

CONTRIBUTION TO THE STUDY OF THE BRYOFLORA OF THE PONTA DE SÃO LOURENÇO

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With 3 figures and 1 table

ABSTRACT. This study aims to provide information about the bryoflora of the Ponta de S. Lourenço. The mosses and liverworts reported were collected on the Ponta de S. Lourenço including the island Ilhéu dos Desembarcadouros, at the extreme eastern part of Madeira island. Their status, phytogeographical approach and degree of threat was determined. A total of 64 taxa are referred, 21 liverworts and 43 mosses. Specimens cited are kept in MADJ ², MADS ³ and LISU ⁴.

Interesting species as macaronesian and madeiran endemisms are notice and for the first time (1993) the endemic moss *Enthostodon fritzei* GEH is referred to this extremity.

INTRODUCTION

The bryoflora of Madeira is very rich either in number or species diversity. It is well known that bryophytes are more common and abundant on localities characterized by frequent foggy and frosty days with high values of precipitation and relative humidity than on coastal dry exposed habitats such as the Ponta de S. Lourenço.

In spite of their preference for colonising wet habitats, several mosses and liverworts are restrict to exposed and dry localities presenting peculiar life strategies. These bryophytes well adapted to the severe natural conditions present short life cycles during the favorable season or are ephemeral occurring sporadically.

² Herbário do Jardim Botânico da Madeira

³ Herbário do Museu de História Natural do Seminário

⁴ Herbário do Museu, Laboratório e Jardim Botânico, Lisboa.

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MATERIAL AND METHODS

General description of the studied area

The Ponta de S. Lourenço including the small island Ilhéu dos Desembarcadouros is situated at the extreme eastern of Madeira island. The longitude and the latitude are respectively 16° 42' 30" and 32° 44' 30", the area is about 11 Km² and the altitudinal range is 0 - 180 m.

The geology consists mainly of basaltic rocks and also of fossiliferous calcareous sediments, beeing the soil particularly sandy with a value of calcium about 10-20% (CARVALHO & BRANDÃO, 1991).

The clime is under maritime influence and it is characterized by relatively mild and wet winters with dry and warm summers.

This extremity is considered the aridest exposed coast of Madeira island with an annual precipitation less than 500 mm (TAVARES, 1965).

Annotations on the natural vegetation

The natural xerothermic and thermophytic vascular vegetation is very interesting with several fanerogamic endemisms (i.e. *Matthiola maderensis* LOWE; *Calendula maderensis* DC; *Helichrysum devium* JOHNS; *Phalaris maderensis* (MNZS.) MNZS.).

Due to the absence of natural tree and shrub layers allied to the climatic conditions, epiphytic bryophytes do not occur. All the collected specimens are terricolous or saxicolous.

Cliffs on shaded sites seem to be preferencial areas for the establishment of several bryophytes in association to some pterydophytes (i.e. *Asplenium marinum* L. *Polipodium macaronesicum* BOBROV., *Davallia canariensis* (L.) J. E. SM. and *Selaginella denticulata* (L.) LINK.).

By the rocks small niches of terricolous species such as *Exormotheca pustulosa* STEPH, *Riccia atlantica* SÉRGIO & PEROLD, *Corsinia coriandrina* (SPRENG.) LINDB., *Tortula solmsii* (SCHIMP.) LIMPR. and several Pottiaceae are frequent.

By the sea cliffs on eroded soil grassland the bryophytes coverage is only sparcely developed perhaps due to the lack of fine soil and the extreme dry conditions. Covering the rocks it is very common the presence of several lichens (i.e. *Caloplaca* sp. *Rocella* sp., *Lecanora* sp.) associated to the liverwort *Frullania ericoides* (NEES) MONT.

Field analysis

Botanical investigations and bryological collections were started later autumn 1989 until earlier summer 1993. The specimens were mainly collected during the winter and earlier spring and are located within an UTM grid of 1x1 Km. The selected sites (Fig. 1) with the UTM square (1x1 Km) value were the following:

1. Palmeira-Fábrica das Baleias, CB3823
2. Babosinhos-Marconi, CB3824

3. Praínha-Piedade, CB3823
 4. Miradouro-Baixas do Guincho, CB3924
 5. Ponta das Gaivotas, CB4023
 6. Radiofarol do Aeroporto CB4024
 7. Ponta do Buraco CB4123
 8. Porta de Abra CB 4124
 9. Casa do Sardinha CB4223
 10. Estreito CB4224
 11. Ilhéu dos Desembarcadouros (Desembarcadouro) CB4322
- The vicinities of Ponta de S. Lourenço, also considered are:
12. Vila do Caniçal CB3723
 13. Pico das Roçadas CB3625

Considering the severe natural conditions and its area, the occurrence of bryophytes is high and very peculiar.

