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## THE GENUS *ISOETES* (ISOETACEAE: PTERIDOPHYTA) IN MALLORCA, BALEARIC ISLANDS

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Key words: Quillwort, *Isoetes histrix*, *Isoetes duriei*, distribution, conservation.

### ABSTRACT

The distribution and previously confused recording history of the genus *Isoetes* on Mallorca, Balearic Islands, is documented and clarified. Two species, *I. duriei* and *I. histrix* are confirmed as present.

### INTRODUCTION

The genus *Isoetes* is widely but discontinuously distributed around the Mediterranean region. The most abundant and widespread are the terrestrial species of the *Isoetes histrix* Bory aggregate; *I. histrix* s.stricto and *I. duriei* Bory. Within the Balearic Islands the presence of *I. duriei* and another circum-mediterranean species *I. velata* A. Braun have long been recorded on the most easterly, Menorca (e.g. Knoche, 1921). It is, however, only comparatively recently that the genus has been discovered on the largest island of the group, Mallorca. Duvigneaud (1971) was the first to report *I. duriei*, from the Clot d'Albarca, the only mention of the genus cited by Bonafè Barceló (1977) in his flora of the island. Castroviejo *et al.* (1986) follow these authors in listing *I. duriei* as the only quillwort species on Mallorca but record they have not seen material, basing the record on Duvigneaud (1979). Subsequently, Rossello and Alomar (1987) reported the morphologically similar *I. histrix* from the same locality cited by Bonafè Barceló (1977) for *I. duriei*, growing on "terrenos arcillosos triásicos del Clot d'Aubarca (DE80), 450 msm, - en sitios húmedos y a veces periódicamente encharcados junto al torrente, raro". In this brief note they do not mention the earlier record of *I. duriei* from this area. Bolòs & Romo (1991) under *I. duriei* dismiss the Mallorcan record of this taxon as *I. histrix* var. *desquamata* R. Br. and list *I. histrix* as Menorcan for the first time. Beckett (1993) followed this view stating under *I. histrix* "recorded previously as *I. duriei*, but recently identified at the University of the Balearic Islands as *I. histrix*". Most recently, in their catalogue of the plants of the Puig Major region, Sáez i Goñalons and Vicens i Fandos (1997) repeat the suggestion that earlier records of *Isoetes* from the Clot d' Albarca refer to *I. histrix*.

