
- <sup>VU</sup> *Ditrichum cylindricum* (Hedw.) Grout (*Trichodon cylindricus* (Hedw.) Schimp.) - Wet banks; 201-500 m; **NF50**; (1); ■.
- Ditrichum subulatum* Hampe - Humid soil banks in roadsides; 0-500 m; **NE49, NF50, NF51**; (4); □ ■.
- Entosthodon attenuatus* (Dicks.) Bryhn - Soil banks; 201-500 m; **NF50, NF64**; (4); ■.
- Entosthodon fascicularis* (Hedw.) Müll.Hal. - Soil banks on roadsides; 0-200 m; **NE49**; (3); ■.
- Entosthodon obtusus* (Hedw.) Lindb. - Soil banks on stream sides; 201-1100 m; **NF50, NF52**; (2); ■.
- ° *Entosthodon pulchellus* (H. Philib.) Brugués - Soil banks on roadsides; 0-200 m; **NF42**; (1); □.
- *Ephemerum minutissimum* Lindb. - Bare ground arable field; 0-200 m; **NE28, NE39**; (2); ■.
- Epipterygium tozeri* (Grev.) Lindb. - Humid soil banks; 0-200 m; **NE28, NE39, NE49, NF30, NF50, NF63**; (7); ■.
- Eucladium verticillatum* (Brid.) Bruch & Schimp. - Permanently wet basic banks; 0-200 m; **NE29**; (1); ■.
- Eurhynchium praelongum* (Hedw.) Schimp. (*Kindbergia praelonga* (Hedw.) Ochyra) - Humid soil banks, crevices, humid rocks near streams; 0-1100 m; **NE28, NE29**,

NE38, NE39, NE48, NE49, NE57, NE59, NF30, NF40, NF41, NF42, NF50, NF51, NF52, NF53, NF61, NF62, NF63; (40); □ ■.

- *Eurhynchium pulchellum* (Hedw.) Jenn. (*Eurhynchiastrum pulchellum* (Hedw.) Ignatov & Huttunen) - Humid soil banks and walls; 0-500 m; NF31, NF40, NF42, NF50; (6); ■.

*Eurhynchium pumilum* (Wilson) Schimp. (*Oxyrrhynchium pumilum* (Wilson) Loeske) - Shaded rocks and soil; 0-500 m; NF50, NF51, NF63; (5); □ ■.

*Eurhynchium speciosum* (Brid.) Jur. (*Oxyrrhynchium speciosum* (Brid.) Warnst.) - Wet rocks, walls near springs; 0-500 m; NE39, NF50, NF51; (3); ■.

*Eurhynchium striatum* (Hedw.) Schimp. - Wet rocks, tree trunks, banks near springs; 201-500 m; NF40, NF41, NF50, NF51; (9); ■.

*Fabronia pusilla* Raddi - Epiphytic; 0-500 m; NE29, NF30, NF50; (4); ■.

*Fissidens crassipes* subsp. *warnstorffi* (M. Fleisch.) Brugg.- Nann. - Wet rocks, walls near springs; 0-200 m; NF41; (1); ■.

*Fissidens dubius* P. Beauv. - Soil banks, rock crevices near springs; 0-500 m; NE48, NF50, NF51; (8); ■.

*Fissidens polyphyllus* Wilson ex Bruch & Schimp. - River banks, wet rocks near springs; 0-1100 m; NE58, NE59, NF41, NF50, NF51, NF52, NF61, NF62; (14); □ ■.

*Fissidens serrulatus* Brid. - Entrance to caves, humid banks and rock crevices; 0-500 m; NE39, NE59, NF41, NF50, NF51, NF52; (18); □ ■.

*Fissidens taxifolius* Hedw. - River banks, wet rocks; 0-500 m; NE28, NE39, NE49, NF41, NF63; (6); ■.

° *Fissidens viridulus* (Sw. ex anon.) Wahlenb. - Soil banks, walls; 201-500 m; NF50; (1); □.

*Fontinalis antipyretica* Hedw. - Water, river banks, intermitent rivulet; 0-500 m; NE57, NF42, NF50, NF51, NF61; (5); ■.

*Fontinalis hypnoides* Hartm. var. *duriaei* (Schimp.) Kindb. - Water and river banks; 0-500 m; NE58, NE59, NF41, NF50, NF52; (7); ■.

*Fontinalis squamosa* Hedw. - Water and river banks, rocky substrate, very slowly flowing; 0-500 m; NE59, NF50, NF52, NF53; (5); ■.

*Funaria hygrometrica* Hedw. - Bare soil and banks after fire, rock crevices; 0-200 and 501-1100 m; NE29, NE49, NF31, NF62; (4); ■.

*Grimmia lisae* De Not. - Granitic rock, wall rock fissures; 201-500 m; NF51; (2); ■.

*Grimmia pulvinata* (Hedw.) Sm. - Man-made substrata; 0-500 m; NE49, NF50; (2); □ ■.

*Grimmia trichophylla* Grev. - Granitic rock, wall rock fissures; 201-500 m; NF50; (2); ■.

*Gymnostomum calcareum* Nees & Hornsch. - Stone walls with concrete, on man-made substrata; 0-500 m; NF50; (5); ■.

*Gymnostomum calcareum* Nees & Hornsch var. *atlanticum* Sérgio - Humid stone walls, concrete on man-made substrata; 0-500 m; NF33, NF50; (7); ■.

