CONTRIBUTION TO THE STUDY OF THE BRYOFLORA OF PICO BRANCO – PORTO SANTO ISLAND

By Carlos Lobo [1]

With 10 figures and 1 table

ABSTRACT. In this study we present data based on inventories of the bryoflora of Pico Branco in Porto Santo Island. A total of 62 *taxa* have been identified, 31 liverworts, 30 mosses and 1 hornwort. Of the total of the inventoried *taxa*, 5 are endemic to Macaronesia and 2 to Madeira Archipelago. Of the species identified, the threat status and phytogeographical distribution is presented and discussed.

RESUMO. Neste trabalho são apresentados dados baseados em inventários da brioflora do Pico Branco na Ilha do Porto Santo. Um total de 62 *taxa* foram identificados; 31 hepáticas, 30 musgos e 1 antocerota. Do total de *taxa* inventariados, 5 são endémicos da Macaronésia e 2 do Arquipélago da Madeira. Das espécies identificadas, o estatuto de ameaça e a distribuição fitogeográfica é apresentada e discutida.

INTRODUCTION

Porto Santo Island is located at approximately 57 Km northeast of Madeira Island. With about 42 Km^2 in area and its highest peak with 512 m, Porto Santo is the second largest island of Madeira archipelago. Its origin is volcanic, being the substrate made up of basaltic rock and areno-calcareous fossiliferous sediments (Carvalho & Brandão, 1991). The relief is much less abrupt than the one existing in Madeira Island and the climate is semi arid (Tavares, 1965).

[1] Jardim Botânico da Madeira, Quinta do Bom Sucesso, 9064-512 Funchal, Madeira, Portugal. E-mail: carloslobo.sra@gov-madeira.pt

In Porto Santo, the vegetation is mostly herbaceous, dominated by annual and biannual plants, and with some scattered shrubs and trees, the latter mostly introduced. Due to the agricultural and industrial exploration of the land in the past, the natural habitats of the island are altered and the indigenous vegetation generally scarce. According to Jardim *et al*. (1998), Pico Branco is considered the only location in Porto Santo Island where the indigenous flora is well preserved, especially on the more inaccessible cliffs on the northern side of the mountain. In that study, the authors showed that the vascular flora of Pico Branco is constituted by 219 *taxa*, 53 of which are endemic. 22 of these are endemic to Macaronesia, 24 are endemic to Madeira archipelago and 7 are exclusive to Porto Santo Island.

In reference to the bryoflora of Porto Santo, not much information is available. Besides the herbarium collections based at the Madeira Botanical Garden herbarium (collection MADS and MADJ), at the Museu Municipal do Funchal Herbarium (collection MADM) and at the Herbarium of the Swedish Museum of Natural History (collection S), ten publications referring to the bryoflora of Porto Santo are found. Of these, one refers to the islets of Porto Santo (Fontinha & Sérgio, 1998), five refer to some species found on this island (Holl, 1830; Schimper, 1868; Gottsche, 1868; Luisier, 1956, Eggers, 1982), three refer to the study of specific bryophyte genus in Madeira Archipelago (Sim-Sim & Sérgio, 1992 – *Frullania* genus; Fontinha, 2004 – *Porella* genus; Luis *et al*., 2005 – *Radula* genus) and only one (Costa & Persson, 1941) refers exclusively to the bryophytes of Porto Santo. Considering the mentioned herbarium collections and literature references, the number of bryophyte species identified to Porto Santo Island and its islets totals 130, of which 76 are mosses, 50 liverworts and 4 hornworts. In reference to the bryophytes existent on Pico Branco, a survey of these sources indicates a total 41 species identified for this peak. Of this value, only 12 species are referenced in the literature, and most of this information dates before 1960.

With this study we present information on the bryophyte species occurring on this peculiar place in Porto Santo Island, and provide a conservational and phytogeographical approach of the bryoflora of Pico Branco and of Porto Santo Island.

