

Some additions to the bryophyte flora of the Azores

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SUMMARY

This paper lists the noteworthy bryophytes collected by the authors in 1980 and 1992 on five of the nine islands of the Azores. Twenty-one species are new to the Azores three of these (*Riccia beyrichiana*, *Dicranella schreberiana* and *Ephemerum cohaerens*) being new to Macaronesia. Reasons are given for regarding *Ptychomitrium azoricum* as a synonym of *P. polyphyllum* and *Tortella cirrifolia* as a variety or subspecies of *T. nitida*.

KEYWORDS: Azores, bryophytes, new records, taxonomy, *Ptychomitrium polyphyllum*, *Tortella cirrifolia*.

INTRODUCTION

The nine islands of the Azores (Fig. 1) are spread through a distance of over 600 km. They are at about the same latitude as Lisbon and rather nearer to Europe than to America. They fall into three groups, eastern, central and western.

Of the two islands of the eastern group the small island of Santa Maria is the only one of the Azores that is not entirely volcanic. It has a little limestone. Its highest point, Pico Alto, is at only 587 m above sea level. São Miguel, in contrast, is the largest of the Azores. It contains Ponte Delgada, the capital, mountains up to 1080 m and a varied scenery of caldeiras, lakes and hot springs. Of the central islands Terceira, the easternmost, reaches an altitude of 1021 m. Pico, the second largest of the Azores, has the highest mountain, reaching 2350 m. Faial is noted for its fine, botanically rich caldeira. We did not visit São Jorge, Graciosa or the two islands (Flores and Corvo) of the western group.

Nearly all the published work on the bryophytes of the Azores has been done by non-residents, and it is scattered through journals from many lands. Nineteenth-century work on the mosses was summarized by Cardot (1897). Major contributions resulted from the prolonged visits in 1937 made independently by Herman and Gurli Persson and by Pierre and Valia Allorge. Fortunately the literature on the bryophytes of Macaronesia was assembled by Eggers (1982) to produce an excellent check-list giving the distribution of all the species and varieties island by island. Repeated visits by Erik Sjögren (1993 and earlier papers) have also added greatly to our knowledge of the bryophytes of the Azores.

São Miguel is the best-worked island, with over 350 taxa listed by Eggers, and, hardly surprisingly, we made very few additions there. Faial and Pico have been less thoroughly

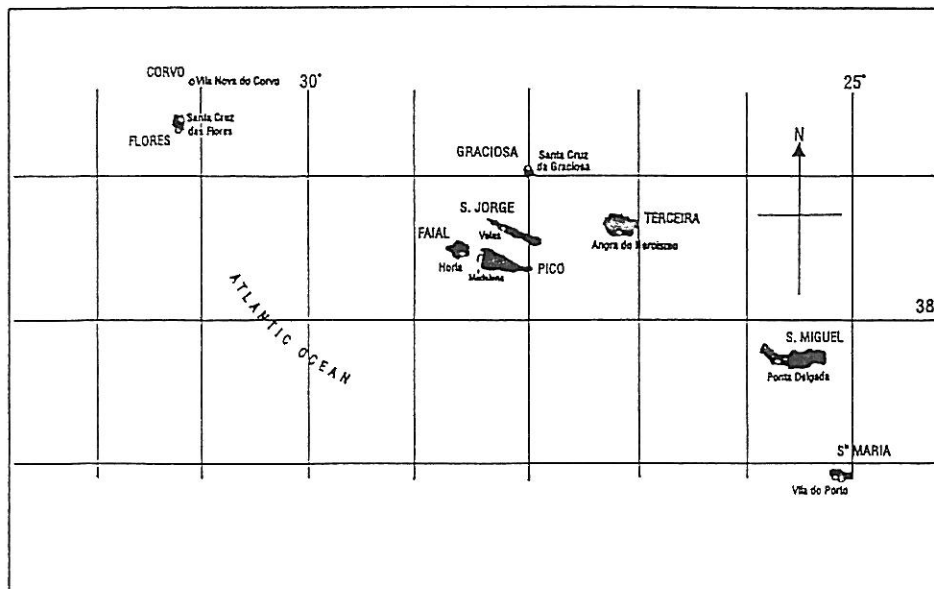


Figure 1. Map of the Azores.

studied and we have added about 30 to each of them. Terceira and Santa Maria were rather poorly known and we have added about 50 species to each. Twenty-one species are new to the Azores and three of these are new to Macaronesia.