*Gymnostomum viridulum* Brid. - Exposed walls with some concrete; 0-500 m; NE47, NE49, NF50, NF51; (7); □ ■.

- <sup>DD</sup> *Gyroweisia reflexa* (Brid.) Schimp. - Shaded walls with concrete, on man-made substrata; 0-200 m; **NF50**; (1); ■.
- Hedwigia ciliata* (Hedw.) P. Beauv. - Rocky banks and crevices; 201-500 m; **NF50**; (2); ■.
- Hedwigia stellata* Hedenäs - Granitic rock, wall rock fissures; 201-1100 m; **NF50, NF62**; (3); ■.
- Heterocladium heteropterum* (Brid.) Schimp. - Rocky shaded banks and crevices, in slowly dripping water; 0-200 m; **NF61, NF63**; (2); ■.
- Homalothecium aureum* (Spruce) H. Rob. - Rocky banks and soil; 0-200 m; **NF31**; (1); ■.
- Homalothecium sericeum* (Hedw.) Schimp. - Rocky banks, walls and tree trunks; 0-500 m; **NE29, NE39, NE47, NE49, NE57, NF30, NF50, NF52**; (21); ■.
- ° *Homomallium incurvatum* (Schrad. ex Brid.) Loeske - Tree trunks; 0-200 m; **NF30**; (2); □.
- Hookeria lucens* (Hedw.) Sm. - Humid soil of river banks; 201-500 m; **NF41, NF50, NF51**; (4); ■.
- *Hygroamblystegium varium* (Hedw.) Mönk. - Wet rocky walls; 0-200 m; **NE39**; (1); ■.  
It is the second report to Portugal. This species is only known in Serra da Estrela.
- *Hygrohypnum ochraceum* (Turner ex Wilson) Loeske - Humid rocky banks and springs; 0-200 m; **NE59, NF52**; (2); ■.
- *Hylocomium splendens* (Hedw.) Schimp. - Rocky banks, crevices among granite blocks with humus; 501-1100 m; **NF62**; (1); ■.
- Hycomium armoricum* (Brid.) Wijk & Margad. - Dripping rocks, intermittent rivulet banks; 0-1100 m; **NE49, NE58, NE59, NF50, NF51, NF52, NF61, NF62**; (9); □ ■.
- Hypnum andoi* A.J.E. Smith - Soil, rocks and tree trunks; 0-1100 m; **NF20, NF51, NF52, NF61, NF62**; (8); □ ■.
- Hypnum cupressiforme* Hedw. - Rocks, soil, epiphytic; 0-1100 m; **NE28, NE29, NE39, NE48, NE49, NE59, NF21, NF22, NF30, NF31, NF33, NF40, NF41, NF42, NF44, NF50, NF51, NF52**; (48); □ ■.
- Hypnum cupressiforme* (Hedw.) var. *filiforme* Brid. - Soil, tree trunks; 501-1100 m; **NF52**; (1); ■.
- <sup>EN</sup> *Hypnum imponens* Hedw. - **NE49**. [PEREIRA COUTINHO, 1917].  
Species known only in one locality in Aveiro region (Águeda, gathered by F. Mendes).
- *Hypnum jutlandicum* Holmen & E. Warncke - Soil and rocky banks, rocky crevices, tree trunks; 0-1100 m; **NE38, NE39, NF21, NF30, NF32, NF40, NF43, NF50, NF52, NF62**; (12); ■.
- Hypnum lacunosum* (Brid.) Hofm. ex Brid. - Soil, rocky banks near the water; 201-1100 m; **NF52, NF64**; (4); ■.
- Hypnum resupinatum* Taylor - Tree trunks; 0-500 m; **NE29, NE39, NE49, NF20, NF30, NF31, NF32, NF52**; (10); ■.
- <sup>EN</sup> *Hypnum uncinulatum* Jur. - Tree trunks; 0-200 m; **NE39, NE57, NF40**; (3); □ ■.

This report corresponds to the second area of occurrence in Portugal and the third in the Iberian Peninsula (RUIZ *et al.*, 2006).

*Isothecium holtii* Kindb. - River rocks, intermittent rivulet banks; 0-1100 m; **NE58, NF50, NF51, NF61, NF62**; (6); ■.

*Isothecium myosuroides* Brid. - Shaded banks, crevices among rocks and tree trunks; 0-1100 m; **NE39, NF40, NF51, NF61, NF62**; (6); □ ■.

° *Leptobryum pyriforme* (Hedw.) Wilson - Wet soil and banks; 0-200 m; **NE39**; (1); □.

*Leptodictyum riparium* (Hedw.) Warnst. - Wet soil and rocks, water; 0-500 m; **NE48, NF40, NF50**; (3); ■.

*Leptodon smithii* (Hedw.) F. Weber & D. Mohr - Epiphytic or on rocks; 0-200 m; **NE29, NE39, NF30, NF31**; (10); □ ■.

• *Leptophascum leptophyllum* (Müll.Hal.) J. Guerra & M.J. Cano - Soil between paving-stones, or on man-made substrata; 0-200 m; **NE29, NE57**; (2); ■.

*Leskea polycarpa* Hedw. - Wet roots near streams; 0-200 m; **NE39, NE49, NF30**; (5); □ ■.