MATERIALS AND METHODS

Pico Branco

Pico Branco is located on the north-eastern coast of Porto Santo Island and has its maximum altitude at 450 m (Fig. 1). The top part and most of the northern slopes of the mountain have a light grey colour mostly due to the trachyt and trachyandesit type of basaltic rock (Carvalho & Brandão, 1991) and also due to the high coverage of lichen species, such as *Parmelia* sp. and *Roccella* sp. The mountain is very exposed and sunny, with an annual mean temperature between 17 and 18º C and an annual mean precipitation usually under 400 mm (Atlas do Ambiente, 2003). The south side of Pico Branco is very dry. Here, due

to a strong erosive process and to the conversion of the land for agricultural exploration in the past, the relief is entirely composed of mounts with gentle declivity (Fig. 7). The top and the northern side of Pico Branco are more humid, with cooler temperatures and frequently fustigated by strong winds from northeast. In these areas, especially on the northern slopes of the mountain, the relief is very steep and mostly inaccessible (Figs. 5 & 6).

Although Pico Branco is considered the only place in Porto Santo Island where the natural vegetation is well preserved, still a great part of the mountains' vegetation is altered. As like on most of Porto Santo Island, on the northern and southern slopes of Pico Branco the vascular vegetation is mostly herbaceous, with some shrubs present here and there. The bryophyte cover on these two areas is quite scarce. Most of the species occur in small disperse populations, in the form of small turfs and cushions, and preferably in areas protected from the wind and the direct sunlight, such as the terricolous slopes under the herbaceous cover, under bushes and rocks and in rock fissures (Fig. 10).

On the top area of Pico Branco, the vegetation is quite different from the rest of the mountain. Here we can find some *Erica platycodon* (Webb & Berthel) Rivas Mart. *et al*. ssp. m*aderincola* (D. C. Mc. Clint) Rivas Mart. *et al*. shrubs mixed with a small forest of exotic trees, composed mostly of *Cupressus macrocarpa* Hartw., *Pinus halepensis* Mill and several other *Pinus* species. These arborescent species, as well as most of the tree cover of Porto Santos' peaks, are a result of several reforestation programs carried out by the regional government since early 1900 as an effort to reduce the severe soil erosion problems there existent. On this area of Pico Branco, the bryophyte cover is clearly more significant than on the rest of the mountain. Here many of the terricolous slopes and rocks are frequently covered with many small turfs and cushions of bryophytes and, particularly on the soil under the *Erica* shrubs some species form large mats and wefts (Figs. 8 & 9). On the bark of the base of some *Cupressos macrocarpa* Hartw. trees some bryophytes may also be observed.

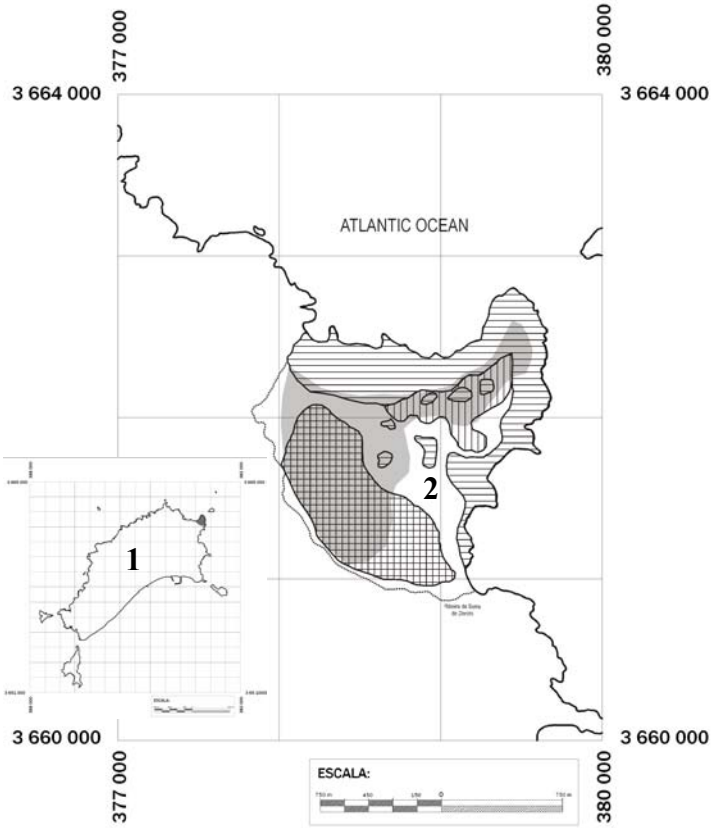
Presently, due to the legal protection of Pico Branco as a site of the Natura 2000 Network, along with the efforts of the technicians of the Direcção Regional de Florestas of the Madeira Government, towards the recovery and expansion of the indigenous flora along Pico Branco, the development of the natural flora is noticeable, especially on the northern side and top of the mountain.

