PICO BRANCO: A PECULIAR FLORISTIC SITE ON PORTO SANTO ISLAND

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With 1 figure, 2 tables, 2 maps and 9 photos

ABSTRACT. Pico Branco is of particular floristic interest in that of the 219 taxa recorded 24% are endemic species.The endemics include for the first time records for *Heberdenia excelsa* (Ait.) BANKS ex DC. and *Asparagus scoparius* LOWE and earlier records for *Scilla maderensis* Mnzs., *Semele androgyna* (L.) KUNTH and *Tamus edulis* LOWE were reconfirmed. In view of this peculiar diversity the site should be considerate for conservation.

RESUMO. O interesse florístico do Pico Branco é evidenciado pelos 219 taxa inventariados, incluindo 24% de taxa endémicos. São citados pela primeira vez para o Porto Santo os endemismos *Heberdenia excelsa* (Ait.) BANKS ex DC. e *Asparagus scoparius* LOWE, bem como a confirmação de referências antigas de *Scilla maderensis* Mnzs., *Semele androgyna* (L.) KUNTH e *Tamus edulis* LOWE. Atendendo à sua diversidade peculiar o Pico Branco deve ser considerado sítio de conservação prioritário.

INTRODUCTION

Porto Santo Island is located in the eastern Atlantic Ocean between the latitudes 32º59'/33º07' N and the longitudes 16º16'/16º24' W and lies about 60 Km from the NE part of Madeira Island. The total area of Porto Santo, including several islets, is about 42 Km^2 and it is volcanic in origin, characterised by both basaltic and fossiliferous calcareous sediments.

The area has a low annual rainfall, usually less than 400 mm and in some years less than 300 mm. The mean annual temperature is 18ºC, ranging from 13ºC to 25ºC. The

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prevailing NE trade winds influence the climate and just occasionally, hot-dry SE winds from Africa will increase temperatures dramatically. The morphoclimatic aspects of the island give the overall landscape the characteristics of semi-arid regions (CARVALHO & BRANDÃO, 1991).

The island at the beginning of the 15th century was covered with native vegetation and the tree layer mainly consisted of *Dracaena draco* (L.) L., *Juniperus phoenicea* L., *Apollonias barbujana* (Cav.) Bornm. ssp. *barbujana, Sideroxylon marmulano* Banks ex LOWE var. *marmulano, Olea europaea* L. ssp. *maderensis* LOWE and *Erica scoparia* L. ssp. *maderinicola* MCCLINTOCK (FRUTUOSO, 1995 and PEREIRA, 1989).

As a result of settlement by man and the subsequent development for agriculture plus the introduction of exotic species dating from the 18th century (SØNDERGAARD, 1997) the island's vegetation is now quite different. There is now a high degree of soil erosion and this limits the reestablishment of the native flora, however, since 1996 grazing controls have been introduced but rabbits still pose a considerable threat to the native plant cover. There still remains, however, important areas of plant cover, especially on Pico Branco and efforts must made to conserve such areas.

MATERIAL AND METHODS

Pico Branco, has maximum altitude 450 m, is situated in the following UTM square (28S, 1km^2): CB7861, CB7872, CB7961, CB7962.

On the northern slopes, there are steep cliffs which are mainly composed of rocks and a thin layer of soil, all are exposed to wind and rain erosion and landslides frequent. The whitish grey peaks and the tops of Pico Branco are mainly composed by trachyts and trachyandesits (CARVALHO & BRANDÃO, 1991).The southern slopes are more gentle and, exposed to the sun and drier, consequently they have been used exclusively for agriculture and grazing. Some afforestation has been done at the higher levels during the past fifty years (ANDRADA, 1990).

Between 1995-1997 a total of a ten days of field survey were done at different times, especially during the spring months. The areas of study were selected according to their accessibility. The southern slopes of Pico Branco were surveyed from the base to the summit but only parts of northern slopes were surveyed.

All voucher specimens are housed in MADJ and to complement the survey the old records housed at the MADS, MADJ and MADM were examined.

The nomenclature and the distribution of taxa largely follows HANSEN & SUNDING (1993) and sometimes PRESS & SHORT (1994).

RESULTS

The vascular flora is composed by 219 taxa which includes 53 endemic plants, 7

exclusive to Porto Santo, 24 endemic from Madeiran archipelago and the other 22 being Macaronesian endemics (Table 1).

The percentage of endemic plants calculated on the total number of taxa surveyed and reported by us in Pico Branco is 24%, being 11% Madeiran, 10% Macaronesian and 3% Porto Santo's endemics.

The most common families in the study area are the Asteraceae with 31 taxa, including 11 endemics, followed by Fabaceae with 22 taxa and by Poaceae with 20 taxa (Figure 1).