*Leucobryum glaucum* (Hedw.) Ängstr. - **NE39, NE49**. [CASAS *et al.*, 1996].

This species was confirmed for Portugal by CASAS *et al.*, (1996) in one only locality (Águeda), however some other material needs from the same area needs to be revised.

*Leucobryum juniperoideum* (Brid.) Müll.Hal. - Tree-roots and humus; 0-500 m; **NE39, NF40, NF41, NF50**; (9); □ ■.

*Leucodon sciuroides* (Hedw.) Schwägr. var. *morensis* (Schwägr.) De Not. - Epiphytic; 0-200 m; **NE29, NE39, NF30, NF31**; (8); ■.

••<sup>DD-n</sup> *Micromitrium tenerum* (Bruch & Schimp.) Crosby - Alluvial mud in the draw-down zone of a pond; 0-200 m; **NE49**; (2); ■.

These localities are the first reference to the bryoflora of Portugal, were the *taxa* can be frequent (SÉRGIO *et al.*, 2006a).

*Mnium hornum* Hedw. - Wet rocks, rock fissures with dripping water; 0-1100 m; **NE58, NE59, NF50, NF51, NF52, NF61, NF62**; (12); ■.

*Neckera complanata* (Hedw.) Huebener - Tree trunk; 201-500 m; **NF50**; (1); ■.

*Neckera pumila* Hedw. - Tree trunk; 201-500 m; **NE69, NF52**; (2); ■.

*Octodiceras fontanum* (Bach. Pyl.) Lindb. (*Fissidens fontanus* (Bach. Pyl.) Steud.) - Water in rocks; 0-200 m; **NF40**; (1); ■.

*Orthotrichum affine* Schrad. ex Brid. - Tree trunks; 201-500 m; **NF40**; (2); ■.

*Orthotrichum diaphanum* Schrad. ex Brid. - Rock fissures and tree trunks; 0-200 m; **NE29, NE39, NE49, NF30, NF31**; (16); ■.

*Orthotrichum lyellii* Hook. & Taylor - Tree trunks; 201-1100 m; **NE39, NF50, NF51, NF52**; (4); ■.

*Orthotrichum rupestre* Schleich. ex Schwägr. - Shaded wet rocks, tree trunks; 201-500 m; **NE69, NF52**; (2); ■.

- Orthotrichum tenellum* Brid. - Tree trunks; 0-500 m; **NE29, NE39, NE49, NF30, NF31, NF50**; (19); ■.
- Philonotis arnelli* Husn. - Wet rocks, loamy soil; 0-1100 m; **NE48, NF50, NF51, NF52**; (5); ■.
- Philonotis caespitosa* Jur. - Wet rocky banks; 201-500 m; **NF50**; (3); □ ■.
- ° *Philonotis fontana* (Hedw.) Brid. - Wet soil and rocks, shade rocks with slowly dripping water; 201-500 m; **NF50**; (2); □.
- Philonotis marchica* (Hedw.) Brid. - Wet rocky banks or soil; 201-500 m; **NF51**; (1); ■.
- Philonotis rigida* Brid. - Humid rocks with dripping water; 0-500 m; **NF50, NF51, NF63**; (6); □ ■.
- Physcomitrium pyriforme* (Hedw.) Bruch & Schimp - **NE48, NF61**. [CASAS, *et al.*, 1996].  
Species known only in one locality in Aveiro region (Aguada de Baixo, gathered by Sérgio, 1969).
- Plagiomnium affine* (Blandow ex Funck) T. J. Kop. - River banks. Wet shaded soil; 0-500 m; **NE57, NF50, NF63**; (10); □ ■.
- Plagiomnium rostratum* (Schrad.) T. J. Kop. - River banks, shaded soil; 0-200 m; **NE57**; (1); ■.
- Plagiomnium undulatum* (Hedw.) T. J. Kop. - Humid and wet soil banks, shaded rocks; 0-500 m; **NE59, NE29, NF51, NF52, NF61**; (8); □ ■.
- Plagiothecium nemorale* (Mitt.) A. Jaeger - Humid soil and rocky banks; 0-500 m; **NF41, NF51, NF61**; (3); ■.
- *Plagiothecium succulentum* (Wilson) Lindb. - Entrance to caves, on humid and wet soil and rocks, dripping cliff, tree trunks; 201-500 m; **NF50, NF51**; (6); ■.
- Plasteurhynchium striatulum* (Spruce) M. Fleisch. - Humid and shaded rocky banks; 0-200 m; **NF51**; (1); ■.
- Platyhypnidium lusitanicum* (Schimp.) Ochyra & Bednarek-Ochyra - Shaded rocks, lowly dripping water, humid and wet banks; 0-1100 m; **NF50, NF51, NF52, NF61**; (7); ■.
- Platyhypnidium riparioides* (Hedw.) Dixon. - Acid rocks and soil, wet rocky banks; 0-1100 m; **NF40, NF50, NF51, NF61, NF62**; (5); ■.
- Pleuridium acuminatum* Lindb. - Dry soil, banks in roadsides; 201-1100 m; **NF50, NF62**; (6); ■.
- Pleuridium subulatum* (Hedw.) Rabenh. - Rocky bank; 0-200 m; **NE49**; (1); ■.
- Pleurochaete squarrosa* (Brid.) Lindb. - Banks in roadsides, exposed wet soil; 0-200 m; **NF20**; (1); ■.
- Pogonatum aloides* (Hedw.) P. Beauv. - Banks in roadsides, walls and fissure of rocks; 0-1100 m; **NE49, NE59, NF33, NF50, NF51, NF62, NF63**; (14); □ ■.
- Pogonatum nanum* (Hedw.) P. Beauv. - Banks in roadsides, soil and rocky banks; 0-200 m; **NE39**; (1); ■.