Field work, plant material and nomenclature

Field work was carried out on the south, top and north side of Pico Branco (Fig. 2) between 2007 and 2008. Inventorying was done by collecting samplings of the bryophyte diversity on all substrates. Unfortunately, due to the very inaccessible relief existent on the top and northern side of Pico Branco (Fig. 6), on these areas the inventorying was limited to the areas with a minimum of accessibility. All the samples collected are kept in the Madeira Botanical Garden Herbarium. In addition to the bryophytes resulting from collections of the

field work, herbarium samples placed in the Madeira Botanical Garden Herbarium (collections MADJ and MADS), the Museu Municipal do Funchal Herbarium (collection MADM) and the Herbarium of the Swedish Museum of Natural History (S) were also considered.

The nomenclature of the mosses is in accordance with Hill *et al*. (2006), and of the liverworts and hornwort with Grolle & Long (2000). The phytogeographical affinities are in accordance with Duell (1983, 1984 and 1985) following some adaptations as suggested by Sérgio & Fontinha (1994).



Figs. 1 & 2 - **1** - Porto Santo Island. The shaded area corresponds to Pico Branco. **2** - Zones of vegetation of Pico Branco as described by Jardim *et al*. (1998). Vertical lined area – zone mainly composed by exotic forest; horizontal lined area – zone mainly composed by indigenous plants; crosses lined area – zone mainly composed by abandoned agricultural fields. The shaded areas correspond to the zones where the bryophyte inventories where carried out.

Threat status

To evaluate the threat status in Madeira Archipelago of the species identified on Pico Branco, we classified the species according to criteria used by Sérgio *et al*. (1992) and Sérgio & Fontinha (1994) in similar studies on Madeira Island.

Besides the evaluation of the endangered status in Madeira, we also point out the species included in the Red book of European Bryophytes (EECB, 1995) and their attributed status.

RESULTS

On Pico Branco, a total of 62 *taxa* were registered; 31 liverworts, 30 mosses and 1 hornwort (Table 1). In the liverworts, the most representative family is the Frullaniaceae with 8 species and in the mosses, the Pottiaceae, with 9 species. The bryophyte diversity is clearly higher on the top (39 species) and northern side (25 species) of Pico Branco, in contrast with the 21 species observed on the southern slopes. In general the species *Trichostomum brachydontium* Bruch, *Tortella flavovirens* (Bruch) Broth., *Tortella nitida* (Lindb.) Broth. and *Weissia controversa* Hedw. var. *controversa* were clearly the ones with a higher frequency along the mountain.

The phytogeographic data of the bryoflora of Pico Branco shows a clear predominance of oceanic-mediterranean species, followed by temperate, oceanic and finally mediterranean species (Fig. 3).

Fig. 3 - Phytogeographical tendency of the species identified on Pico Branco. Barred – hornworts; White – liverworts; Black – mosses. Phytogeographical categories considered: Oc – Oceanic; Mac – Macaronesian; Mad – Madeira; Med – Mediterranean; Oc-med – Oceanic-mediterranean; Temp – Temperate.

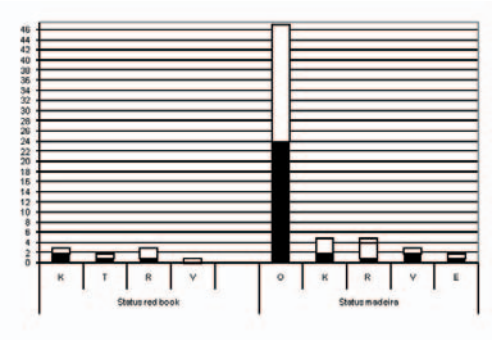


Fig. 4 - European and Regional threat status of the species identified on Pico Branco. Barred – hornworts; White – liverworts; Black – mosses. Categories considered: O – out of danger; K – species considered endangered due to know restricted distribution, but still in need of more data before placed in an other category; T – taxa with taxonomical problems and impossible to consider objectively in the red list; R – rare; V – vulnerable; E – endangered.