Considering the floristic composition of Pico Branco it was possible to define three zones of vegetation: **a**- mainly composed by indigenous plants; **b**- mainly composed by exotic forest and **c**- mainly composed by abandoned agriculture fields (Map 2 and Table 2).

The zone **a** has the highest number of endemisms (48%) whereas zone **c** has a greater number of taxa but only 14% endemics. In zone **b** the exotic forest species are mainly Cupressaceae and Pinaceae.

Map 1 - PORTO SANTO

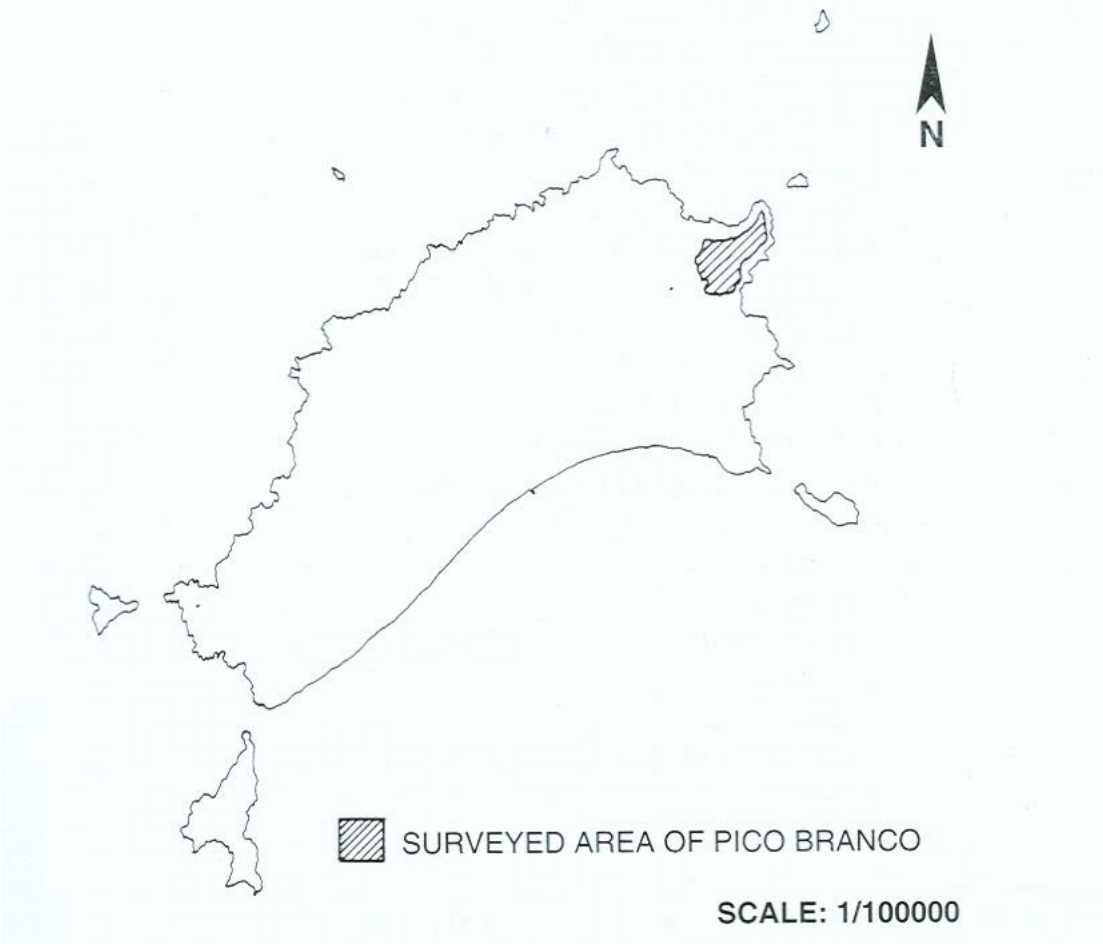


TABLE 1 - Surveyed plants, within each of the three parts (Pteridophyta, Gymnospermae, Angiospermae), organised alphabetically by family.

