

- 1 -

A GUIDE TO BRYOLOGICAL HOTSPOTS IN EUROPE

ed. by Jan-Peter Frahm

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Preface

Europe, especially Central and South Europe, is largely influenced by man, leaving only few less influenced sites. Most parts are covered by more or less intensive agriculture, more or less natural forests, urban and industrial areas. Even relatively natural regions can have a very different diversity of bryophytes. Many parts are relatively less interesting and curiously, only some places are characterized by an unusual richness of species or by extraordinary species. Reasons for these „hot spots“ are a combination of factors such as climatic reasons, special geological formations or especially phytogeographical reasons such as refugial areas or relict areas. These places need special conservation and need our special attention.

For that reason, an attempt is made to list such localities, similar to the Red Data Book of European Bryophytes (Stewart 1995), but in a more extended way. Such listings bear always the fear of „overcollecting“, but it is hoped that serious bryologists do not collect species like stamps but feel responsible for the protection of species according to the motto, one can only protect what he knows. In general, only locations are included in which no damage can happen to threatened species and sensitive locations will not be included.

The listing can serve by the way as some kind of guide to bryologically interesting places, which does so far not exist. There are geological field guides, those for flowering plants, but not for bryophytes. The problem is often, that someone is spending holidays in some parts of Europe but does not know where to go for bryophytes. This initiative will help to find such places of interest. The idea was derived from the experience of the editor, who has compiled a guide for botanical fieldtrips in the surroundings of Bonn, when he came to Bonn but did not know where to go for fieldtrips. So it is useless, if everybody has to make his often vain experiences. It makes more sense to profit from the experiences of others.

It is hoped that the guide will be completed by more „hot spots“ in the future and extend to a directory of bryologically interesting sites. Therefore any contributions are welcome.

STEWART, N. 1995. Red Data Book of European Bryophytes. European Committee for Conservation of Bryophytes, Trondheim, 291 pp.

Contents

1. The Azores.....	5
1.1 Island of Pico.....	6
1.2 Island of Terceira.....	8

1. The Acores

by Jan-Peter Frahm

The Azores are of bryological interest in many respects: They are young volcanic islands with an age between 4 mio and 40.000 years, are situated in an hyperoceanic environment favouring bryophyte growth, the bryophyte flora is composed of European, Neotropical, African and subantarctic elements, there are about as many bryophyte species as flowering plants, the islands have a comparably high rate of endemic species (on single Azorean islands, all Azorean islands or the Macaronesian islands), and the bryophyte flora gives an impression of the bryophyte flora of continental Europe during Tertiary, since many species such as *Echinodium* spp. or *Andoa berthelotiana*, known as fossils from the Tertiary of continental Europe, survived here the glaciation periods and got extinct in Europe. The main floristic element is the eu-atlantic element, with species which are found else in Ireland, Brittany, western Scotland or the Faeroers.

The most recent checklist of the bryophytes is that by Sjögren (2001). It lists about 430 species.

A main problem are maps. The official topographical maps 1: 50.000 (at a price of 8•) are hopelessly outdated. The actual map from Terceira is from 1965 and includes only a few unpaved roads in the interior but not many forest roads, and even some of the roads in the map apparently did not exist anymore.

SJÖGREN, E. 2001. Distribution of Azorean bryophytes up to 1999, their island distribution and information on their presence elsewhere, including Madeira and the Canary Islands. Boletim do Museu Municipal do Funchal (História Natural) Suplemento No. 7. , Funchal, 89 pp.