Most of the apparent differences between the floras of the various islands are certainly the consequence of differing amounts of fieldwork done in them and of the emphasis by most botanical visitors upon natural vegetation to the neglect of disturbed and artificial habitats. Others result from differences in altitudinal range and to a lesser extent in geology and climate — the rainfall increases to the west. Some differences, however, are probably due to chance. We found the South African *Campylopus flaccidus* on São Miguel, the only island from which it is already recorded, but on none other. The endemic *Breutelia azorica* is common on São Miguel and three islands of the central Azores, but we failed to find it on Terceira from where it is unknown.

The bryophytes listed in this paper were collected by the authors on visits to five of the islands of the Azores as follows:

Faial (Fa.) H.C.G. 12–20 March 1992

Pico (Pi.) H.C.G. 16 March 1992; A.C.C. and R.C.S. 14–18 May 1992

Santa Maria (SMa.) A.C.C. 23 March–1 April 1980

São Miguel (SMi.) A.C.C. and R.C.S. 8–13 May 1992

Terceira (Ter.) A.C.C. 2–10 April 1980; A.C.C. and R.C.S. 19–21 May 1992

We have also included a few records made by the late E. C. Wallace during a visit to Faial on 2–5 June 1981. His specimens, which we have checked, are at Cardiff (NMW). All others are in the collectors' herbaria.

The nomenclature and order of the liverworts follows Grolle (1983), of the mosses Corley *et al.* (1981) with modifications by Corley & Crundwell (1991). Authorities are

cited only for names not in these papers. Records new to individual islands are marked with asterisks. Very few others have been included. Altitudes (abbreviated to 'alt.') are given for localities above 500 m but for very few below. Unless otherwise indicated Terceira records are by A. C. C. in 1980, Pico records by A. C. C. and R. C. S. and Faial ones by H. C. G.

NOTEWORTHY SPECIES COLLECTED

Anthocerotae

Phaeoceros laevis SMA*. Roadside bank, Feteiras. Ter*. Roadside bank, Monte Brasil. Very common on both islands. No monoecious plants were found.

Hepaticae

Targionia hypophylla Pi*. On earth among rocks, roadside bank west of São João.

Reboulia hemisphaerica Pi*. On roadside rocks 7 km east of São Roque. det. D. G. Long.

Lunularia cruciata Pi*. On soil between lava blocks below Santana, near Santo António.

Ter*. Roadside bank, Monte Brasil, male plants.

Riccia beyrichiana Ter*. Rocky seepage area, bank of track, Monte Brasil: bare ground at roadside, Cabrito, Caldeira de Guilherme Moniz. New to Macaronesia. A species of western Europe, extending north to Iceland and southern Norway and in the Mediterranean region east to Yugoslavia. This is an interesting though not surprising extension to its range.

Riccia bifurca Ter*. Waste ground at roadside south of Agualva: on trackway in lava field south of Biscoitos.

Riccia glauca SMA*. Damp soil on path north of Praia. Ter*. On paths and tracks, Monte Brasil and near Biscoitos.

Riccia nigrella SMA*. On thin soil over rocks on path at Anjos: on bare soil in waste ground near the airport.

Riccia sorocarpa SMA*. Waste ground, roadside north of Praia.