Family	Taxa	Endemism	Zones
Adiantaceae	*Adiantum reniforme* L. var. *reniforme*		a
Aspleniaceae	*Asplenium billotii* F.W. Schultz		a, b
	Asplenium hemionitis L. var. *hemionites*		a
	Asplenium marinum L.		a
Davalliaceae	*Davallia canariensis* (L.) J.E. Sm.		a, c
Gymnogrammaceae	*Anogramma leptophylla* (L.) Link		a
Hypolepidaceae	*Pteridium aquilinum* (L.) Kuhn		a, b, c
Polypodiaceae	*Polypodium macaronesicum* Bobrov s.l.		a, c
Selaginellaceae	*Selaginella denticulata* (L.) Spring.		a, b, c
Cupressaceae	*Cupressus macrocarpa* Hartw.		b
	Juniperus phoenicea L.		a
Pinaceae	*Pinus halepensis* Mill.		b
	Pinus pinaster Ait.		b
	Pinus pinea L.		b
	Pinus radiata D. Don		b
Aizoaceae	*Aptenia cordifolia* (L. fil.) Schwantes		c
	Carpobrotus edulis (L.) L. Bolus		a, b, c
	Mesembryanthemum crystallinum L.		a, c
	Mesembryanthemum nodiflorum L.		a, c
Apiaceae	*Ammi majus* L.		c
	Apium graveolens L.		c
	Bupleurum salicifolium R. Br. in Buch ssp. *salicifolium* var. *salicifolium*	M. C.	a
	Capnophyllum peregrinum (L.) Lag.	M. C. CV.	c
	Crithmum maritimum L.		a
	Torilis nodosa (L.) Gaertn.		c
Arecaceae	*Phoenix canariensis* Chab.*	C.	c
Asteraceae	*Andryala glandulosa* Lam. ssp. *glandulosa*		a, c
	Artemisia argentea L' Hér.	M.	a, b, c
	Bidens pilosa L.		c
	Calendula arvensis L.		a, b, c
	Carlina salicifolia (L. fil.) Cav. var. *salicifolia*	M. C.	a
	Carthamus lanatus L.		a, c
	Centaurea melitensis L.		c
	Cheirolophus massonianus (Lowe) A. Hans. et Sund.	M.	a
	Cichorium endivia L. ssp. *divaricatum* (Schousb.) Sell		c

* not considered as an macaronesian endemic in the surveyed taxa.

Family	Taxa	Endemism	Zones
	Crepis divaricata (Lowe) F. W. Schultz	M.	a, c
	Crepis noronhaea Babc.	P.	a, c
	Cynara cardunculus L. var. *ferocissima* Lowe		a, c
	Filago pyramidata L. var. *pyramidata*		c
	Galactites tomentosa Moench		a, c
	Gymnostyles stolonifera (Brot.) Tutin		c
	Hedypnois cretica (L.) Dum.-Cours.		a, b, c
	Helichrysum melaleucum Rchb. ex Holl	M.	a
	Helminthotheca echioides (L.) Lack		a, b, c
	Hypochoeris glabra L.		a, b, c
	Leontodon taraxacoides (Vill.) Mérat ssp. *longirostris* Finch et Sell		a, b, c
	Pericallis aurita (L' Hér.) B. Nord.	M.	a, b
	Phagnalon hansenii Qaiser et Lack	M.	a, b, c
	Scolymus maculatus L.		c
	Senecio incrassatus Lowe	M. C.	a, c
	Senecio vulgaris L.		c
	Silybum marianum (L.) Gaertn.		c
	Sonchus asper (L.) Hill ssp. *asper*		c
	Sonchus oleraceus L.		b, c
	Sonchus ustulatus Lowe ssp. *maderensis* Aldr.	M.	a, b
	Tolpis succulenta (Dryand. in Ait.) Lowe	M. A.	a, b, c
	Urospermum picroides (L.) Scop. ex F.W. Schmidt		a, c
Basellaceae	*Anredera cordifolia* (Ten.) Steenis		c
Boraginaceae	*Echium* cf. *nervosum* Dryand.	M.	a
	Echium plantagineum L.		a, c
Brassicaceae	*Capsella bursa-pastoris* (L.) Med.		c
	Coronopus didymus (L.) J.E. Sm.		c
	Crambe fruticosa L. fil	M.	a
	Eruca vesicaria (L.) Cav. ssp. *sativa* (Mill.) Thell.		c
	Erysimum arbuscula (Lowe) Snog.	P.	a
	Matthiola maderensis Lowe	M.	a, c
	Rapistrum rugosum (L.) All. s. l.		c
	Sisymbrium erysimoides Desf.		c
Cactaceae	*Opuntia tuna* (L.) Mill.		c
Campanulaceae	*Wahlenbergia lobelioides* (L. fil.) A. DC. ssp. *lobelioides*	M. C. CV.	a, c
Caryophyllaceae	*Arenaria leptoclados* (Rchb.) Guss.		b
	Herniaria cinerea DC.		a, c
	Polycarpon tetraphyllum (L.) L.		a, c
	Sagina procumbens L.		c
	Silene gallica L.		a, c