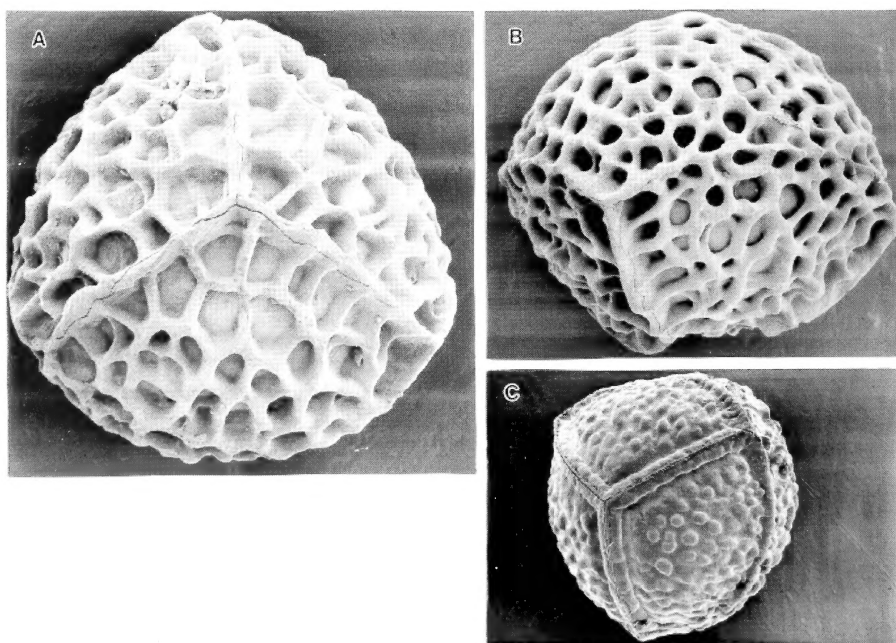
### OBSERVATIONS

The first author (FJR) became acquainted with the genus in Mallorca when searching for material at the request of Dr. Elspeth Beckett who was then producing an illustrated flora of the island. A search of the Clot d'Albarca in the company of Dr. Beckett and S. Rumsey in early May 1990 revealed a small number of plants about to aestivate in the silty gravel at the edge of a seasonal stream. One of these plants was collected, depicted by Beckett (1993) and the specimen lodged at RNG. By its megaspore size and ornamentation it was clearly referable to *I. histrix*. During a

survey of scarce and hybrid fern taxa on Mallorca in April 1999 the first two authors re-visited the Clot d'Albarca with the aim of refinding *I. histrix* and establishing that the earlier reports of *I. duriei* were indeed erroneous.

### RESULTS

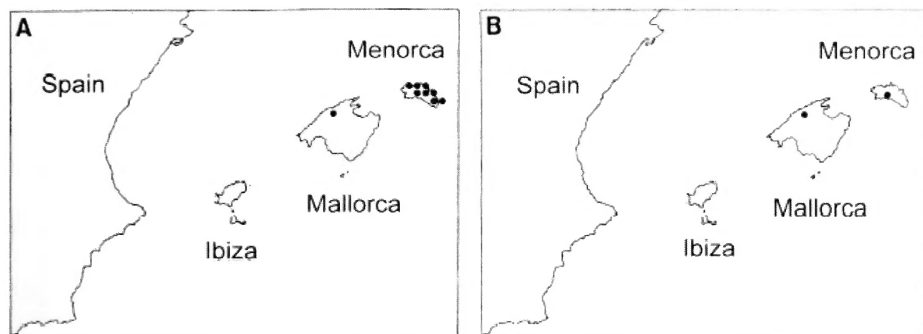
Plants were located in considerable quantity but in a different location (although within c. 500m) and habitat to the earlier find by FJR. Whereas previously the plants had been seen in a seasonal stream bed, the new site was in a sheep-grazed field, bordered on one side by the stream which, further down the valley, had supported the small 1990 population. The majority of plants occurred in those areas where the stony clay soil retained most moisture, visible as slightly lower-lying depressions with a sparser vascular plant cover and greater bryophytic representation. In the field it was assumed that a single taxon was present and a random representative sample of ten plants was collected. These were then to be grown on for cytological investigation and the establishment of experimental protocols for allozymic analysis of genetic diversity.



**Figure 1.** A. Megaspore of *Isoetes duriei* (Clot d' Aubarca, Mallorca). Proximal surface showing character of the triradiate aperture and the distinctive, coarsely-reticulate ornamentation, x 100. B. Megaspore of *Isoetes duriei* (Clot d' Aubarca, Mallorca). Lateral view, x 100. C. Megaspore of *Isoetes histrix* (Clot d' Aubarca, Mallorca). Proximal view. Note prominence of the apertural arms = triradial ridge (laesurae), tuberculate ornamentation, and thickened equatorial ridge (cingulum), x 100.

On return to the laboratory it became obvious, however, that the collection actually represented a mixed gathering of two taxa, with both *I. histrix* and *I. duriei*

present. The latter could clearly be separated by its larger megaspores, approximately twice the size of those of *I. histrix*, a difference visible to the naked eye. Under the microscope the distinctly different megaspore ornamentation, coarsely reticulate (*I. duriei*) as opposed to tuberculate (*I. histrix*) is readily apparent (Fig. 1). Upon excavation the distinctive persistent leaf bases from which *I. histrix* has derived its specific epithet were apparent on some but not all of the plants identified by megaspore characters as *I. histrix*. The distribution of these two taxa within the Balearic Islands can therefore be revised and is illustrated in Figure 2.