Riccia subbifurca Ter*. Tracks and paths, Monte Brasil and near Biscoitos: bare ground at roadside, Cabrito, Caldeira de Guilherme Moniz. Well known from Madeira and the Canaries, but perhaps new to the Azores. Eggers (1982) accepts an unlocalized record by the Allorges in an ecological paper, but there is no mention of this species in their full account (Allorge & Allorge, 1950) of their hepatic collections from the Azores.

Riccardia palmata Pi*. On trunks and roots in scrub west of Lagoa do Caiado, alt. 790 m.

Fossombronia angulosa SMA*. Roadside bank near Almagreira: clearing in forest, Chã de João Tomé. Common on the island.

Fossombronia husnotii SMA*. Roadside banks, Anjos and Ribeira do Engenho: clearing in forest, Chã de João Tomé.

Lophozia incisa Pi*. On bank by stream, Lagoa do Caiado, alt. 770 m. Ter*. On peat, boggy ground by Lagoa do Negro, alt. 540 m.

Mylia taylorii Pi*. With *Lophozia incisa* on bank by stream, Lagoa do Caiado, alt. 770 m.

Jungermannia pumila SMA*. Rocks at roadside, Cruz dos Picos. Ter*. On roadside and lane banks near Fontinhas and Cabrito, Caldeira de Guilherme Moniz; wet rocks near Algar do Carvão.

- Jungermannia gracillima* SMA*. Roadside bank, Ribeira do Engenho.
- Jungermannia hyalina*. On roadside banks. SMA*. Ribeira do Engenho and Pico Alto. Ter*. East end of Serra do Morião; Cabrito, Caldeira de Guilherme Moniz.
- Nardia scalaris* SMA*. On banks by pine plantation north-west of Malbusca and at roadsides at Cruz dos Picos and Ribeira do Engenho.
- Nardia geoscyphus* Ter*. Roadside bank, Cabrito, Caldeira de Guilherme Moniz.
- Marsupella profunda* SMA*. Earthy rock face at roadside, Feteiras. Det. J.A.Paton. New to the Azores. A very rare species otherwise known only from the Canaries (Palma), Madeira, Portugal and south-west England — a remarkably southern distribution for a member of this northern genus.
- Lophocolea bidentata* s.l. Pi*. On rock in open pine forest near São João.
- Plagiochila punctata* Ter*. Trunk of *Cryptomeria japonica* in forest on slopes of Serra de Santa Bárbara, 1992.
- Scapania nemorea* Ter*. On rock in plantation south of Biscoitos: on stones and soil under *Erica azorica* in scrub by road south of Algar do Carvão, 1992.
- Cephaloziella baumgartneri* Ter*. On wall tops, Terreiro dos Padres and north-east of Angra do Heroísmo.
- Cephaloziella divaricata* Ter*. On soil among *Calluna*, Monte Brasil.
- Cephaloziella hampeana* Ter*. On *Sphagnum palustre* on wet slope. Algar do Carvão, alt. 590 m. New to the Azores; known from Madeira and Tenerife.
- Cephaloziella calyculata* SMA*. On soil among rocks. Anjos, det. J. A. Paton; on damp rocks, Feteiras. Perhaps new to the Azores. As with *Riccia subbifurca*, Eggers (1982) accepts an unlocalized record by the Allorges in an ecological paper though this species is unmentioned in the later full account of their hepatic gatherings. It is recorded from four islands in the Canaries.
- Cephalozia bicuspidata* var. *bicuspidata* SMA*. Roadside bank, Ribeira do Engenho. Var. *lammersiana* SMi*. Wet shaded bank near caldeiras, Furnas.
- Telaranea nematodes* SMA*. Bank of forest road, Chã de João Tomé.
- Calypogeia arguta* SMA*. Bank of forest road, Chã de João Tomé.
- Frullania microphylla* SMA*. On planted trees near the airport. On rocks at roadside, Anjos.
- Lejeunea flava* SMA*. On stones of shaded retaining wall, Chã de João Tomé.
- Lejeunea eckloniana* SMA*. In small quantity among *Andoa berthelotiana* on rocks at roadside, Pico Alto. SMi*. On *Pittosporum* trunk by stream. Lagoa das Furnas.
- Aphanolejeunea microscopica* SMA*. On planted trees near the airport.