Family	Taxa	Endemism	Zones
	Silene vulgaris (Moench) Garcke ssp. *vulgaris*		a, c
	Silene vulgaris (Moench) Garcke ssp. *maritima* (With.) A. et D. Löve		a, c
	Spergularia fallax Lowe		a, c
	Spergularia marina (L.) Griseb.		a, c
	Stellaria media (L.) Cyr.		c
Chenopodiaceae	*Atriplex halimus* L.		c
	Beta maritima L.		a, c
	Chenopodium murale L.		c
	Patellifolia procumbens (Chr. Sm. ex Hornem.) S., F.-L. et W.	M. C. CV.	a, c
Convolvulaceae	*Convolvulus althaeoides* L.		c
	Convolvulus arvensis L. ssp. *arvensis*		c
	Convolvulus siculus L. ssp. *siculus*		c
	Cuscuta approximata Bab.		a, c
Crassulaceae	*Aeonium glandulosum* (Ait.) Webb et Berth.	M.	a
	Aeonium glutinosum (Ait.) Webb et Berth.	M.	a
	Aichryson villosum (Ait.) Webb et Berth.	M. A.	a
	Sedum nudum Ait. ssp. *nudum*	M.	a
	Umbilicus rupestris (Salisb.) Dandy		a, c
Cyperaceae	*Cyperus laevigatus* L. ssp. *laevigatus*		c
Dioscoreaceae	*Tamus edulis* Lowe	M. C.	a
Ericaceae	*Erica scoparia* L. ssp. *maderinicola* McClintock	M.	a, b
Euphorbiaceae	*Euphorbia helioscopia* L.		c
	Euphorbia peplus L.		c
	Euphorbia piscatoria Ait.	M.	a
	Euphorbia terracina L.		a, c
	Mercurialis annua L.		a , c
Fabaceae	*Biserrula pelecinus* L.		c
	Hippocrepis multisiliquosa L.		c
	Lotus argyrodes Murr.	M.	a
	Lotus glaucus Dryand. in Ait. var. *glaucus*	M. C.	a, c
	Lotus loweanus Webb	P.	a, c
	Lotus macranthus Lowe	M.	a, c
	Medicago polymorpha L.		a, c
	Melilotus indica (L.) All.		c
	Ononis dentata Sol. ex Lowe		c
	Ononis diffusa Ten.		c
	Ononis mitissima L.		c
	Ononis serrata Forssk.		c
	Scorpiurus muricatus L. var. *sulcatus* (L.) Fiori		c
	Trifolium angustifolium L.		c

Family	Taxa	Endemism	Zones
	Trifolium campestre Schreb.		c
	Trifolium scabrum L.		c
	Trifolium squarrosum L.		c
	Trifolium tomentosum L.		c
	Vicia costae A. Hans.	P.	c
	Vicia hirsuta (L.) S. F. Gray		c
	Vicia sativa L. ssp. *cordata* (Wulfen ex Hoppe) Batt.		c
	Vicia tenuissima (Bieb.) Schinz et Thell.		c
Frankeniaceae	*Frankenia laevis* L.		a, c
Fumariaceae	*Fumaria muralis* Sond. ex Koch ssp. *muralis* var. *laeta* Lowe	P.	a, b, c
	Fumaria muralis Sond. ex Koch ssp. *muralis* var. *lowei* Pugsley	M. C.	a, b, c
Geraniaceae	*Erodium botrys* (Cav.) Bertol.		c
	Erodium chium (L.) Willd. ssp. *chium*		c
	Erodium cicutarium (L.) L' Hér.		c
	Erodium malacoides (L.) L' Hér.		c
	Erodium moschatum (L.) L' Hér.		c
	Geranium dissectum L.		c
	Geranium molle L.		c
	Geranium purpureum Vill.		c
	Geranium rotundifolium L.		c
Globulariaceae	*Globularia salicina* Lam.	M. C.	a
Hypericaceae	*Hypericum glandulosum* Ait.	M. C.	a, b
Juncaceae	*Juncus acutus* L.		a
Lamiaceae	*Ajuga iva* (L.) Schreb. var. *pseudiva* (DC.) Benth.		a, c
	Calamintha sylvatica Bromf. ssp. *ascendens* (Jord.) P.W. Ball		c
	Marrubium vulgare L.		a, c
	Origanum vulgare L. ssp. *virens* (Hoffm. et Link) Ietswaart		c
	Salvia verbenaca L.		c
	Satureja varia (Benth.) Webb et Berth. ex Briq. ssp. *thymoides* (Sol. ex Lowe) A. Hans. et Sund. var. *thymoides*	M.	a, c
	Siderites candicans Ait. var. *multiflora* (Bornm.) Mend.-Heu.	P.	a, b, c
	Stachys ocymastrum (L.) Briq.		c
Liliaceae	*Asparagus scoparius* Lowe	M. C. CV.	a
	Asphodelus fistulosus L.		a, c
	Scilla maderensis Mnzs.	M.	a
	Semele androgyna (L.) Kunth	M. C.	a