**Figure 2.** Distribution in the Balearic Islands of **A** *Isoetes duriei*; **B** *Isoetes histrix*.

Of the ten randomly selected plants, four were *I. duriei*, which showed the most obvious megasporophyll development/ripeness when collected. Megasporophyll maturation may routinely be earlier in the polyploid *I. duriei* than in *I. histrix*; however, further phenological observation is necessary. None of the *I. duriei* plants had mature or even developing microspores when collected. Manton (1950) noted that in this genus, as in other heterosporous pteridophytes, megasporangial production precedes that of the microspores. If true in these terrestrial species, in the Mallorcan site the microspores must be produced very late in the growing season, shortly preceding aestivation. The vast majority of the sporophylls were devoted to megasporangial production but the ratio of male to female gametophytes may be almost equal, given the magnitude of the corresponding structures. Neither species has the ability to propagate or disperse asexually. Therefore their local abundance, with the presence of plants of varied stature, hence age, including some very small individuals, would indicate healthy populations with regular sexual reproduction.

### DISCUSSION

The identity of terrestrial *Isoetes* on Mallorca has been confused due to the gross morphological similarity of the two species. Whilst ecologically similar, *I. histrix* and *I. duriei* have rarely been reported to grow intermixed. Akeroyd & Jermy (1993) suggest that *I. duriei* occurs in damper sites than *I. histrix*, but this is not true of the Mallorcan locality, where the most aquatic habitat supported *I. histrix* alone.

Hybridisation is commonplace between sympatric aquatic quillwort taxa (Taylor *et al.*, 1985) but has not been reported between terrestrial species. The Clot d'Albarca site would seem to present an ideal area in which to establish whether hybridisation does occur between terrestrial taxa.

In spite of reasonable population sizes, the species must be regarded as vulnerable in Mallorca as they are only known to occur in a limited area, the pattern

of land use or hydrology of which could conceivably change to the species detriment and perhaps loss.

#### ACKNOWLEDGEMENTS

We would like to thank Clive Jermy for his helpful discussions on the genus and Dr. Elspeth Beckett for her generosity in introducing FJR to the Lluc area.

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***ADIANTUM GIGANTEUM* (PTERIDACEAE: PTERIDOPHYTA), A  
NEW MAIDENHAIR FERN FROM AMAZONIA, BRAZIL**

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Key words: *Adiantum*, fern, maidenhair, Amazonia, Brazil, pteridophytes.

**ABSTRACT**

*Adiantum giganteum* (Pteridaceae), a new species, is described from the states of Mato Grosso and Pará, Brazil. Long-creeping rhizomes, 2-pinnate fronds up to 2 m long, 6-10 pairs of lateral pinnae, and dimidiate incised pinnules are the most important features to distinguish this new species. Illustrations of the diagnostic characters of the taxon and a brief discussion about its group are provided.