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- Pogonatum aloides* Pi*. Roadside bank above Lagoa do Caiado, alt. 790 m.
- Atrichum angustatum*. On earthy rocks and on soil. Pi*. Near São Roque. SMA*. Ribeira do Engenho. Ter*. Stream-bed near Agualva; wood north-east of Angra do Heroísmo.
- Archidium alternifolium* SMA*. Rough grazing near the airport.
- Fissidens sublineaefolius* Pi*. Side of wet rock face, Lagoa do Caiado, alt. 790 m.
- Fissidens curnovii* SMi*. On side of fissure in old grassy lava field above Lagoa do Fogo, alt. 820 m.
- Fissidens incurvus* SMA*. Stream-banks, Praia and near the airport.

- Fissidens limbatus* SMA*. Stream-bed, Praia, conf. M. F. V. Corley; on soil under tree roots near Ponte dos Agriões.
- Fissidens exiguus* SMA*. On stone in stream, Feteiras, det. M.F.V. Corley. New to Macaronesia. A rare plant of western and southern Europe and North America.
- Fissidens cristatus* var. *cristatus* Ter*. On top of stone wall near Fontinhas. Var. *mucronatus* Fa*. Caldeira, earth between rocks. Pi*. On soil in abandoned vineyards, Greven.
- Leucobryum juniperoideum* Pi. On rock in secondary woodland. Cabeço da Queimada, south-east of Madalena, c.fr. In the older literature this species, which is generally distributed through the Azores, was often given the name *L. albidum*. There are also many records of *L. glaucum*, which we did not see. We suspect that all these are based on material of *L. juniperoideum*.
- Dicranum scottianum* var. *canariense* (C. Müll.) Corb. Ter*. On *Cryptomeria* trunk by main road south of Altares, alt. 520 m, 1992.
- Microcampylopus laevigatus* SMA*. On damp soil in forest clearing. Chã de João Tomé. Fa*. Caldeira, path around caldeira; Pedro Miguel, steep earth slope.
- Dicranella schreberiana* Ter*. Roadside bank below Furnas do Enxofre, alt. 550 m; side of pit, roadside at east end of Serra do Morião, alt. 400 m, both c.fr. New to Macaronesia. This was mentioned by Düll (1992) who corrected a previous erroneous record. A circumboreal species, rather northern in distribution and perhaps unlikely to be found near sea level in the Azores.
- Dicranella heteromalla* SMA*. Bank of forest road, Chã de João Tomé.
- Pseudephemerum nitidum* Ter*. In grass ley near Fontinhas.
- Ditrichum pallidum* SMA*. Roadside bank. Ribeira do Engenho; on damp soil in forest clearing, Chã de João Tomé. Ter*. Bare soil in rough grazing north-east of Angra do Heroísmo.
- Pleuroidium acuminatum* Ter*. On soil among heather, Monte Brasil; roadside bank south of Aqualva.
- Tortula canescens* SMA*. On bare soil on waste ground near the airport. New to the Azores, though known from Madeira and the Canaries.
- Tortula cuneifolia* Fa. Castelo Branco, compressed soil.
- Tortula vahliana* Fa*. Horta, steep slope along coast. New to the Azores, but already known from the Canaries.
- Tortula laevipila* Ter*. Trunks of trees in Praça Velha, Angra do Heroísmo.
- Tortula muralis* Pi*. On concrete margin of pond near Madalena.
- Tortula revolvens* Fa*. On rock in ravine east of Horta, Wallace. New to the Azores, previously recorded from the Canaries.
- Aloina ambigua* SMA*. Waste ground near the airport.
- Aloina rigida* Fa*. Capelo, old mortared wall. New to the Azores, though known from Madeira and the Canaries.
- Desmatodon bogosicus* SMA*. Roadsides near Praia. Ter*. Damp soil at foot of wall, São Bartolomeu. New to the Azores, known previously from the Canaries, Sudan, Ethiopia, Kenya and S. Africa.
- Pottia truncata* SMA*. Rough grazing near the airport; on soil among rocks at Anjos; roadside north of Praia. Ter*. On soil on rock near Biscoitos.
- Phascum leptophyllum* C. Müll (*Chenia rhizophylla* (Sak.) Zander). Pi*. On farm track S.E. of Madalena. SMA*. On waste ground near the airport and by roadside north of Praia. Tel*. On soil by path at Monte Brasil and at foot of wall. São Bartolomeu.