Family	Taxa	Endemism	Zones
Linaceae	*Linum strictum* L.		c
Malvaceae	*Lavatera cretica* L.		c
	Malva parviflora L.		c
Mimosaceae	*Acacia melanoxylon* R. Br.		b
	Albizia distachya (Vent.) Macbr.		b
Moraceae	*Ficus carica* L.		c
Myoporaceae	*Myoporum tenuifolium* G. Forst.		c
Myrsinaceae	*Heberdenia excelsa* (Ait.) Banks ex DC.	M. C.	a
Oleaceae	*Olea europaea* L. ssp. *maderensis* Lowe	M.	a
Orchidaceae	*Gennaria diphylla* (Link) Parl.		a, b
Orobanchaceae	*Orobanche minor* J.E. Sm.		a, c
Oxalidaceae	*Oxalis pes-caprae* L.		c
Papaveraceae	*Papaver rhoeas* L.		c
	Papaver somniferum L. ssp. *somniferum*		c
	Papaver somniferum L. ssp. *setigerum* (DC.) Corb.		c
Plantaginaceae	*Plantago arborescens* Poir. ssp. *maderensis* (Dcne.) A. Hans. et Kunk.	M. C.	a, c
	Plantago coronopus L.		a, c
	Plantago leiopetala Lowe	M.	a
	Plantago ovata Forssk.		a, c
Poaceae	*Aira caryophyllea* L. ssp. *caryophyllea*		a, b, c
	Arundo donax L.		c
	Avena barbata Pott. ex Link		c
	Briza maxima L.		c
	Briza minor L.		c
	Bromus diandrus Roth		c
	Bromus hordeaceus L.		c
	Bromus madritensis L.		c
	Dactylis smithii Link ssp. *marina* (Borr.) Parker		a, b
	Festuca jubata Lowe	M. A.	a
	Hordeum murinum L. ssp. *leporinum* (Link) Asch. et Graebn.		c
	Hyparrhenia hirta (L.) Stapf		c
	Lagurus ovatus L.		c
	Lamarckia aurea (L.) Moench		c
	Lolium canariense Steud.	M. C.	c
	Phalaris brachystachys Link		c
	Polypogon maritimus Willd.		a
	Setaria adhaerens (Forssk.) Chiov.		c
	Stipa capensis Thunb.		c
	Trachynia distachya (Hasselq. ex L.) Link		c
Polygonaceae	*Emex spinosa* (L.) Campd.		c

Family	Taxa	Endemism	Zones
	Rumex bucephalophorus L. ssp. *canariensis* (Steinh.) Rech. fil. var. *canariensis*	M. C. A.	a, b, c
	Rumex pulcher L. ssp. *divaricatus* (L.) Murb.		c
Portulacaceae	*Portulaca oleracea* L.		c
Primulaceae	*Anagallis arvensis* L.		c
Resedaceae	*Reseda luteola* L.		c
Rosaceae	*Chamaemeles coriacea* Lindl.	M.	a
Rubiaceae	*Galium aparine* L.		b, c
	Galium murale (L.) All.		b, c
	Galium verrucosum Huds.		c
	Phyllis nobla L.	M. C.	a, b, c
	Sherardia arvensis L.		c
Sapotaceae	*Sideroxylon marmulano* Banks ex Lowe var. *marmulano*	M. C. CV.	a
Saxifragaceae	*Saxifraga portosanctana* Boiss.	P.	a
Scrophulariaceae	*Bellardia trixago* (L.) All.		c
	Misopates orontium (L.) Raf. var. *orontium*		c
	Scrophularia lowei Dalg.	M.	a
	Verbascum virgatum Stokes		c
Solanaceae	*Hyoscyamus albus* L.		c
	Lycium europaeum L.		c
	Lycopersicon esculentum Mill.		c
	Nicotiana glauca Grah.		a, b, c
	Solanum nigrum L.		c
Tamaricaceae	*Tamarix gallica* L.		a, b, c
Tetragoniaceae	*Tetragonia tetragonioides* (Pall.) O. Kuntze		c
Tropaeolaceae	*Tropaeolum majus* L.		c
Urticaceae	*Parietaria debilis* Forst. fil.		a, c
	Urtica membranacea Poir.		a, b, c
	Urtica portosanctana Press	M.	a, c
	Urtica urens L.		a, c