**INTRODUCTION**

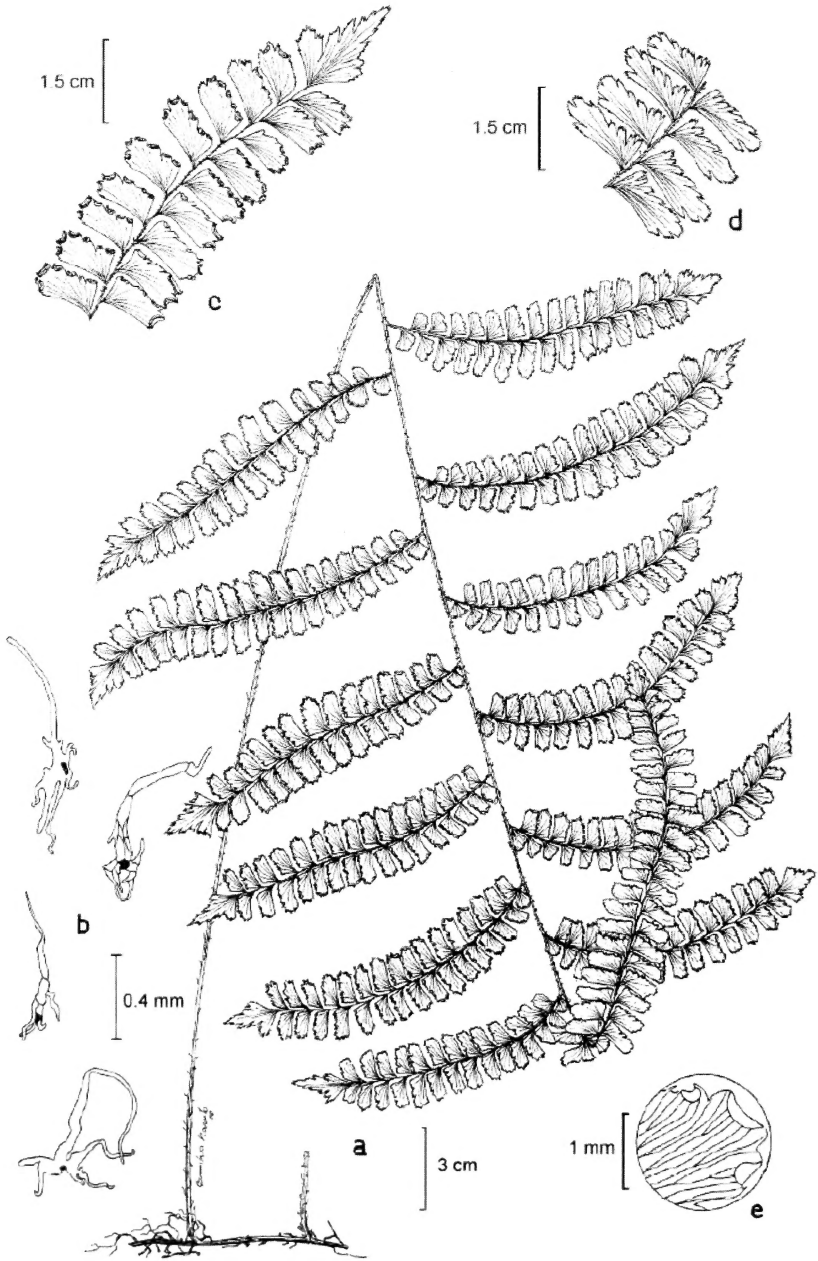
The present paper is part of a floristic survey for the genus *Adiantum* in Brazil that has been carried out by the author during the last six years (Zimmer & Prado, 1997; Prado, 1997; Prado & Palacios-Rios, 1998; Prado, 2000; Lellinger & Prado, 2001; Prado & Lellinger, unpublished). During a recent visit to several Brazilian and foreign herbaria, I noticed three specimens, from Amazonian Brazil, that seemed unusual by their large size and incised pinnules. They belong to the group of *A. tetraphyllum*, which is characterized by 2-pinnate laminae and conform terminal pinnae. Within this group it is related to *A. serratodentatum*, which can be distinguished by long-creeping rhizomes, (3)8-10 pairs of lateral pinnae with dimidiate and small pinnules, and rachises with fibrilous to pectinate scales.

***Adiantum giganteum* Prado, sp. nov.** (Figs. 1, 2)

*A. serratodentatum* Humb. & Bonpl. ex Willd., cui affinis, folis lamina chartacea, gigantea 2m longa, pinnulis abaxialiter glaucentibus, margine interiore integro recto cum rache prorsus contiguo, inferiore et superiore incisa in pinnula sterili duplo serrulatis differt.