- Pohlia annotina* (Hedw.) Lindb. - Entrance of caves, moist soil; 201-1100 m; **NF50, NF63**; (2); ■.
- Pohlia elongata* Hedw. - Soil and rock banks, crevices among granite blocks; 501-1100 m; **NF52**; (1); ■.
- *Pohlia prolifera* (Kindb.) Lindb. ex Broth. - Humid soil with dripping water; 0-500 m; **NF30, NF50**; (6); □ ■.
- *Pohlia wahlenbergii* (F. Weber & D. Mohr) A. L. Andrews - Moist basic soil; 0-200 m; **NE29**; (1); ■.
- Polytrichum commune* Hedw. - Soil and rocky banks, very slowly water through bogs, mineral soil; 0-1100 m; **NF40, NF52, NF61, NF62**; (5); ■.
- Polytrichum formosum* Hedw. - Rocky banks, soil, base of trees; 0-200 m and 501-1100 m; **NE39, NE48, NF40, NF43, NF52, NF61, NF62**; (8); □ ■.
- Polytrichum juniperinum* Hedw. - Soil, rocky banks, gaps in grasslands, tree trunks; 0-200 m; **NE29, NE47, NE49, NF22, NF30, NF31**; (12); □ ■.
- Polytrichum piliferum* Hedw. - Rocky exposed banks, little humus; 0-1100 m; **NE49, NF50, NF51, NF62**; (6); □ ■.
- Pottia intermedia* (Turner) Fűrnr. - Soil in walls fissures; 201-500 m; **NF50**; (1); ■.
- Pottia truncata* (Hedw.) Bruch & Schimp. - Soil near the water; 0-200 m; **NE29, NE39, NE49**; (6); □ ■.
- *Pseudephemerum nitidum* (Hedw.) Loeske - Soils with clay very humid; 0-200 m; **NE28, NE39, NE49**; (4); ■.
- Pseudocrossidium hornschurchianum* (Schultz) R.H. Zander - Sandy soils; 0-200 m; **NE29**; (1); ■.
- Pseudotaxiphyllum elegans* (Brid.) Z.Iwats. - Crevices among granite blocks, wet shaded rocks, tree trunks; 0-1100 m; **NF31, NF32, NF33, NF41, NF50, NF51, NF52, NF62, NF64**; (17); ■.
- <sup>DD-n</sup>*Pseudotaxiphyllum laetevirens* (Dixon & Luisier ex F. Koppe & Düll) Hedenäs - Wet shaded rocks, tree trunks; 0-1100 m; **NF41, NF43, NF50, NF62**; (4); ■.
- One of these locality is the first reference to the bryoflora of Portugal, were the *taxa* seems to be frequent. (SÉRGIO *et al.*, 2006b).
- Pterogonium gracile* (Hedw.) Sm. - Trees, rocky banks; 0-500 m; **NE29, NE39, NE49, NF30, NF40, NF50**; (12); ■.
- Ptychomitrium polyphyllum* (Dicks. ex Sw.) Bruch & Schimp. - **NE49**. [SÉRGIO, 1969].
- Racomitrium aciculare* (Hedw.) Brid. - Crevices among wet granite blocks, shaded rocks in river banks near water; 0-1100 m; **NF50, NF52, NF53, NF61, NF62**; (10); ■.
- *Racomitrium affine* (F. Weber & D. Mohr) Lindb. - Humid man-made substrata; 201-500 m; **NF50**; (1); ■.
- Racomitrium aquaticum* (Brid. ex Schrad.) Brid. - Shaded rocks in river banks near water, dripping cliff; 0-500 m; **NF50, NF61**; (2); ■.