1.1 Island of Pico

In the Red Data Book of European Bryophytes (Stewart 1995), the „Montanha de Pico“ is indicated as bryological point of interest. This is probably because of the high altitudinal range, reaching 2351 m at the top of Mt. Pico and the impressive precipitation, ranging from 2650 mm in 350 m altitude to 9793 mm at the top. However, the description is somewhat whitewashed by the authors or misleading. The protected area shall cover 36 km², resembling the Natura 2000 region, which extends over the whole center of the island. It is not identical with Mt. Pico (port. Pico de Pico). Mt. Pico itself is not as interesting. The lower elevations on the W and N side below 1000 m consist mainly of pastures and the higher elevations above 1500 m are rocky areas. At the end of the road leading up Mt. Pico (at the begin of the summit trail) are some fragments of degenerated forest consisting of low *Erica azorea* – *Vaccinium cylindricarpum* shrubs with few single laurel trees (*Laurus azorica*). In general, this site is much drier than other parts of the islands and thus are of less bryological interest. Dry rocks are covered with *Racomitrium lanuginosum* and also *R. fasciculare* and *Campylopus pilifer*, humid bryophyte vegetation is restricted to some depressions with *Campylopus shawii* or few low lava cliffs with *Echinodium*, *Diphyscium foliosum*, *Scapania*, *Myurum hochstetteri* pp. The only densely forested area is the S-slope above the villages of Sao Mateus and Sao Caetano. They consist, however, predominantly of *Pittospermum* forest with dense undergrowth of *Rubus* and the invasive neophyte *Hedychium gardneranum* (Zingiberaceae), are only accessible by a small forest road from Sao Caetano and almost inaccessible. The only interesting area discovered was a forest road leading from the road Sao Mateus – Montanha de Pico at about 600 m elevation to Sao Caetano. It goes the first kilometres on this elevation through pastures and grazed forest fragments, consisting of *Laurus azorica*, *Pittospermum undulatum* and *Myrica faya*. The soil is covered by *Fissidens* spp., *Jubula hutchinsiae*, *Leucobryum juniperoideum*... The stems are densely covered with hepatic crusts of *Lejeunea*, *Microlejeunea*, *Radula*, *Lejeunea*, *Porella* and *Daltonia stenophylla*. On rocks (especially in ravines) are found *Dumortiera hirsuta*, *Fissidens asplenioides*, *F. luisieri*, *Fossombronia angulosa*, *Thamnobryum alopecurum*, *Conocephalum* etc. Species such as *Herbertus azoricus*, *Lepidozia azorica* or *Bazzania azorica* were not found at Mt. Pico as indicated in the Red Data book but only in the eastern part of the island.

More interesting are the highlands of the eastern part of the islands (Zona de Lagoas), in which several forest reserves are situated, interrupted by pastures. This area is accessible by the „Longitudinal“ road from Piedade to the center of the island (road from Lajes to Sao Roque). In contrast to the island of Terceira, all roads are paved and signposts are situated at every crossing making orientation easy. This region is situated in the cloud belt between 700 and 900 m. Although the Zona dos Lagoas is Natura 2000 area, it consists predominantly of pastures. There are some protected forest areas in between (all situated in the eastern part of the island between the Transversal and Piedade), such as the Reserva Florestal Natural do Caveira in about 900 m alt., which consists of very low *Laurus-Juniperus-Ilex-Erica* shrub. The Reserva Florestal Natural de Lagoa de Caiado in about

800 m alt. consists of „tall“ *Laurus-Juniperus-Ilex* forest. All these protected areas as well as some other forest remnants harbour thick hepatic mats on the ground with species such as *Bazzania azorica*, *Herbertus azoricus*, *H. borealis*, *Lepidozia azorica*, *L. pinnata*, *L. reptans*, *Saccogyna viticulosa*, *Calypogeia* sp., *Scapania gracilis*, *Plagiochila bifaria* (*killarniensis*), *Plagiochila* sp., *Tylimanthus azoricus*, *Lejeunea* spp.. The junipers have *Dicranum scottianum* as common epiphyte, the *Erica* shrubs are interwoven by *Frullania teneriffae*. *Laurus* stems and branches are occupied by *Echinodium* and *Myurium*. There are lots of small epiphytes and locally in damp situations such as lava holes epiphylls (for instance *Aphanolejeunea microscopica*). Small temporarily flooded stream beds have *Jungermannia*, *Conocephalum* and *Fissidens* spp. on rocks and *Fossombronias* and *Entosthodon attenuatus* on the banks. Large parts of the forests are overgrown by *Sphagnum palustre* or *subnitens*.

Steep open roadsides are covered by *Phaeoceros*, *Anthoceros*, *Marchantia paleacea*, *Pellia epiphylla*, *Nardia scalaris*, *Pogonatum aloides* with *Entosthodon* and *Fossombronias* species in between. Dripping cliffs are full of *Sphagnum auriculatum*, *palustre*, *subnitens*, *Breutelia azorica*, *Pellia epiphylla*, *Aneura pinguis*, *Riccardia chamaedryfolia*. Lava cliffs bear *Porella obtusata*, *Frullania tamarisci*, *Plagiochila bifaria*, *Herbertus azoricus*, *Echinodium prolixum* and *Myurium hochstetteri*. The „forests“ consists of low *Erica azorica* shrub with few *Laurus azoricus* and *Juniperus brevifolia* treelets in between. Stems and branches are covered with *Myurium* and pendant *Echinodium*, *Plagiochila*, twigs with *Colura calyptifolia*, *Frullania tamarisci*, *Aphanolejeunea*, *Lejeunea*, *Metzgeria leptoneura*, *Radula* etc.. Humic soil at steep slopes are occupied by *Lepidozia pinnata*, *Bazzania azorica*, *Odontoschisma prostratum*, *Pallavicinia lyelli*, *Lophocolea* etc.