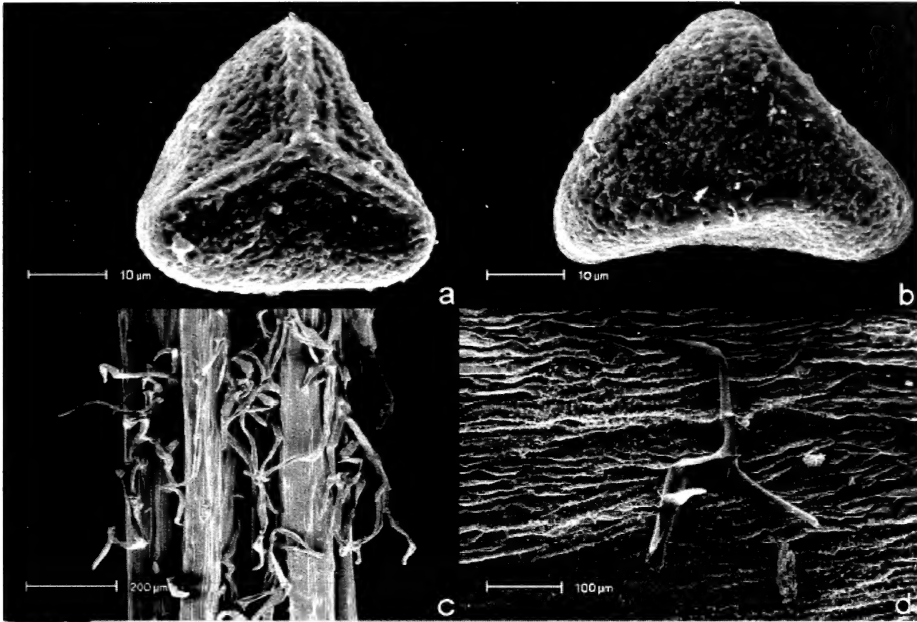
Type: Brazil. Pará: Acará, Thomé Açu, down Rio Acará, damp clay in forest, 35 m, 31 July, 1931, *Mexia 6031* (Holotype UC. Isotypes: MO, US).

Plants terrestrial. Rhizomes long-creeping, 2-3 mm in diam., scaly, the scales somewhat shiny, essentially concolorous, appressed, varying from gold to medium or dark brown, lanceate, sparsely ciliate at margins. Fronds monomorphic, 2-pinnate, 59-200 cm long, the laminae (12)24-44 cm wide; stipes 2-4 cm apart, 2/3-1/2 the length of the frond, black, adaxially sulcate, scaly, the scales appressed throughout, concolorous, brown, 1-2 mm long, fibrilous to narrowly lanceolate with a filiform



**Figure 1.** *Adiantum giganteum*. a. Habit (*Mexia 5962*, UC); b. Rachis scales (*Mexia 6031*, UC); c. Abaxial surface of pinna (*Mexia 5962*, UC); d. Detail of sterile pinna incised (*Mexia 5962*, UC); e. Detail of pseudoindusium (*Mexia 5962*, UC).





**Figure 2.** Scanning electron micrographs of *Adiantum giganteum*. a: Proximal view of the spore (*Mexia 6031*, UC); b: Distal view of the spore (*Mexia 6031*, UC); c: Scales on the rachis (*Mexia 5962*, R); d: Scale on the abaxial pinnule surface (*Mexia 5962*, R). Scale bars ( $\mu\text{m}$ ): a & b, 10; c, 200; d, 100.