- Racomitrium elongatum* Ehrh. ex Frisvoll - Crevices among granite blocks, wet shaded rocks; 0-1100 m; **NE48, NF50, NF52**; (3); ■.
- \*\* *Racomitrium hespericum* Sérgio, Muñoz & Ochyra - Rocks slowly dripping water; 501-1100 m; **NF62, NF63**; (2); ■.
- Racomitrium heterostichum* (Hedw.) Brid. - Dry rocks, soil, rarely tree trunks; 501-1100 m; **NF52, NF62, NF63**; (7); ■.
- Racomitrium lamprocarpum* (Müll.Hal.) A. Jaeger - Shaded rocks in river banks near water, slowly dripping water; 201-1100 m; **NF50, NF63**; (2); ■.
- Racomitrium lanuginosum* (Hedw.) Brid. - Crevices in exposed granite blocks, on soil, rock outcrop; 0-1100 m; **NE39, NF50, NF62**; (4); □ ■.
- *Racomitrium obtusum* (Brid.) Brid. - Wet rocks and soil; 501-1100 m; **NF62**; (1); ■.
- Rhabdoweisia fugax* (Hedw.) Bruch & Schimp. - Shaded rocks and caves, large boulders in rock fissures; 201-500 m; **NF50, NF51**; (2); ■.
- *Rhizomnium punctatum* (Hedw.) T. J. Kop. - Wet rocky banks, wet soil, dripping water; 0-1100 m; **NE59, NF41, NF51, NF61, NF62**; (7); ■.
- Rhynchostegiella tenella* (Dicks.) Limpr. - Small cave in rocky banks; 0-200 m; **NE49**; (1); ■.
- Rhynchostegium confertum* (Dicks.) Schimp. - Humid rocks and tree trunks; 0-500 m; **NF30, NF50**; (6); ■.
- Rhynchostegium megalopolitanum* (F. Weber & D. Mohr) Schimp. - Rocky banks with soil in *Pinus* plantation; 0-500 m; **NE48, NF50**; (2); ■.
- *Rhytidiadelphus loreus* (Hedw.) Warnst. - Rock crevices, on soil with much humus; 501-1100 m; **NF62**; (1); ■.
- *Rhytidiadelphus triquetrus* (Hedw.) Warnst. - Rock crevices, on soil with much humus; 501-1100 m; **NF62**; (1); ■.
- *Schistidium apocarpum* (Hedw.) Bruch & Schimp. - Rocks, walls with concrete; 201-500 m; **NF50**; (1); ■.
- *Schistidium rivulare* (Brid.) Podp. - Rocks in river banks; 0-200 m; **NF50**; (2); ■.
- Scleropodium purum* (Hedw.) Limpr. - Rocky banks, soil in woodlands; 0-1100 m; **NE28, NE29, NE38, NE39, NE47, NE48, NE59, NF20, NF22, NF30, NF50, NF51, NF62, NF64**; (29); □ ■.
- Scleropodium touretii* (Brid.) L. Koch - Banks, rocks and exposed soil; 0-500 m; **NF31, NF50**; (3); ■.
- Scorpiurium circinatum* (Brid.) M. Fleisch. & Loeske - Tree trunks with clay; 0-200 m; **NE49, NF31**; (2); ■.
- Scorpiurium deflexifolium* (Solms) M. Fleisch. & Loeske - Humid rocky and root banks; 201-500 m; **NF50**; (1); ■.
- Sematophyllum substrumosum* (Hampe) E. Britton - Tree trunks; 0-500 m; **NE28, NE29, NE39, NE48, NF30, NF31, NF32, NF33, NF40, NF50**; (21); ■.
- Sphagnum capillifolium* (Ehrh.) Hedw. - Permanently wet soils; 0-200 m; **NF61**; (1); ■.



*Sphagnum compactum* Lam. & DC. - Permanently wet soils; 0-200 and 501-1100 m; **NE39, NF62**; (2); ■.

To this moment Pateira de Fermentelos is the only locality of the species in Beira Litoral region.

*Sphagnum denticulatum* Brid. - Permanently wet soils; 0-1100 m; **NE38, NE39, NE48, NE58, NE59, NF40, NF43, NF50, NF52, NF62**; (19); □ ■.

<sup>VU</sup> *Sphagnum molle* Sull. - **NE39, NE49**. [ANÓNIMO 1967; SÉNECA, & DANIELS, 1994].

To this moment Pateira de Fermentelos is the only locality of the species in Beira Litoral region.

*Sphagnum subnitens* Russow & Warnst. - Permanently wet soils in *Mollinia* grasslands; 0-200 m; **NE39**; (7); □ ■.

To this moment Pateira de Fermentelos is the only locality of the species in Beira Litoral region.

*Sphagnum inundatum* Russow - Wet river banks and rivulet with *Juncus* sp.; 0-200 m; **NE39, NF31**; (3); □ ■.

*Syntrichia laevipila* Brid. - Tree trunks; 0-500 m; **NE29, NE39, NE49, NF30, NF31**; (26); ■.

*Syntrichia papillosa* (Wilson) Jur. - Tree trunks; 0-200 m; **NE39**; (1); ■.

° *Syntrichia ruralis* (Hedw.) F. Weber & D. Mohr var. *ruraliformis* (Besch.) Delogne - Sandy soils; 0-200 m; **NF21**; (1); □.

*Syntrichia ruralis* (Hedw.) F. Weber & D. Mohr var. *ruralis* - **NE29**. [SÉRGIO, 1969].

*Thamnobryum alopecurum* (Hedw.) Gangulee - Wet river banks, rocks of springs and caves; 0-1100 m; **NE57, NF41, NF50, NF51, NF52, NF62, NF63**; (13); ■.

• <sup>DD-n</sup> *Thamnobryum maderense* (Kindb.) Hedenäs - Rocks slowly dripping water; 201-500 m; **NF41**; (1); ■.

*Thuidium tamariscinum* (Hedw.) Schimp. - Wet river banks, rocks of springs and caves; 201-1100 m; **NF40, NF41, NF50, NF62**; (6); ■.

*Timmiella barbuloidea* (Brid.) Mönk. - Walls in man-made substrata; 201-500 m; **NF50**; (2); ■.

*Tortella flavovirens* (Bruch) Broth. - Walls in man-made substrata; 0-500 m; **NE28, NE29, NE57, NF50**; (6); □ ■.

° *Tortella inclinata* (R. Hedw.) Limpr. - Sandy soils; 0-200 m; **NE28**; (1); □.