Of the total of the inventoried *taxa*, 5 are endemic to Macaronesia (*Frullania polysticta* Lindenb, *Radula wichurae* Stephani, *Fissidens coacervatus* Brugg.-Nann., *Leucodon treleasei* (Cardot) Paris) and *Tortella limbata* (Schiffn.) Geh. & Herzog and 2 to Madeira Archipelago (*Trichostomum contortum* (Kunze) Sérgio) and *Frullania sergiae* Sim Sim *et al*. (Table 1; Fig. 3).

Nine species are included in the European Bryophyte Red List (EECB, 1995); 1 vulnerable (*Radula wichurae* Stephani), 3 rare (*Frullania polysticta* Lindenb, *Fissidens coacervatus* Brugg.-Nann. and *Exormotheca pustulosa* Mitt), another 3 (*Frullania ericoides* (Nees) Mont., *Fissidens curvatus* Hornsch., *Leucodon treleasei* (Cardot) Paris) that are considered endangered due to know restricted distribution, but still in need of more data before placed in an other category, and 2 (*Tortella limbata* (Schiffn.) Geh. & Herzog and *Porella canariensis* (F. Weber) Underw.), which despite some taxonomical problems they are apparently threatened. (Table 1; Fig. 4).

In reference to the threat status of the species on Madeira archipelago, 15 have a significant condition; 2 endangered (*Frullania sergiae* Sim Sim *et al*. and *Didymodon luridus* Hornsch.); 3 vulnerable (*Radula wichurae* Stephani, *Fissidens coacervatus* Brugg.-Nann. and *Microbryum starckeanum* (Hedw.) R. H. Zander); 5 rare (*Phaeoceros laevis* (L.) Prosk., *Lophocolea minor* Nees, *Riccia crozalsii* Levier, *Riccia nigrella* DC. and *Bryum caespiticum* Hedw.) and 5 insufficiently known (*Cephalozia bicuspidata* (L.) Dumort., *Frullania azorica* Sim-Sim *et al*., *Lophocolea heterophylla* (Schrad.) Dumort., *Trichostomum contortum* (Kunze) Sérgio and *Tortella limbata* (Schiffn.) Geh. & Herzog) (Table 1; Fig. 4).

Of the 62 species identified for Pico Branco, 15 were not found during this survey. Of these, 12 were confirmed through the study of previous herbarium collections on Pico Branco, being 8 from collections previous to 1960 (*Corsinia coriandrina* (Spreng.) Lindb., *Frullania sergiae* Sim Sim *et al.*, *Plagiochila punctata* (Taylor) Taylor, *Riccia crozalsii* Levier, *Brachythecium rutabulum* var. *atlanticum* Hedenäs, *Kindbergia praelonga* (Hedw.) Ochyra., *Epipterygium tozeri* (Grev.) Lindb., *Campylopus pilifer* Brid.), 3 after 1960 (*Cephalozia bicuspidata* (L.) Dumort., *Didymodon luridus* Hornsch, *Pleuridium subulatum* (Hedw.) Rabenh.) and 1 from collections previous and after 1960 (*Trichostomum contortum* (Kunze) Sérgio). Three other species result from a bibliographical survey and were not confirmed by observation of herbarium material (*Lejeunea lamacerina* (Steph.) Schiffn. Porto Santo – Pico Branco, colector: Costa & Persson. 1938. (Costa & Persson, 1941); *Lophocolea heterophylla* (Schrad.) Dumort. Porto Santo – Pico Branco, colector: Costa & Persson. 1938. (Costa & Persson, 1941); *Orthotrichum diaphanum* Brid.- Porto Santo – Lombo Branco, col. Nóbrega. (Luisier, 1956).

Figs. 5-10 - **5** - Top of Pico Branco; **6** - Northern side of Pico Branco; **7** - Southern side of Pico Branco; **8** & **9** - Cushions and turfs of bryophytes on the top of Pico Branco; **10** - Moss cushions on the southern part of Pico Branco.