- Fa*. Horta, abundant on compressed soil in park and harbour. New to the Azores; previously known from Tenerife. Arts & Sollman (1991) have shown convincingly that *Chenia rhizophylla* is a synonym of *Phascum leptophyllum*, described from South Africa, and figure and describe the sporophyte. This weedy species has a mediterranean-subtropical distribution pattern and is almost cosmopolitan.
- Barbula unguiculata* Ter*. Rocks at roadside, Monte Brasil; by path in *Erica* scrub by road south of Algar do Carvão, 1992.
- Barbula convoluta* Ter*. Frequent on bare ground and on wall tops.
- Barbula revoluta* Fa*. With *Didymodon luridus* on rocks by stream east of Horta, Wallace; old mortared wall, Pedro Miguel. New to the Azores, but known from Madeira and the Canaries.
- Leptobarbula berica* Fa*. Horta, Cedros, Pedro Miguel and Ramado, all on old mortared walls in the villages.
- Didymodon acutus* Fa*. Concrete block near entrance tunnel to caldeira, alt. 900 m.
- Didymodon luridus* Fa*. On rocks by stream east of Horta, Wallace. Old mortared walls, Cedros and Pedro Miguel. SMA*. Roadside near the airport. Ter*. On top of stone wall, Terreiro do Padres.
- Didymodon rigidulus* Pi*. Cabo da Serrata, concrete block on roadside, alt. 500 m, Greven. New to the Azores. Already known from Madeira and the Canaries.
- Bryoerythrophyllum inaequalifolium* Ter*. On track near Biscoitos, Pi*. On farm track south-east of Madalena. New to the Azores but known from the Canaries and (previously unpublished) from Madeira (on bare soil by pipeline south-west of reservoir near Rabaçal, alt. 1150 m R.C.S., 1993). A much overlooked species, widely distributed in the warmer parts of the world.
- Eucladium verticillatum* Ter*. Underside of bridge over stream near Agualva.
- Gyrowesia tenuis* Fa*. Pedro Miguel, old mortared wall in village, alt. 300 m.
- Gymnostomum calcareum* SMA*. Side of building, S. Lourenço. Ter*. Side of wall, São Bartolomeu. Fa*. Pedro Miguel, mortared wall in village. Horta, mortared wall in town.
- Gymnostomum viridulum* Brid. SMi*. On concrete at roadside, Vista do Rei. On stone steps and stone walls in the neighbourhood of Furnas, where rather frequent, conf. H. L. K. Whitehouse. New to the Azores, but not unexpected as known from several localities in Madeira and the Canaries (Whitehouse & Crundwell, 1992).
- Trichostomum crispulum* Fa*. Pedro Miguel, shaded mortared wall.
- Pleurochaete squarrosa* Pi*. Stony ground at roadside between Monte and Candelária.
- Tortella cirrifolia* SMA*. Ter*. Frequent on roadside rocks and on walls on both islands. Recorded previously only from Pico, Madeira and Tenerife. Luisier (1930) compared it with *T. flavovirens*: '*T. cirrifolia* est voisin de *T. flavovirens* mais les feuilles sont beaucoup plus étroites et les cellules hyalines de la base beaucoup moins distinctes'. Anatomically however, it is closest to *T. nitida*. In *T. flavovirens* the transition from the elongate hyaline smooth cells of the leaf base to the quadrate chlorophyllose papillose cells of the upper part of the leaf is a sharp one with rarely more than five intermediate cells in any one row, even in the neighbourhood of the midrib. In *T. nitida* on the other hand there is in each cell row a long band of intermediate thick-walled, slightly elongate cells, only occasionally at the extreme margin of the leaf the transition being sharp. In most leaves of *T. cirrifolia* the transition is sharp for a slightly longer way in from the margin, but near the midrib there is a large area of intermediate cells as in *T. nitida*.