*Tortella nitida* (Lindb.) Broth. - Wall with concrete; 0-200 m; **NE28, NE47**; (2); ■.

*Tortula canescens* Mont. - Banks in roadsides; 201-500 m; **NF51**; (1); ■.

*Tortula marginata* (Bruch & Schimp.) Spruce - Wall with concrete; 0-500 m; **NF50**; (2); ■.

*Tortula muralis* Hedw. - Exposed rocks, walls with some concrete; 0-500 m; **NE28, NE29, NF50**; (5); □ ■.

• *Tortula vahliana* (Schultz) Mont. - Exposed banks; 0-200 m; **NE29**; (2); ■.

- Trichostomum brachyodontium* Bruch. - Rocks and wet banks; 0-500 m; **NF50, NF51**; (5); ■.
- Trichostomum brachyodontium* Bruch. var. *littorale* (Mitt.) C.O.E. Jensen - Banks in roadsides; 0-200 m; **NE57**; (1); ■.
- Ulota crispa* (Hedw.) Brid. - Epiphytic; 201-500 m; **NF41**; (1); ■.
- Weissia condensa* (Voit) Lindb. - Rocks and banks; 201-500 m; **NF50, NF51**; (3); ■.
- ° *Weissia controversa* Hedw. - Walls with soil; 0-500 m; **NE29, NE49, NF32, NF50**; (4); □.
- Zygodon rupestris* Schimp. ex Lorentz - Tree trunks, rarely concrete; 0-500 m; **NE29, NE39, NE47, NE49, NF30, NF31, NF50**; (13); ■.

### Hepatics

- Aneura pinguis* (L.) Dumort. - **NE39**. [SABINO DE FREITAS, 1948].  
Species known only in one locality in Aveiro region (Eirol, gathered by Póvoa).
- <sup>RE</sup> *Anthoceros agrestis* Paton - Bare ground, arable field; 0-200 m; **NE39**; (1); ■.
- Anthoceros punctatus* L. - Wet and humid soil banks; 0-500 m; **NF50**; (2); ■.
- Calypogeia arguta* Nees & Mont. - Shaded rivulets, caves and humid soil banks; 0-500 m; **NE49, NF41, NF51**; (3); □ ■.
- *Calypogeia azurea* Stotler & Crotz - Wet banks and walls, springs; 0-200 m and 501-1100 m; **NE39, NF50**; (4); ■.
- Calypogeia fissa* (L.) Raddi - Soil banks, wet grassland and tree trunks; 0-500 m; **NE39, NF30, NF31, NF43, NF50**; (5); □ ■.
- Calypogeia sphagnicola* (Arnell & J. Perss.) Warnst. & Loeske - **NE39, NE69**. [ANÓNIMO, 1967].  
Species known only in one locality in Aveiro region (Pateira de Fermentelos).
- Cephalozia bicuspидata* (L.) Dumort. - Wet soil and rock banks; 0-500 m; **NE39, NF50**; (4); ■.
- <sup>DD</sup> *Cephalozia connivens* (Dicks.) Lindb. - **NE39**. [SÉRGIO, 1971].  
Species known only in one locality in Aveiro region (Pateira de Fermentelos, gathered by Póvoa dos Reis).
- Cephalozia lunulifolia* (Dumort.) Dumort. - **NF50**. [SÉRGIO, 1967].  
Species known only in one locality in Aveiro region (Cedrim do Vouga, gathered by C. Sérgio).
- Cephaloziella baumgartneri* Schiffn. - **NE29**. [ALLORGE, 1931].  
Species known only in one locality in Aveiro region (gathered during 1930 by P. Allorge).
- Cephaloziella divaricata* (Sm.) Schiffn. - Permanently wet soils; 0-200 m; **NE39**; (1); ■.
- <sup>DD</sup> *Cephaloziella rubella* (Nees) Warnst. - Tree stumps in woods; 0-500 m; **NF30, NF63**; (2); ■.