apex, strongly ciliate proximally; rachises similar to the stipes and their indument similar; pinnae oblong-lanceolate, slightly decreasing at the base, tapering at the apex, (6)12-22 cm long, 1.5-2.5 cm wide, the lateral pinnae (4)6-10 pairs, oblique, alternate, the terminal pinna conform, 1-1.5 times longer than the subtending pinnae, 0.7-1 times as long as the medial pinnae; indument of the costae like that of the stipes and rachises; pinnules 16-32 pairs, c. 2 times longer than wide, chartaceous, continuous to the rachis (not articulate), free-veined, without an evident midrib, the proximal pairs reduced, somewhat rounded or triangular, the medial pairs dimidiate, oblong to somewhat quadrangular, the acroscopic base truncate, the sterile apex obtuse to acute, the sterile margins incised, irregularly and distantly biserrate, the fertile apex angular, the distal pinnules c. 1/2 as long as the medial pinnules, the adaxial surface of the pinnules glabrous, the veins slightly prominent, idioblasts present among the veins, the abaxial surface of the pinnules glaucous, glabrescent, with patent, sparse, fibrilous scales 0.3-0.4 mm long but otherwise similar to those of the stipes, glands absent, the veins slightly prominent, the idioblasts inconspicuous; sori arcuate to oblong, up to 4 or 6 per pinnule; pseudoindusia glabrous, entire to erose; spores trilete, 30-40  $\mu\text{m}$  in equatorial diameter, tetrahedral-globose, without prolonged angles, the surface rugulose.

Paratypes: Brazil. Pará: Acará, Thomé Açu, down Rio Acará about 1 km, overflow bank among tangle, 23 July, 1931, *Mexia 5962* (HBR, R, UC, US). Mato Grosso, 8 km NE of the base camp of the Expedition (base camp at 12°54'S, 51°52'W), Xavantina-São Felix road, 11 April, 1968, *Ratter et al. 997* (E, K, NY, US).

*Adiantum giganteum* can be distinguished by the large size of its fronds (up to 2 m long), distal and acroscopic margins of the sterile pinnules incised, and abaxial surface of the pinnules glaucous. This species occurs in wet forests (Amazon forest) at low elevations (c. 30 m) along river margins.

*Adiantum serratodentatum* Humb. & Bonpl. ex Willd. is the most closely related species but differs in having laminae subcoriaceous, fertile pinnules with conspicuous revolute margins on the acroscopic and distal sides, sterile pinnules with serrulate or entire margins (not incised) on the acroscopic and distal sides. It grows in drier and more open places.

*Adiantum giganteum* is endemic to the Brazilian Amazon forest (Pará and Mato Grosso States), whereas *A. serratodentatum* has a wide range of distribution from Mexico to Panama, Colombia to Guianas, Trinidad, Ecuador to Bolivia, and Brazil.

#### ACKNOWLEDGEMENTS

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## DISTRIBUTION AND STATUS OF THE PTERIDOPHYTES OF FAIAL ISLAND, AZORES (PORTUGAL)

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KEY WORDS: Azores, dot grid mapping, Faial, Macaronesia, pteridophytes

### ABSTRACT

In 1999, a dot grid mapping project based on the UTM 1 km<sup>2</sup> grid, was carried out on Faial Island, Azores (Portugal). Distribution maps of the 52 species of pteridophytes and two hybrids found on the island are presented. *Diphasiastrum madeirense*, *Asplenium x ticinense* and *Nephrolepis cordifolia* are reported from the island for the first time. The status of each taxon on Faial was determined by intensive study of habitat, general distribution and literature.

### INTRODUCTION

Faial Island is the westernmost island of the central group of the Azores, an isolated archipelago of nine inhabited islands in the northern Atlantic Ocean between 36°55' and 39°43' northern latitude, and between 24°46' and 31°16' western longitude (Figure 1). The distance to the European continent is about 1600 km and to the American continent, almost 2000 km.