TABLE 1 - List of the surveyed bryophyte species on Pico Branco: the source of the material (Source); species localization on the mountain (Locat.); species phytogeographical tendencies (Geog.); species European (status RB) and Regional (status MAD) threat status. Source of the plant material, categories considered: a – herbarium specimens collected between 1900 and 1960; b – herbarium specimens collected after 1960; c – species collected in this study field work; L1 – bibliographic records dating between 1900 and 1960; L2 – bibliographic records dating after 1960. Localization on mountain, categories considered: s – south side of mountain; t – top of mountain; n – north side of mountain. Phytogeographical categories considered: Oc – Oceanic; Mac – Macaronesian; Mad – Madeira; Med – Mediterranean; Oc-med – Oceanic-mediterranean; Temp – Temperate. European and Regional threat status, categories considered: O – out of danger; T – species which despite some taxonomical problems are apparently threatened; K – species considered endangered due to know restricted distribution, but still in need of more data before placed in an other category; R – rare; V – vulnerable; E – endangered.
* *Frullania sergiae* Sim Sim *et al*. was published after the publication of the Red Data Book of European Bryophytes considered in this paper. Nevertheless, we believe this species to have a category no lower than endangered.

Family	*Taxa*	Source	Locat.	Geog	Status RB	Status MAD.
	Antocerota					
Anthocerotaceae	*Phaeoceros laevis* (L.) Prosk.	b,c	s-t	oc-med		R
	Hepaticae					
Arnelliaceae	*Gongylanthus ericetorum* (Raddi) Nees	b,c	t-n	oc-med		O
Aytoniaceae	*Mannia androgyna* (L.) A. Evans	c	s-n	med		O
Cephaloziaceae	*Cephalozia bicuspidata* (L.) Dumort.	b	n	temp		K
Corsiniaceae	*Corsinia coriandrina* (Spreng.) Lindb.	a	n	oc-med		O
Exormothecaceae	*Exormotheca pustulosa* Mitt	a,b,c	s-n	oc-med	R	O
Fossombroniaceae	*Fossombronia caespitiformis* De Not. ex Rabenh.	c	t	oc-med		O
	Fossombronia husnotii Corb.	c	t	oc-med		O
Frullaniaceae	*Frullania azorica* Sim-Sim, Sergio, Mues & Kraut	c	t-n	oc		K
	Frullania dilatata (L.) Dumort.	a,b,c, L1	t	temp		O
	Frullania ericoides (Nees) Mont.	c	s-t-n	oc	K	O
	Frullania microphylla (Gottsche) Pearson	a,b,c, L1, L2	t-n	oc		O
	Frullania polysticta Lindenb	a,b,c, L1, L2	t	mac	R	O
	Frullania sergiae Sim Sim, Fontinha, Mues & Lion	a		mad	*	E
	Frullania tamarisci (L.) Dumort.	a,c, L2	s-t-n	oc		O
	Frullania teneriffae (F. Weber) Nees	a,c, L1, L2	t-n	oc		O
Geocalycaceae	*Lophocolea bidentata* (L.) Dumort.	b,c	t	temp		O
	Lophocolea heterophylla (Schrad.) Dumort.	L1		temp		K
	Lophocolea minor Nees	c	t	temp		R
Lejeuneaceae	*Cololejeunea minutissima* (Sm.) Schiffn.	a,c	t	oc-med		O
	Lejeunea eckloniana Lindenb.	b,c	t	oc		O
	Lejeunea lamacerina	L1		oc		O
	Marchesinia mackaii (Hook.) Gray	c, L1	t	oc-med		O
Lunulariaceae	*Lunularia cruciata* (L.) Lindb.	c	s	oc-med		O
Plagiochilaceae	*Plagiochila punctata* (Taylor) Taylor	a, L1	t	oc		O
Porellaceae	*Porella canariensis* (F. Weber) Underw.	b,c, L2	t	oc	T	O
Radulaceae	*Radula lindenbergiana* Gottsche ex C. Hartm.	c, L2	t-n	oc		O
	Radula wichurae Steph.	b,c, L1, L2	t	mac	V	V
Ricciaceae	*Riccia crozalsii* Levier	a	t	oc-med		R
	Riccia nigrella DC.	a,c	s-t-n	oc-med		R
	Riccia sorocarpa Bisch.	c	s-t-n	temp		O
Targioniaceae	*Targionia hypophylla* L.	c	s	oc-med		O
	Musci					
Brachytheciaceae	*Brachythecium rutabulum var. atlanticum* Hedenäs	a		temp		O
	Kindbergia praelonga (Hedw.) Ochyra	a		temp		O
	Homalothecium sericeum (Hedw.) Schimp.	a,b,c	t-n	med		O
	Rhynchostegiella litorea (De Not.) Limpr.	a,c	t	oc-med		O
	Rhynchostegium confertum (Dicks.) Schimp.	a,c	t-n	med		O
	Scleropodium touretii (Brid.) L.F.Koch	c	t	oc-med		O
Bryaceae	*Bryum caespiticium* Hedw.	c	s-t-n	temp		R
	Bryum capillare Hedw.	c	s-t-n	temp		O
	Bryum dichotomum Hedw.	c	s	oc-med		O
	Epipterygium tozeri (Grev.) Lindb.	a		oc-med		O
Leucobryaceae	*Campylopus pilifer* Brid.	a		oc-med		O
Ditrichaceae	*Pleuridium subulatum* (Hedw.) Rabenh.	b	s	oc-med		O
Fissidentaceae	*Fissidens curvatus* Hornsch.	a,c	s	oc-med	K	O
	Fissidens coacervatus Brugg.-Nann.	c	n	mac	R	V
	Fissidens bryoides Hedw.	c	s	temp		O
	Fissidens viridulus (Sw. ex anon.) Wahlenb. var. *incurvus* (Starke ex Röhl.) Waldh.	a,b,c	n	med		O
Grimmiaceae	*Grimmia trichophylla* Grev.	c	t	temp		O
Hypnaceae	*Hypnum cupressiforme* var. *resupinatum* (Taylor) Schimp.	a,c	t	oc		O
Leucodontaceae	*Leucodon treleasei* (Cardot) Paris	c	t	mac	K	O
Orthotrichaceae	*Orthotrichum diaphanum* Schrad. ex Brid.	L1		temp		O
	Zygodon rupestris Schimp. ex Lorentz	b,c	t	oc-med		O
Pottiaceae	*Didymodon luridus* Hornsch.	b		med		E
	Microbryum starckeanum (Hedw.) R.H.Zander	b,c	s	med		V
	Tortella flavovirens (Bruch) Broth.	a,c	s-t-n	oc-med		O
	Tortella limbata (Schiffn.) Geh. & Herzog	a,b,c	t-n	mac	T	K
	Tortella nitida (Lindb.) Broth.	c	s-t-n	oc-med		O
	Tortula muralis Hedw.	c	s	temp		O
	Trichostomum brachydontium Bruch	a,c	s-t-n	med		O
	Trichostomum contortum (Kunze) Sérgio	a,b	t-n	mad		K
	Weissia controversa Hedw. var. *controversa*	a,c	s-t-n	temp		O