- Cephaloziella stellulifera* (Taylor ex Spruce) Schiffn. - Turf in rock fissures and tree trunks; 0-200 m; **NE28, NF31, NF50**; (3); □ ■.
- Cephaloziella turneri* (Hook.) Müll. Frib. - Soil and rock banks in shaded places; 0-1100 m; **NE39, NE49, NF50, NF52, NF62**; (7); □ ■.
- *Chiloscyphus pallescens* (Ehrh. ex Hoffm.) Dumort. - Dripping cliff and springs; 201-500 m; **NF41**; (1); ■.
- Chiloscyphus polyanthos* (L.) Corda - River banks and wet rocks; 0-500 m; **NE59, NF50, NF51**; (3); ■.
- Cololejeunea minutissima* (Sm.) Schiffn. - Tree trunks and branches; 0-500 m; **NE28, NE39, NE57, NF30, NF50**; (7); ■.
- Conocephalum conicum* (L.) Dumort. - Wet soil and rocks, walls near springs; 0-500 m; **NE49, NE57, NE58, NE59, NF41, NF50, NF52, NF53**; (10); □ ■.
- Corsinia coriandrina* (Spreng.) Lindb. - Exposed banks and bare soil; 0-200 m; **NE49, NF63**; (2); □ ■.
- <sup>DD-n</sup> *Cryptothallus mirabilis* Malmb. - Below mats of *Hypnum cupressiforme* in *Pinus pinaster* forest in heathland humid formations; 0-200 m; **NE28, NE29, NF21, NF22**; (7); ■.
- Diplophyllum albicans* (L.) Dumort. - Soil banks in roadsides, in shade cliffs; 0-1100 m; **NE39, NE49, NF43, NF50, NF51, NF52, NF61, NF62**; (11); □ ■.
- *Fossombronia angulosa* (Dicks.) Raddi - Banks in roadsides and rocky wet slopes or walls; 0-500 m; **NE48, NF50**; (2); □.
- <sup>CR</sup> *Fossombronia foveolata* Lindb. - Dried-up pools, acid soil; 0-200 m; **NE39**; (1); ■.
- *Fossombronia husnotii* Corb. - Banks in roadsides and bare soil; 0-500 m; **NE39, NE46, NF50**; (3); □.
- *Fossombronia pusilla* (L.) Nees - Soil in man-made walls; 0-200 m; **NE49**; (1); □.
- Frullania dilatata* (L.) Dumort. - Epiphytic and exposed rocks; 0-500 m; **NE28, NE29, NE38, NE39, NE47, NE48, NE49, NE57, NF21, NF22, NF30, NF31, NF32, NF33, NF34, NF40, NF41, NF50, NF51, NF52**; (58); □ ■.
- Frullania fragilifolia* (Taylor) Gottsche *et al.* - Shaded rocks and tree trunks; 201-1100 m; **NF50, NF51, NF62**; (4); □ ■.
- Frullania tamarisci* (L.) Dumort. - Wet rocks and tree trunks in shaded sites; 201-1100 m; **NF50, NF52, NF62**; (3); ■.
- *Frullania tamarisci* (L.) Dumort. var. *sardoa* (De Not.) De Not – Epiphytic; 201-500 m; **NE57**; (1); □.
- Gongylanthus ericetorum* (Raddi) Nees - Soil banks and rocky wet slopes; 0-200 m; **NF50**; (2); ■.
- Gymnocolea inflata* (Huds.) Dumort. - Wet soil with *Sphagnum* sp.; 0-200 m; **NE39**; (1); ■.

To this moment Pateira de Fermentelos is the only locality of the species in Beira Litoral region.

- Jungermannia gracillima* Sm. - Permanently wet soils with *Sphagnum* sp. or dripping rocks; 201-500 m; **NF50**; (2); ■.
- Jungermannia sphaerocarpa* Hook. - **NE39**. [SABINO DE FREITAS, 1948].  
Species known only in one locality in Aveiro region (Eirol, gathered by Póvoa).
- <sup>NT</sup> *Kurzia pauciflora* (Dicks.) Grolle - Slowly dripping water walls; 0-200 m; **NE39**; (2); ■.
- Lejeunea cavifolia* (Ehrh.) Lindb. - Shaded banks rocks and wet walls; 0-500 m; **NF30**, **NF50**; (3); ■.
- Lejeunea lamacerina* (Steph.) Schiffn. - Wet trees, shaded banks with dripping water or walls; 0-500 m; **NF32**, **NF41**, **NF51**, **NF63**; (4); ■.
- Lejeunea patens* Lindb. - Shaded wet banks or rocks; 201-500 m; **NF50**; (1); ■.
- Lophocolea bidentata* (L.) Dumort. - Slowly dripping water, in shade of cliff or tree trunks; 0-500 m; **NE39**, **NE48**, **NF31**, **NF41**, **NF50**, **NF51**, **NF61**, **NF63**; (8); ■.
- Lophocolea heterophylla* (Schrad.) Dumort. - Walls, tree trunks or in dead wood; 0-500 m; **NE28**, **NE48**, **NE49**, **NF21**, **NF30**, **NF32**, **NF50**; (10); ■.
- Lunularia cruciata* (L.) Lindb. - Trampled soil and deep crevices, in base of walls, banks of streams and rivers. Rarely on tree trunks; 0-500 m; **NE49**, **NF31**, **NF50**, **NF61**; (8); □ ■.
- Mannia androgyna* (L.) A. Evans - Rock crevices, exposed banks or walls; 201-500 m; **NF50**; (2); □ ■.
- Marsupella emarginata* (Ehrh.) Dumort. - Soil covered rocks, rocky wet slopes, rarely tree trunks; 201-1100 m; **NF50**, **NF52**, **NF62**; (6); ■.
- *Marsupella funckii* (F. Weber & D. Mohr) Dumort. - Soil covered rocks, rocky wet slopes; 201-1100 m; **NF51**, **NF62**; (4); ■.  
It is the second area of occurrence in Portugal. This species is only known in Serra da Estrela and Gerês.
  - <sup>Att</sup> *Marsupella profunda* Lindb. - Gravel of decomposed granite rocks, banks in roadsides and rock-crevices; 201-500 m; **NF50**; (1); ■.
- Metzgeria conjugata* Lindb. - Tree trunks; 0-200 m; **NF30**; (1); ■.
- Metzgeria furcata* (L.) Dumort. - Tree trunks; 0-500 m; **NE57**, **NE69**, **NF30**, **NF32**, **NF40**, **NF50**, **NF52**; (11); □ ■.
- Nardia scalaris* Gray - River banks and wet soil; 501-1100 m; **NF52**; (1); ■.
- Pallavicinia lyellii* (Hook.) Carruth. - Wet walls, in slowly dripping water in springs; 201-500 m; **NF41**; (1); ■.
- Pellia endiviifolia* (Dicks.) Dumort. - Wall in calcicolous rock crevices and running water; 0-200 m; **NE29**; (1); ■.
- Pellia epiphylla* (L.) Corda - Banks in rivers, waterfalls, cascades, in slowly dripping water; 0-1100 m; **NE39**, **NE58**, **NE59**, **NF41**, **NF50**, **NF51**, **NF52**, **NF61**, **NF62**; (16); ■.
- Phaeoceros bulbiculosus* (Brot.) Prosk. - Wet soil and rock banks; 0-500 m; **NE48**, **NF50**, **NF64**; (5); □ ■.