M.- Madeiran Archipelago; C.- Canary Islands; A.- Azores; CV.- Cape Verde Islands; P. - Porto Santo
a- Zone mainly composed by indigenous plants
b- Zone mainly composed by exotic forest
c- Zone mainly composed by abandoned agriculture fields

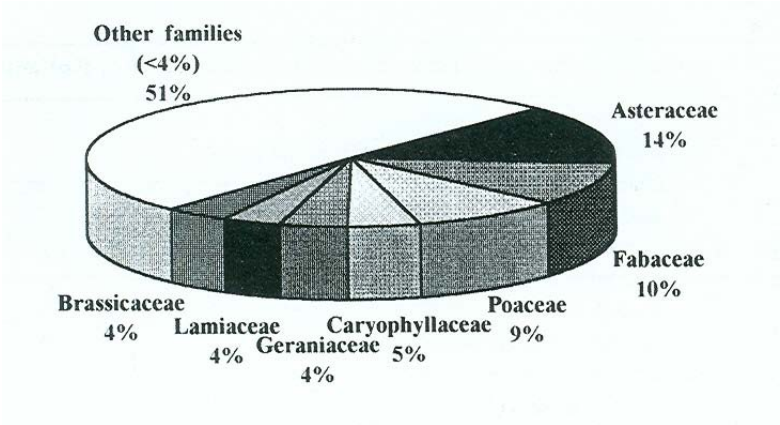


Fig. 1 - Surveyed taxa in terms of percentage of families.