DISCUSSION

The predominance of oceanic-mediterranean species on Pico Branco reflects a bryoflora well adapted to the dry climatic conditions generally existent along the mountain. Nevertheless, on the top and higher altitude northern slopes of Pico Branco, areas where most of the bryophyte diversity occurs and where their cover is highest, a high number of oceanic and temperate species is also observed. These results reflect a strong atlantic influence on these areas which, *in situ*, is observed by the exceptionally humid conditions there existent.

As a result of this study, 62 species are included in the Pico Branco bryoflora catalogue. This represents an increase of 21 species from the known bryoflora of this peak in Porto Santo, some of which are endemic or present a significant threat status. Although some species previously identified were not found in the field work, we consider possible their existence in the inaccessible areas of the mountain. Seven species are new references to the Porto Santo islands' bryoflora, being the total bryoflora of this island now estimated in 137 species; 80 mosses, 53 liverworts and 4 hornworts.

As a result of the herbarium material study, we came across some plant material collected in Pico Branco by Nóbrega in 1952. This material was identified as *Frullania sergiae* Sim Sim *et al.*, a species endemic to Madeira archipelago. This taxon was first found and described in 2000 from material collected on the Deserta Grande Island of the Desertas sub-archipelago (Sim-Sim *et al.*, 2000). Until now, it has only been known to the Deserta Grande Island where it exists in only four locations. In Pico Branco, despite our recent field work we were not able to locate it in the field. Nevertheless, considering the very inaccessible relief there existent, we agree that it may still subsist there and therefore, a greater inventorying effort is necessary to determine the species present location on Pico Branco and also its possible existence on other coastal areas on Porto Santo Island. In Madeira archipelago, this species is considered endangered (Fontinha *et al.*, 2001).