During the dry season the visibility of bryophytes is quite null however after the rainfall season the abundance and coverage of these small plants is surprising. Later winter and earlier spring different colors of bryophytes layers cover the ground. The redishspots are mainly originated by the presence of genus such as *Aloina*, *Pottia*, *Didymodon*. The yellow-brownish ones are composed by species of *Funaria*, *Byrum*, *Fissidens*, *Tortella*, *Trichostomum* and the small green-withish spots occur by the presence of the following species *Riccia atlantica*, *Corsinia coriandrina*, *Exormotheca pustulosa*, *Tortula solmsii*, etc.

Covering the rocks is common large dark green blackish layers mainly composed by *Frullania ericoïdes*.

Herbarium material

As a complement herborised specimens located at MADS, MADJ and LISU were studied. The following bryophytes also refered were not collected by the author: *Ptychomitrium nigrescens* (KUNZE) WJK & MARG.; *Brachymenium notarisii* (MITT.) SCHAW.; *Scorpiurium circinatum* (RIC.) FLEISCH. & LOESKE; *Acaulon triquetrum* (SPRUCE) C. MUELL.; *Grimmia* sp.; *Frullania dilatata* (L.) DUM.; *Frullania tamarisci* (L.) DUM; *Adelanthus decipiens* (HOOK.) MITT.; *Riccia atomarginata* LEVIER var. *glabra*.

Results and discussion

The total number of taxa, 64 bryophytes including 21 liverworts and 43 mosses is given in Table 1. These lists include for each taxon the phytogeographical affinities the threat status and the locality. A taxonomic pattern of the bryoflora in terms of number of taxa is given in Fig. 2. Data about the phytogeographic tendency is given in Fig. 3.

The nomenclature largely follows CORLEY *et al*, (1981, 1991) and GROLLE, (1983) and sometimes EGGERS (1992). Phytogeographical affinities are according to DULL'S (1983,

1984, 1985) definitions with some adaptations.

The evaluation of the bryophytes status is according to the IUCN Survival Service Commission Criteria.

Endemic species and taxa with mediterranean affinities colonise preferentially or are restricted to this coastal exposed area. The most important phytogeographical elements are the mediterranean and the atlantic ones. Interesting species as macaronesian and madeiran endemisms are notice such as:

Riccia atlantica SÉRGIO & PEROLD

Brachymenium notarsii (MITT.) SHAWN.

Fissidens coacervatus BRUGG.-NANN.

Enthostodon fritzei GEH., is refered for the first time (1993) to this extremity (Ilhéu dos Desembarcadouros).

The most representativ bryophytes ate the *Marchantiales* with 11 taxa including 8 species of *Riccia* and the *Pottiales* with 26 taxa. In fact the *Pottiales* and the *Marchantiales* are the groups which are well adapted to xeric habitats (SÉRGIO & FONTINHA, 1994). Only two pleurocarpous mosses (*Scorpiurium circinatum* and *Rhynchostegium megapolitanum*) occur.

For the first time *Pottia truncata* (HEWD.) B., S. & G. is refered to Ponta de S. Lourenço, beeing the second locality to Madeira.

The most common bryophytes are the mosses *Trichostomum crispulum* var. *crispulum*, *Tortella flavoriens*, and *Byrum dunense* and the liverworts *Frullania ericoides*, *Riccia sorocarpa* and *Riccia atlantica*.

Due to the occurrence of some groups with taxonomical problems and considering the non fertility of some collected specimens and their peculiar life strategy, allied to the existence of landscapes difficult to reach, new surveys need to be undertaken.

Threats and Conservation

The Ponta de S. Lourenço is a special protected area, with a representative xerophytic vegetation of Madeira. This locality excluding the Ilhéu dos Desembarcadouros, is a touristic zone reflecting some alterations in the natural conditions. Nevertheless the native flora is less disturbed. Perhaps the higher threat is the rubbish and detritus accumulation in the vicinity and the increase of introduced plants (FONTINHA & SÉRGIO, 1995).