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Typical *T. cirrifolia* is distinguished from *T. nitida* also by its long narrow leaves, but occasional plants have them shorter and it is possible that it is best regarded as a subspecies or variety of *T. nitida*. *T. nitida* var. *irrigata* Winter from Tenerife, discussed by May (1986), may be the same thing.

Tortella flavovirens Pi*. On rocky ground by the sea, Lajes, with old setas, and Porto Cachorro. Ter*. Lava wall by sea, Porto do Biscoitos. Fa*. Castelo Branco, compressed soil along coast.

Timmiella barbuloidea Pi*. São Caetano, along Riba Nova, alt. 100 m, *Greven*.

Ptychomitrium polyphyllum. Common on all islands visited, often as the form named *P. azoricum* (Card.) Par. Cardot (1897) himself had reservations about the status of this taxon for he followed his description with: 'May be considered as a subspecies of *G. polyphyllum* Mitt., from which it differs in the smaller sizes, the shorter and less aggregated pedicels, the smaller capsules and the narrower, entire or less denticulate leaves'. Düll (1992) considered the 'azoricum expression' restricted to Spain and Macaronesia and to be worthy of at least varietal status. Yet plants with the *azoricum* characters even more pronounced than in Cardot's excellent figures occur, though not commonly, in Scotland, where no-one has ever thought of them as having any taxonomic significance. As depauperate plants they are under-represented in herbaria.

Ptychomitrium nigrescens Pi*. Wall, Santana.

Funaria hygrometrica Ter*. Side of track, Monte Brasil; on rock in waste ground near Angra do Heroísmo.

Entosthodon obtusus. SMA*. On banks near the airport and north-west of Malbusca. Fa*. Caldeira, bare soil, alt. 800 m. All Macaronesian plants seen are rather smaller than most British ones and their spores are a good deal smaller than indicated by Smith (1978), suggesting at first that they might belong to a different taxon. However, spore sizes from various Macaronesian gatherings range from 20–22 μm to 28–31 μm and in British specimens examined from 22–24 μm to 31–37 μm . Smith gives 30–38 μm which understates the variation. Loeske (1914) gave 25–40 μm .

Ephemerum cohaerens Fa*. Ponta de Castelo, loamy soil along the coast. This genus is new to Macaronesia. One of the more southerly European species, known also from Turkey and North Africa.

Pohlia annotina. At roadsides. Pi*. Cerrado de Sonices, alt. 790 m. SMA*. Ribeira do Engenho and Feteiras.

Anomobryum julaceum Pi*. On rocks in ravine, Terra do Pão, near São Caetano, alt. 60 m. On soil by road just west of Lagoa do Caiado, alt. 750 m.

Bryum donianum SMA*. On side of rock by stream near the airport.

Bryum capillare Pi*. On rocks at roadside, Porto Cachorro, and in *Pinus* forest near São João.

Bryum canariense Pi*. On walls, road south-east of Madalena, and at Santano, near Santo António.

Bryum pseudotriquetrum SMA*. On rocks at roadsides in several places, mostly sterile but with female inflorescences between Almagreira and Ribeira do Engenho.

Bryum dunense SMA*. Roadside bank between Almagreira and Ribeira do Engenho; waste ground, São Lourenço. A recently described species known from the Canaries but not previously reported from the Azores.