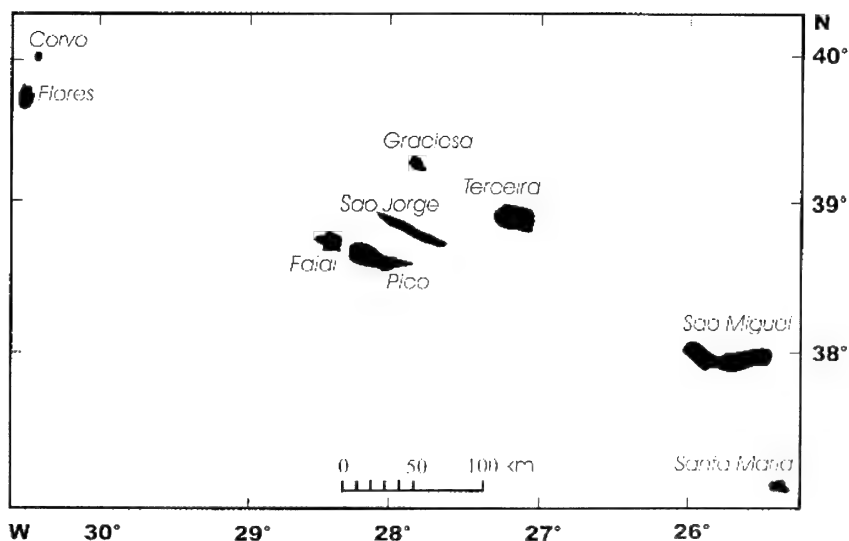


Figure 1. Map of the Azores.

The islands are of volcanic origin and located near the seafloor-spreading zone of the mid-Atlantic ridge. Faial Island is probably less than one million years old

(Frias Martins, 1998). This island has an area of 173 km<sup>2</sup> and is dominated by a large central crater and a few secondary cones in the west, the highest point reaching 1043 m. The last volcanic eruption was in 1957/58 (Zbyszewski *et al.*, 1959). The climate is dominated by a branch of the gulfstream and by a high-pressure zone, called the "Azores anticyclone". Annual precipitation ranges between 1000 mm in coastal areas to more than 3000 mm in the highest parts (Schäfer, 2000a). Mean temperatures reach 17 °C near the coast but can be less than 8 °C in the highest parts (Schäfer, 2000a).

Though famous for their landscape and "unspoiled nature", the Azorean Islands are one of the most intensively used regions in Western Europe. Dairy farming, raising of bulls and plantation of exotic trees like *Cryptomeria japonica* (*Taxodiaceae*) and *Eucalyptus globulus* (*Myrtaceae*) has destroyed large areas of indigenous vegetation, especially on Faial Island. Today, forests dominated by native species such as *Laurus azorica*, *Ilex perado* subsp. *azorica* and *Juniperus brevifolia* can be found only in a very few, inaccessible places like steep cliffs, mountains or craters. Even there, invasive neophytes, for example *Hedychium gardnerianum* (*Zingiberaceae*), *Pittosporum undulatum* (*Pittosporaceae*) or the worst of all: *Hydrangea macrophylla* (*Hydrangeaceae*), are a serious threat (Schäfer 2000a). Several Azorean endemics are almost extinct and will most likely disappear during the next few years, as nothing is being done to prevent further spread of neophytes. In the dot grid mapping project of all species of higher plants on Faial Island, distribution maps of both rare endemics and invasive neophytes were created. These maps can be used for protection of rarities as well as control of neophytes. In this paper, only data for the pteridophytes are presented, less than ten percent of the total flora of Faial.

## METHODS

Fieldwork for this study was carried out on Faial Island from May to November 1999, with a previous exploration trip in December 1998. The area of the island was divided into 1-km-squares, using the Universal Transverse Mercator-Projection (UTM). The 173 km<sup>2</sup> of Faial Island are divided into 210 UTM squares marked by the numbers 64 to 78 from the South to the North, and 40 to 61 from the West to the East. Each km<sup>2</sup> was visited at least once during the stay. Every day, one square was visited on foot, usually for a period of 11 to 13 hours, depending on day length. All species of higher plants that were discovered in the square were marked in species lists based on Hansen & Sunding (1993), together with a short note describing the habitat. In rain and fog, a dictating machine was used. Difficult of access areas, like the steep slopes of Caldeira and some cliffs, were visited on several days and scanned by telescope, to achieve species lists as complete as possible.