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REFERENCES

CARVALHO, A. M. G. & BRANDÃO, J. M.:

1991. Geologia do Arquipélago da Madeira. Museu Nacional de História Natural. Universidade de Lisboa. 1-170.

DÜLL, R.:

1983. Distribution of European and Macaronesian liverworts (Hepaticophytina). *Bryol. Beitr.* **2**: 1-115.
1984. Distribution of European and Macaronesian liverworts (Bryophytina). *Bryol. Beitr.* **4**: 1-113.
1984. Computerized evaluation of the distribution of European liverworts. *Journ. Hattori Bot. Lab.*, **56**: 1-5.
1985. Distribution of European and Macaronesian liverworts (Bryophytina). *Bryol. Beitr.* **5**: 110-232.

EGGERS, J.:

1982. Artenliste der Moose Makaronesiens. Cryptogamie, *Bryol. Lichenol.*, **3**: 283-335.

FONTINHA, S. & SÉRGIO, C.:

1995. Conservação da Flora Briológica da Madeira, sítios prioritários. Red Data Book of European Bryophytes. The European Committee for Conservation of Bryophytes, pp: 256-259.

HAMPSHIRE, R. J.:

1984. A study of the vegetation of the Ponta de S. Lourenço in Madeira. Ilhéu Chão and Deserta Grande. *Bol. Mus. Mun. Funchal*, **36** (164): 207 - 226.

HÜBSCHMANN, A.:

1971. Bryosociologische Studien auf der Insel Madeira. *Nova Hedwigia*, **2**: 423 - 467.

HUMPHRIES, C. J.:

1979. Endemism and evolution in Macaronesia. In: Bramwell, D. Plants and Islands. *Academic Press*. London.

KOPPE, F. & DÜLL, R.:

1986. Beitrage zur Moosflora Madeiras. *Bryol. Beitr.*, **6**: 32 - 48.

SÉRGIO, C.:

1985. Notulae Bryoflorae Macaronesicae. I. 1 - Considerações sobre a presença de *Frullania musicola* Stepph. e *Frullania ericoides* (Ness) Mont. nos Açores e Madeira. *Portug. Acta Biol. B.* **14**: 161 - 168.

SÉRGIO, C. & FONTINHA, S.:

1994. Natural and semi-natural Bryophyte Flora of the Coastal Dry Zones of Madeira Island. *Bol Mus. Mun. Funchal*, **46** (254): 95-144.

SÉRGIO, C. SCHUMACKER, R. FONTINHA, S. & SIM-SIM, M.:

1992. Evaluation of the status of the bryophyte flora of Madeira with reference to endemic and threatned European species. *Biological Conservation*, **59**: 223 - 231.

SJOGREN, C. & PEROLD, S.:

1992. A new species of *Riccia* L. from the island of Madeira, *Riccia atlantica*, sp. nov. *J. Bryol.* **17**: 127 - 132.

SLACK, N. G.:

1990. Bryophytes and ecological niche theory. *Bot J. Linn. Soc.*, **104**: 187-213.

TAVARES, C.:

1965. *Ilha da Madeira. O Meio e a Flora.* Rev. Fac. Ci. Lisboa. Sér. 2, **13**(1): 51 - 174.

TABLE 1 - Nomenclature following mostly CORLEY *et al.* (1981, 1991) for mosses and GROLE (1983) for liverworts, and sometimes EGGERS (1982).

Status in Madeira; **E** (Endangered) in danger of extinction: survival unlikely if causal factors continue operating. Includes taxa whose population numbers have been reduced to a critical level or whose habitats or localities have been drastically reduced. Species Known from 2 or less localities in the island; **V**, (Vulnerable) expected to move into category **E** in the near future if the causal factors continue operating, 30 to 50% of the localities or known populations have disappeared. Species known from 3 to 5 localities (with small populations) in the island; **R**, (Rare) taxa localized within restricted geographical areas or habitats, often with small populations, not at present **E** or **V**, but at risk. Species known from 6 to 10 localities (with small populations) in the island. **O**, (Out of danger), species known from more than 10 localities (or with large populations) in the island. **Z** (Insufficiently known), due to lack of information. **Oc-med** - oceanic-mediterranean (including the suboc-med, suboc-submed, oc-submed, -mont); **Med** - Mediterranean (including the med-oc, submed-suboc, c.med, w.submed, w.med); **Temp**- temperate (including the s. temp, n. temp, w. temp and temp-mont); **Mac.** - Macaronesian and Madeiran endemic. Localities where the specimens were collected: P. R. - Pico das Roçadas; P. S. L. Península of Ponta de S. Lourenço; V.C. - Vila do Caniçal; I. D. - Ilhéu dos Desembarcadouros.