Bryum radiculosum SMA*. In turf at roadside, Praia. Ter*. On wall north-east of São Bartolomeu. Frequent on both islands.

- Bryum ruderale* SMA*. On site of fire, waste ground near the airport. Ter*. On banks, Monte Brasil and (1992) Vila Nova. Fa*. Horta, compressed soil in park near harbour. New to the Azores. but known from the Canaries.
- Bryum sauteri* SMA*. Edge of path in woodland N.W. of Malbusca. SMi*. On rock in stream-bed, Lagoa das Furnas. New to the Azores. Previously recorded from Tenerife.
- Bryum tenuisetum* SMA*. On bare soil, waste ground near the airport. New to the Azores. A rather northern species but present in Tenerife.
- Bryum microerythrocarpum* C. Müll. & Kindb. Ter*. Bare soil in rough grazing north-east of Angra do Heroísmo. New to the Azores, but recorded from the Canaries.
- Bryum rubens* SMA*. Waste ground, Feteiras. Ter*. Roadside bank south of Agualva. Frequent on roadside banks, on waste ground and on bare patches in pasture. New to the Azores but recorded from Madeira and the Canaries.
- Philonotis fontana* Ter*. On trackway in lava field south of Biscoitos.
- Zygodon viridissimus* Pi*. Fallen tree near Quinta das Rosas.
- Zygodon conoideus* Ter*. On tree trunks in wood north-east of Angra do Heroísmo. Fa*. Ribeira Funda. on trunk of *Laurus*, alt. 500 m.
- Orthotrichum diaphanum* Ter*. Trunks of trees in Praça Velha, Angra do Heroísmo. 1992.
- Murium hochstetteri* Smi. Fruiting on a trunk of *Ginkgo biloba* in Terra Nostra Park, Furnas, and in several other places.
- Daltonia splachnoides* Fa*. Richly fruiting on twigs in *Hydrangea* hedgerows along the road to the caldeira. many localities from 600–800 m.
- Thmnbryum maderense* (Kindb.) Hedenäs. Pi*. On rock in secondary *Laurus* woodland. Cabeço da Queimada, south-east of Madalena, conf. L. Hedenäs.
- Heterocladium wulfsbergii* Pi*. Mistério do Prainha, shaded rock in river bed. *Greven*. This species is not recorded from Macaronesia by Eggers but Hedenäs (1992) reported it from Madeira and, without giving localities, from the Azores and Canaries. There are many reports of *H. heteropterum* from Macaronesia but Hedenäs suspected that they were all based on *H. wulfsbergii*.
- Amblystegium riparium* Ter*. Waste ground on roadside south of Agualva.
- Drepanocladus fluitans* Pi*. Boggy ground by small lake 2 km east of Lagoa do Caiado, alt. 750 m.
- Hygrohypnum luridum* Ter*. Rocks in stream-beds, Agualva and S. Bras; Serra de Santa Bárbara. 1992.
- Brachythecium ruabulum* SMA*. Ter*. On rock in ravine, Praia. Ter*. Wall top, São Bartolomeu. Frequent on both islands on walls, rock and tree stumps.
- Brachythecium populeum* SMA*. On rocks at roadside, Pico Alto.
- Rhynchostegium riparioides* Ter*. On concrete embankment in stream above Agualva, 1992.
- Rhynchostegium confertum* Pi*. On rock in pine forest near São João.
- Rhynchostegium megapolitanum* Ter*. On farm track, São Bartolomeu. Pi*. Footpath in Madalena. *Greven*.
- Eurhynchium meridionale* SMA*. On wall between Almagreira and Ribeira do Engenho. Pi*. Rocky ground in scrub near Quinta das Rosas, alt. 160 m.
- Hypnum julandicum* SMA*. Roadside bank between Ponte dos Agriões and Cruz dos Picos.
- Hylocomium brevirostre* Fa*. Road to caldeira, alt. 800 m.

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