- Phaeoceros carolinianus* (Michx.) Prosk. - Soil and rocky banks; 0-200 m; **NE49**; (2); ■.
- Phaeoceros laevis* (L.) Prosk. - Banks in rivers and in roadsides; 0-500 m; **NE39, NE49, NF33, NF50**; (8); ■.
- Porella obtusata* (Taylor) Trevis. - Shaded and wet rocky banks or tree trunks; 0-500 m; **NE47, NF50, NF51**; (4); □ ■.
- Radula complanata* (L.) Dumort. s. *lat.* - Rock crevices; 0-500 m; **NF30, NF50**; (3); ■.
- Radula lindenbergiana* Gottsche ex C. Hartm. - Epiphytic; 0-200 m; **NE39, NE49, NF30**; (4); ■.
- Reboulia hemisphaerica* (L.) Raddi - Shaded rocks and soil or soil banks in roadsides; 0-500 m; **NF50, NF51, NF63**; (5); ■.
- Riccardia multifida* (L.) Gray - Wet slopes; 0-500 m; **NE39, NF50**; (2); ■.
- Riccia ciliata* Hoffm. - **NE29**. [SÉRGIO, C. 1966].
- Riccia ciliifera* Link ex Lindenb. - **NE29**. [SABINO DE FREITAS, 1948].
- Species known only in one locality in Aveiro region (Travassô, Águeda, gathered by Póvoa).
- Riccia crozalsii* Levier - Bare ground, arable field; 0-500 m; **NE38, NF50**; (2); ■.
- Riccia crystallina* L. emend. Raddi - Bare ground arable field; 0-200 m; **NE29**; (1); ■.
- Riccia glauca* L. - Soils with clay very humid; 201-500 m; **NF50**; (1); ■.
- Riccia gougetiana* Durieu & Mont. - **NF64**. [SÉRGIO, C. & MENDES, 1971].
- Species known only in one locality, in the Northern boundary of Aveiro region (Castelo de Paiva, gathered by Sérgio, 1968).
- <sup>VU</sup> *Riccia huebeneriana* Lindenb. - Soils with clay very humid; 0-500 m; **NE39, NE49, NF50**; (4); □ ■.
- Riccia macrocarpa* Levier - Wet exposed slopes; 0-200 m; **NE49**; (1); ■.
- Riccia sorocarpa* Bisch. - Bare soil or arable field; 0-500 m; **NE29, NE38, NF50**; (4); ■.
- <sup>NT</sup> *Riccia subbifurca* Warnst. ex Croz. - Soils with clay very humid; 0-200 m; **NE49**; (1); ■.
- Riccia warnstorffii* Limpr. ex Warnst. - Bare ground arable field; 0-200 m; **NE39**; (1); ■.
- Saccogyna viticulosa* (L.) Dumort. - Wet soil and rock banks in slowly dripping water; 201-500 m; **NF50**; (4); ■.
- Scapania compacta* (A. Roth) Dumort. - Exposed rocky banks and soil; 0-1100 m; **NE49, NF50, NF62**; (6); □ ■.
- Scapania gracilis* Lindb. - Shaded rocky banks and soil; 501-1100 m; **NF62**; (1); ■.
- Scapania nemorea* (L.) Grolle - Wet soil and rock banks; 0-500 m; **NF43, NF50**; (4); ■.
- <sup>NT</sup> *Scapania subalpina* (Nees ex Lindenb.) Dumort. - **NF50**. [SÉRGIO, 1966].
- Species known only in one locality in Aveiro region (Cedrim do Vouga, gathered by C. Sérgio).

*Scapania undulata* (L.) Dumort. - Shaded wet rocks, rocks in water; 0-1100 m; **NF50**, **NF51**, **NF61**, **NF62**; (6); ■.

*Southbya nigrella* (De Not.) Henriq. - Walls with concrete; 0-500 m; **NF33**, **NF50**; (2); □ ■.

*Southbya tophacea* (Spruce) Spruce - **NE49**. [SÉRGIO, 1966].

Species known only in one locality in Aveiro region (Travassô, Varanda de Pilatos, gathered by A. Fernandes).

*Sphaerocarpos michelii* Bellardi - Bare soil or arable fields; 0-200 m; **NE29**; (1); ■.

*Sphaerocarpos texanus* Austin - Bare soil or arable fields; 0-500 m; **NE28**, **NE39**, **NF50**; (4); □ ■.

*Targionia hypophylla* L. - Walls, soil and exposed rocky banks; 201-500 m; **NF50**; (2); ■.

*Targionia lorbeeriana* Müll. Frib. - Rocky banks; 201-500 m; **NF50**; (1); ■.