TABLE 1			
LIVERWORTS	STATUS	GEOGR.	LOCALITY
<i>Adelanthus decipiens</i> (Hook.) Mitt.	V	euoc	P.R.
<i>Anthoceros punctatus</i> L.	V	oc-med	P.S.L.
<i>Corsinia coriandrina</i> (Spreng.) Lindb.	O	oc-med	P.S.L.
<i>Exomotheca pustulosa</i> Steph.	O	oc-med	P.S.L.
<i>Fossombronia angulosa</i> (Dicks.) Radd.	O	med	P.S.L.
<i>Fossombronia caespitiformis</i> De Not. ex Rabenh.	O	oc-med	P.S.L.
<i>Fossombronia lusnotii</i> Corb.	O	oc-med	P.S.L.
<i>Frullania dilatata</i> (L.) Dum.	O	temp	P.S.L.
<i>Frullania ericoides</i> (Nees) Mont.	O	euoc	P.S.L.
<i>Frullania tamarisci</i> (L.) Dum.	O	euoc	P.R.
<i>Gongylanthus ericetorum</i> (Raddi) Nees	O	oc-med	P.S.L.
<i>Lunularia cruciata</i> (L.) Dum. ex Lindb.	O	oc-med	P.S.L.
<i>Phaeoceros laevis</i> (L.) Prosk.	R	oc-med	V. C.
<i>Riccia atlantica</i> Sérgio & Perold	V	med	P.S.L.-I.D.
<i>Riccia atomarginata</i> Levier var. <i>glabra</i>	E	med	I.D.
<i>Riccia gougetiana</i> Durieu & Mont.	E	med	P.S.L.
<i>Riccia lamellosa</i> Raddi	V	med	P.S.L.
<i>Riccia nigrella</i> DC.	R	oc-med	P.S.L.
<i>Riccia sorocarpa</i> Bisch.	O	temp	P.S.L.
<i>Riccia subbifurca</i> Warnst. ex Crozals.	R	med	P.S.L.
<i>Riccia warnstorffii</i> Limpr.	V	euoc	P.S.L.

TABLE 1			
MOSSES	STATUS	GEOGR.	LOCALITY
<i>Acaulon muticum</i> (Hedw.) C. Muel.	E	temp	P.S.L.
<i>Acaulon triquetrum</i> (Spruce) C. Muell.	E	med	P.S.L.
<i>Aloina aloides</i> (Koch ex Schultz) Kindb.	O	med	P.S.L.
<i>Aloina ambigua</i> (Br. & S.) Limpr.	V	med	P.S.L.
<i>Aloina rigida</i> (Hedw.) Limpr.	V	temp	P.S.L.
<i>Brachymerium notarisii</i> (Mitt.) Schaw = <i>Haplodontium notarisii</i> Mitt.	O	mac	P.S.L.
<i>Bryum argenteum</i> Hedw.	O	temp	P.S.L.
<i>Bryum bicolor</i> complex	O	med	P.S.L.
<i>Bryum capillare</i> Hedw.	O	temp	P.S.L.
<i>Bryum dunense</i> A.J.E. Sm. & Whiteh.	O	oc-med	P.S.L.-I.D.
<i>Bryum gemmiparum</i> De Not. s. lat.	O	oc-med	P.S.L.
<i>Bryum torquescens</i> B. & S.	O	med	P.S.L.
<i>Desmatodon</i> sp.	Z	Z	P.S.L.
<i>Didymodon luridus</i> Homsch. var. <i>luridus</i>	E	med	P.S.L.-I.D.
<i>Didymodon tophaceus</i> (Bird.) Lisa	E	temp	P.S.L.
<i>Didymodon vinealis</i> (Bird.) Zander var. <i>flacida</i>	O	med	P.S.L.
<i>Entosthodon fritzei</i> Geh.	E	mac	I.D.
<i>Epipterygium tozeri</i> (Grev.) Lindb.	O	oc-med	P.S.L.
<i>Fissidens algarvicus</i> Soims.	O	oc-med	P.S.L.
<i>Fissidens coacervatus</i> Brugg. - Nann.	V	mac	P.S.L.
<i>Fissidens viridulus</i> (Sw.) Wahlenb.	O	med	P.S.L.
<i>Funaria hygrometrica</i> Hedw.	O	temp	P.S.L.
<i>Grimmia</i> sp.	Z	Z	P.S.L.
<i>Gymnostomum calcareum</i> Nees & Homsch.	O	med	P.S.L.
<i>Gymnostomum viridulum</i> Brid. = <i>G. luisieri</i> Sérgio	E	oc-med	P.S.L.
<i>Pottia commutata</i> Limpr.	V	oc-med	P.S.L.
<i>Pottia davalliana</i> (sm.) C. Jens. = <i>P. starckeana</i> (H.) C.M. ssp. <i>minutula</i>	V	med	P.S.L.
<i>Pottia davalliana</i> (sm.) C. Jens var. <i>conica</i>	V	oc-med	P.S.L.
<i>Pottia starckeana</i> (Hedw.) C. Muell.	V	med	P.S.L.
<i>Pottia truncata</i> (Hedw.) B., S. & G.	E	temp	P.S.L.
<i>Ptychomitrium nigrescens</i> (Kunze) Wijk & Marg.	O	oc-med	P.S.L.
<i>Rhynchostegium megapolitanum</i> (Web & Mohr) B., S. & G.	O	med	P.S.L.
<i>Scorplurium circinatum</i> (Ric.) Fleisch. & Loeske	O	oc-med	P.S.L.
<i>Tortella flavovirens</i> (Bruch) Broth.	O	oc-med	P.S.L.-I.D.
<i>Tortella nitida</i> (Lindb.) Broth.	O	oc-med	P.S.L.
<i>Tortula atrovirens</i> (Sm.) Lindb.	E	med	P.S.L.
<i>Tortula muralis</i> Hedw. var. <i>muralis</i>	O	temp	P.S.L.
<i>Tortula revolvens</i> (Schimp.) G. Roth.	E	med	P.S.L.
<i>Tortula solmsii</i> (Schimp.) Limpr.	O	oc-med	P.S.L.
<i>Trichostomum crispulum</i> Bruch var. <i>crispulum</i>	O	temp	P.S.L.
<i>Weissia controversa</i> Hedw.	O	temp	P.S.L.
<i>Weissia longifolia</i> Mitt.	E	temp	P.S.L.
<i>Weissia triumphans</i> (De Not.) M. Hill.	E	oc-med	P.S.L.