The northern part of the island is more covered by forests, mainly *Pittospermum* forests. They are quite dry at lower elevations but there are few places at higher altitudes such as in 600 m altitude along the road Longitudinal – Santa Luzia, which give an rainforest impression. Rocks and rotten wood below the dense fern layer (*Pteris* sp.) are covered with *Cyclodictyon laetevirens* and also *Riccardia chamaedryfolia*, and there are *Plagiochila bifaria*, *Thamnobryum madeirense* (looking like *Poroathamnium* in the tropics), *Porella canariensis*, *Myurium hochstetteri*, *Neckera intermedia*, *Frullanias* and *Lejeuneas* on the stems. Species such as *Tetrastichium virens*, which are found else on the ground, are growing here on trunks. Regretably, also walking through the forest is similar difficult as in real rainforests.

STEWART, N. 1995. Red Data Book of European Bryophytes. European Committee for Conservation of Bryophytes, Trondheim, 291 pp.

1.2. Terceira

The interesting effect on the Azores is that all islands are different in their bryoflora. Species which are found frequently in one island are rare in the other or lack in the third island.

The lower part of Terceira is mostly converted into cattle grassland, some higher parts are also forested with *Cryptomeria japonica*. Of bryological interest is mainly only the central part of the island, which is Natura 2000 protected area. It ranges from Pico Alto in the NE to the Caldera de Guilherme Moniz in the south and includes the volcanic massif of St. Barbara in the west. The best way to discover the eastern part is to take to road from Algar de Carvao to Aqualva. It starts at Algar de Corvao in about 450 m elevation in Erica shrub and leads over 600 m. The road banks are overgrown by masses of *Sphagnum palustre* and *subnitens*. Along the roads are some *Laurus* forest relicts, very dense and steep and almost inaccessible. There are *Bazzania azorica*, *Lepidozia azorica*, *Pallavicinia lyellii*, *Riccardia palmata*, *Herbertus azoricus* in the underground and *Dicranum scottianum*, *Myurium hochstetteri*, *Echinodium prolixum* and *Neckera intermedia* on branches.

The Caldeira de Santa Barbara can be reached by car. The rim is in 1024 m, and the summit area is covered with *Calluna* heath and dwarf forms of *Juniperus brevifolia*. There are large amounts of *Campylopus shawii*, *Sphagnum subnites*, *auriculatum* and *imbricatum*, and this is the only known locality of *Sphagnum nitidulum*. Conspicuous is the occurrence of *Sphagnum monocladum*. The interesting species are found under the juniper shrubs, such as *Breutelia azorica*, *Plagiochila* spp., and the branches of the juniper are densely covered with Frullanias and Lejeuneaceae. Large masses of *Sphagnum* hang down the crater rim. The Caldeira itself is densely covered with *Laurus* forest but not easily accessible.

Other points of interest are the Furnas do Enxofre, fumarols with few but messy bryophytes and warm ground such as *Campylopus cygneus*, *pyriformis*, *incrassatus*, *pilifer*; reddish erect and not prostrate plants of *Odontoschisma prostratum*, *Leucobryum albidum* and again *Sphagnum palustre* and *subnitens*.



Andoa berthelotiana



Bazzania azorica



Breutelia azorica



Campylopus shawii



Dumortiera hirsuta





Echinodium prolixum



Fissidens asplenioides



Fissidens luisieri



Fissidens serrulatus



Fossombronia angulosa



Herbertus azoricus



Jubula hutchinsiae



Leucobryum albidum



Leucobryum junperoides



Marchantia paleacea



Myurium hochstetteri





Pallavicinia lyellii



Philonotis rigida



Plagiochila bifaria



Ptychomitrium nigrescens



Saccogyna viticulosa



Sphagnum



Tetrastichium virens



Thamnobryum madeirense



Tylimanthus azoricus



Sematophyllum substrumulosum



Alophozia azorica



Anomobryum julaceum