Map 2 - Zones of Vegetation of Pico Branco

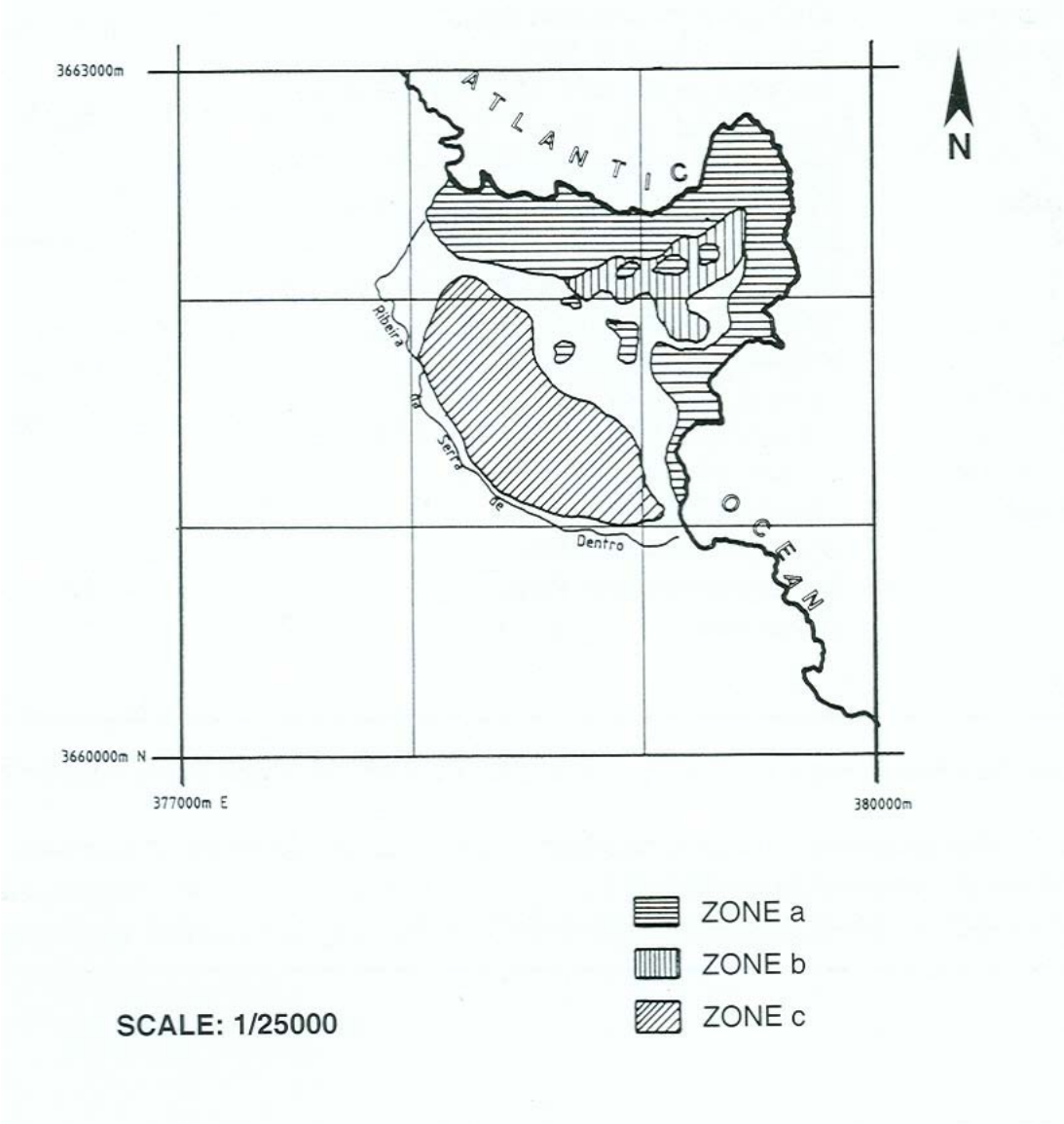


TABLE 2 - Number of taxa and endemisms surveyed in the three zones of vegetation (a, b, c)

Zones	Number of taxa	Number of endemisms		
		Madeiran Archipelago	Porto Santo	Macaronesia
a	105	24	6	20
b	38	5	2	5
c	170	7	5	11

DISCUSSION

The presence of *Asparagus scoparius* (MADJ 8772), *Heberdenia excelsa* (MADJ 8774) and *Bidens pilosa* (MADJ 8755) are first time records of Porto Santo. Furthermore, as *A. scoparius* and *H. excelsa* were discovered in steep inaccessible slopes unfrequented by man these are deemed to be indigenous to Porto Santo.

A relevant note is the confirmation of old records such as *Scilla maderensis* (MADJ 8571, 8733), *Semele androgyna* and *Tamus edulis* (MADJ 8698). *Tamus edulis* was present on Pico Branco, a species considered extinct by VIEIRA (1992) on Porto Santo nor was its occurrence listed by HANSEN & SUNDING (1993) and PRESS & SHORT (1994).

The plant cover of Pico Branco is mainly formed by a herbaceous layer and a sparse distribution of trees and some shrubs on the top. The most important floristic cover is mainly confined to inaccessible places at the top and northern slopes. The shaded rock fissures with a northern aspect have a higher establishment of Macaronesian endemics and also pteridophytes and bryophytes.

As the vegetation of Pico Branco is characterised by the occurrence of some endemic species regarded as restricted to Porto Santo (*Crepis noronhaea, Erysimum arbuscula*, *Fumaria muralis* ssp*., muralis* var. *laeta*, *Lotus loweanus, Saxifraga portosanctana*, *Siderites candicans* var. *multiflora* and *Vicia costae*) the site should be given priority for conservation.

Furthermore, during the last two years we observed an increase on the plant cover of endemic taxa such as *Cheirolophus massonianus*, *Siderites candicans* var. *multiflora* and *Artemisia argentea*.

The presence of native remaining trees such as *Heberdenia excelsa*, *Sideroxylon marmulano, Olea europaea* ssp. *maderensis* and *Juniperus phoenicea***,** associated to other Macaronesian, Madeiran and Porto Santo endemics, as referred above, enable us to consider Pico Branco a priority site for conservation. Pico Branco is already a candidate for the prioritary sites of the Nature 2000, which certainly will contribute for a better implementation of conservation programmes.

We regard that the shruby *Echium* observed at Pico Branco is similar to *Echium* cf. *nervosum*, nevertheless the shape, texture and colour of the leaves as well the colour of the inflorescence are different. A previous observation about the peculiarity of this *Echium* was made by ANDRADA (1974). We also surveyed in Porto Santo the typical forms of *E. nervosum*.

Some exotic woody species surveyed at Pico Branco such as *Cupressus macrocarpa* (dominant species), *Pinus halepensis*, *P. pinaster*, *P. pinea*, *P. radiata*, *Acacia melanoxylon* and *Albizia distachya*, result from afforestation programmes during the 20th. century and enhanced after 1950.

The following species: *Phoenix canariensis*, *Myoporum tenuifolium*, *Aptenia cordifolia* and *Anredera cordifolia*, near to abandoned houses, plausibly were cultivated as ornamental plants.