The species *Radula wichurae* Stephani is endemic to the Macaronesian region. It is included in the Red book of European Bryophytes (EECB, 1995) where it is considered as vulnerable. In Madeira Island, it is very hard to come across, and has only been collected in 5 different locations. Of these, only 2 date after 1950. In Porto Santo island it has been registered in 6 locations (Luis *et al*., 2005), generally restricted to the main mountains of this island, where it is quite common. Although in Madeira Island it is considered an endangered species (Sérgio *et al.*, 1992), in the Madeiran Archipelago it is vulnerable.

The species *Trichostomum contortum* (Kunze) Sérgio), which is endemic to Madeira archipelago, was first described from material collected from Pico Branco in 1830 (Holl, 1830). Since then it has also been recorded in Madeira Island (Sérgio, 1985; Nóbrega, 1990). Presently the validity of this species is not consensus among bryologists and more studies in order to clarify its taxonomical position is needed. Although some authors consider it to be a good species (Sérgio, 1985), others consider it a variation of the very alike species *Trichostomum brachydontium* Bruch (Hill *et al*., 2006; Frey *et al*., 2007), which is wide spread on the madeiran archipelago. During the course of this work, despite our attempts to purposely find *Trichostomum contortum* (Kunze) Sérgio) on Pico Branco, such was not possible. Nevertheless, due to the presence of herbarium material from a recent collection

(MADJ – Nóbrega, 1994) and considering that the plant may still exist along the inaccessible slopes of Pico Branco, we include the species in the list of plants of this place.

Fissidens coacervatus Brugg.-Nann. is a species endemic to Macaronesia which was also found on Pico Branco. At an European level, it is considered rare (EECB, 1995). In Madeira it is vulnerable and according to Sérgio & Fontinha (1994) declining in Madeira Island. On Madeira archipelago, this species has been mostly found in specific habitats along the exposed and drier areas of the islands. In Madeira and Porto Santo islands most of these fragile environments are subject to intense human development, which has lead, and continues to lead, to their disturbing and in more extreme situations to their destruction.

Tortella limbata (Schiffn.) Geh. & Herzog is another species endemic to Macaronesia, where it exists only on Madeira and Canary Archipelagos. According to Cezón & Muñoz (2006), who recently reinstated it, this species was previously known only from the type locality on Grand Canary Island (Canary Islands, Spain) and frequently misjudged as a synonym of *Trichostomum brachydontium* Bruch. It was considered rare by Cezón & Muñoz (2006). In Madeira Archipelago very little information on this species is available. More field work is needed to determine its distribution and present threat status.

Special reference should still be made to the Macaronesian endemic species *Frullania polysticta* Lindenb, which although is not endangered in Madeira archipelago it is included in the Red Data Book of European Bryophytes where it is considered as rare (EECB, 1995), and to other species which though not being endemic to the Macaronesian islands, present a significant European threat status (Table 1; Fig. 5). Of these we focus the rare mediterranean species *Mannia androgyna* (L.) A. Evans and other rare species such as *Frullania ericoides* (Nees) Mont., *Lejeunea eckloniana* Lindenb. and *Fissidens curvatus* Hornsch (EECB, 1995; Sérgio *et al.*, 1994). In addition, on Pico Branco we can still find some species which are considered threatened in Madeira archipelago, those of which we point out *Phaeoceros laevis* (L.) Prosk., *Riccia nigrella* DC., *Microbryum starckeanum* (Hedw.) R. H. Zander and *Didymodon luridus* Hornsch.

CONCLUSIONS

Pico Branco is a special protected area on Porto Santo. Presently it is a place of the Natura 2000 Network under the code name PTPOR0002. Although the mountains' flora has been subjected to profound alterations in the past, many elements of its natural vegetation managed to survive in the more inaccessible areas. The bryoflora of Pico Branco is not vast, but it includes many species that are endemic to Madeira and Macaronesia or that have a significant threat status at a Regional and European level. For this, and due to the peculiar characteristics of the mountain in Porto Santos' social and climatic context, this area is indeed a priority site for *in situ* conservation on this island, not only for vascular plants, but also for bryophytes.

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