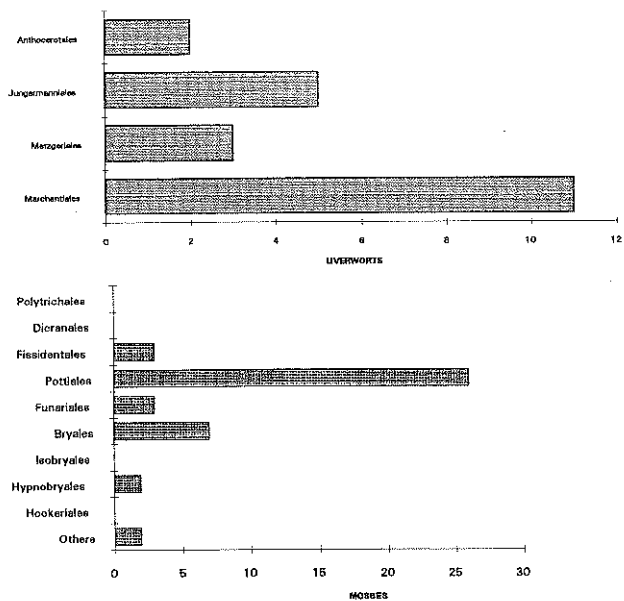


Figure 2 - Taxonomic pattern of the bryoflora, in terms of number of taxa.

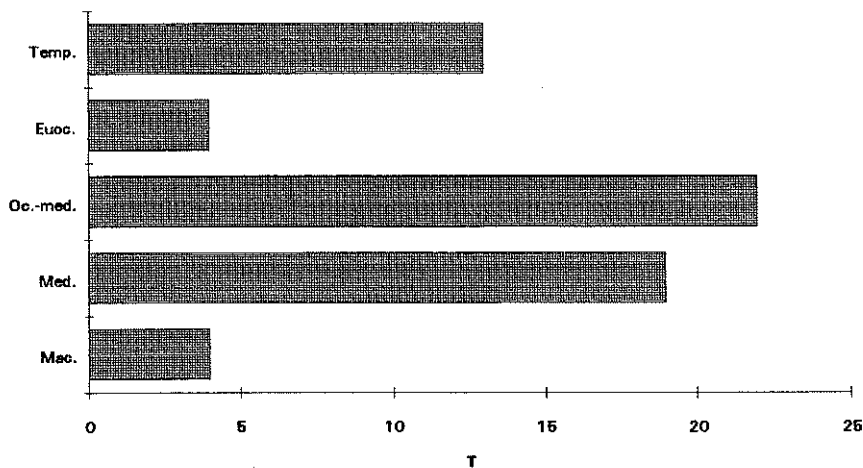


Figure 3 - Total data (T) of the phytogeographic tendency of the bryoflora.