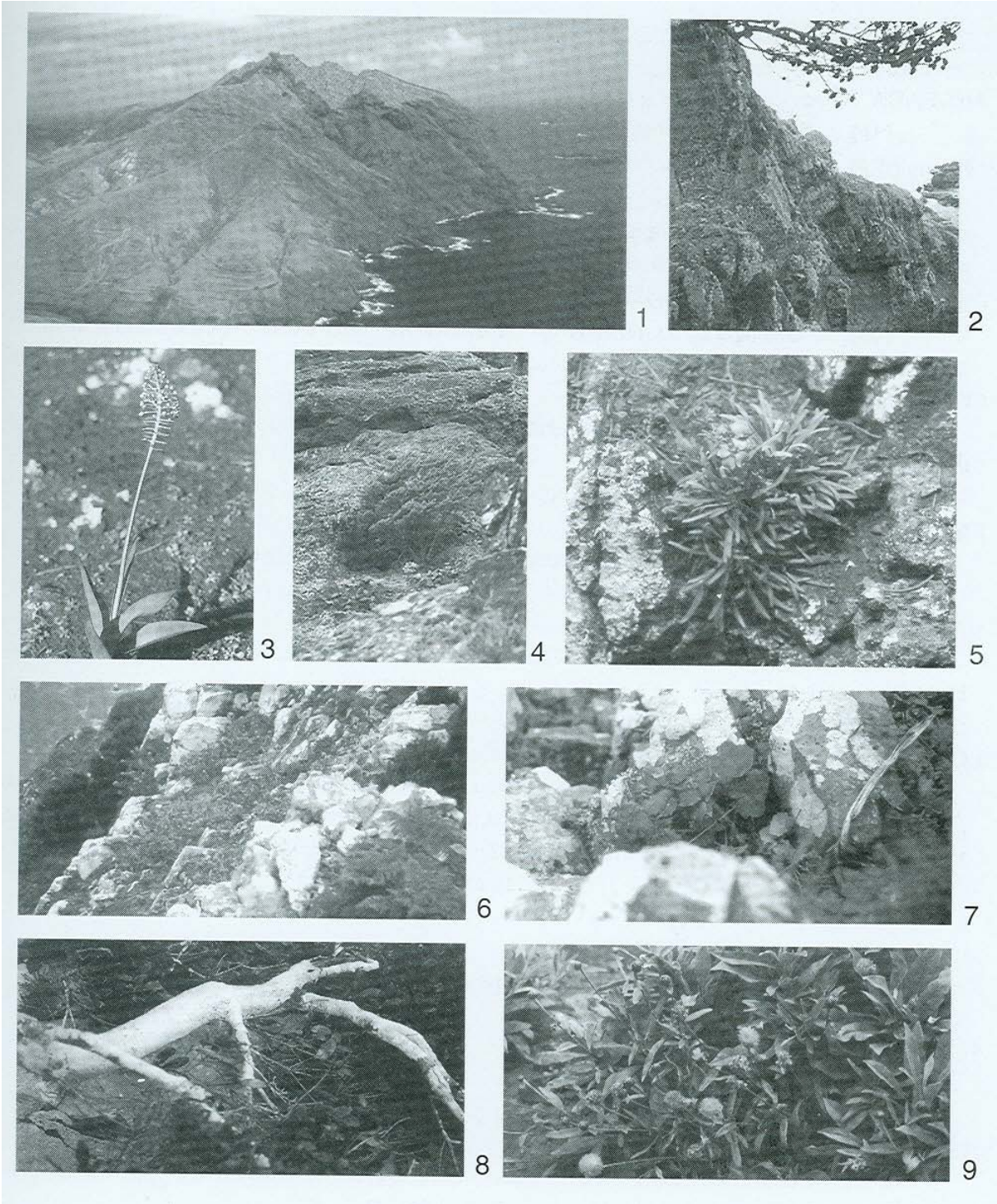
The abandoned agriculture fields are mainly composed by an herbaceous layer, dominated by Asteraceae, Fabaceae and Poaceae species.

The surveyed data with the new records incentive us to continue investigating the peculiar flora of Pico Branco and beside of Porto Santo.

ACKNOWLEDGEMENTS

We would like to thank Mr. A. CORREIA, Mr. L. SILVA, Mr. G. MELIM, Mr. H. FERNANDES and Mr. R. SENA, from Direcção Regional de Florestas (DRF) for the invaluable support during the surveys. We are also indebted to Mr. E. ANDRADA, Mrs. G. FREITAS, Mr. J. GOMES and Mr. M. NÓBREGA for their collaboration.

This work was support financially by DRF from the Secretaria Regional de Agricultura, Florestas e Pescas (Madeira government) and by C.C.B.G. (Centro de Ciências Biológicas e Geológicas da Universidade da Madeira).



1- Pico Branco; 2- *Asparagus scoparius* and *Sideroxylon marmulano* var. *marmulano* in the SE slopes of Pico Branco; 3- *Scilla maderensis*; 4- *Juniperus phoenicea;* 5- *Erysimum arbuscula*; 6- *Echium* cf. *nervosum* in the N slope of Pico Branco; 7- *Tamus edulis*; 8- *Heberdenia excelsa*; 9- *Cheirolophus massonianus.*

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Date received: 05-02-98.