Doubtful and unknown plants were collected during the day and identified at night. Rare, or assumed rare, species were usually not collected, but documented by photograph or determined in the field. The locations of relevant species were determined, using the Global Positioning System (GPS) Garmin GPS 12. The abundance of each species was noted in the field.

The mapping program FLOREIN 5.0 (Subal 1997), allowed production of provisional distribution maps and several kinds of synthetical maps throughout the mapping period. Much emphasis was put on the study of plant lists from former centuries. Following the method of other authors, e. g. Sjögren 1973b, the presence or absence of a species in these lists was used as an important factor in the decision as to whether a certain plant is an Azorean native or introduced. Voucher specimens of all

pteridophytes of Faial Island were deposited in the herbarium of the University of Regensburg (REG). In addition, some important specimens, e. g. *Diphasiastrum madeirense*, will be deposited in one of the best collection of Azorean plants at the Universidade dos Açores, Terceira (AZU).

### SPECIES AND THEIR DISTRIBUTION

This list contains all the pteridophytes that were found to be well established and growing spontaneously on Faial Island. Cultivated ornamental plants and casuals were not included in this work. For each species, information about the ecology and distribution on Faial, distribution in the Azores and in general is given. In addition, the records in the literature concerning Faial Island are listed. The order of the families follows Tutin *et al.* (1993).

#### Abbreviations

* Endemic to the Azores and Madeira	GRA - Graciosa Island, Azores
** - Endemic to the Azores only	H - Habitat, distribution and altitudinal range on Faial Island
Col - Collection number	JOR - São Jorge Island, Azores
COR - Corvo Island, Azores	L - Records in literature of Faial Island
CV - Cabo Verde	MAR - Santa Maria Island, Azores
D(A) - Distribution in the Azores	MIG - São Miguel Island, Azores
D(G) - General distribution	PIC - Pico Island, Azores
FAI - Faial Island, Azores	TER - Terceira Island, Azores
FLO - Flores Island, Azores	

#### Abundance and status on the distribution maps

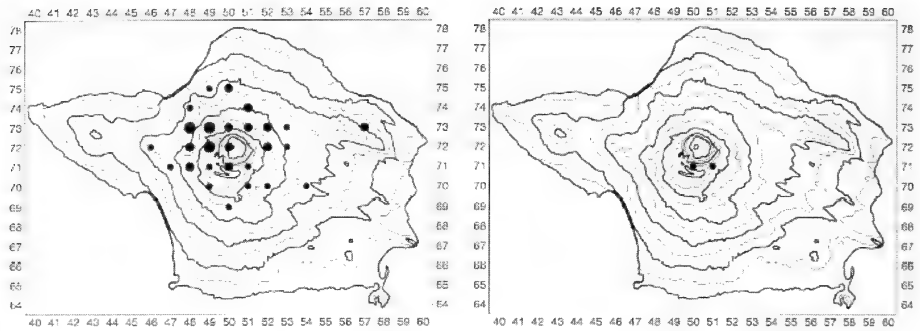
- indigenous, (very) rare
- indigenous, rare - scattered
- indigenous, scattered - common
- indigenous, (very) common
- introduced, (very) rare
- introduced, rare - scattered
- introduced, scattered - common
- introduced, (very) common

Contour lines are along 100 m isohypses (thin lines) and 200 m isohypses (strong lines). The grid system (1 x 1 km) is according to UTM (WGS-84): values of horizontal grid lines are from <sup>42</sup>64 to <sup>42</sup>78, and of vertical grid lines from <sup>03</sup>40 to <sup>03</sup>60.

#### LYCOPODIACEAE

\**Huperzia dentata* (Herter) Holub, Folia Geobot. Phytotax. 20: 72. 1985. *H. selago* (L.) Bernh. ex Schrank & Mart., Hort. Monac.: 3. 1829. subsp. *dentata* (Herter) Valentine, Feddes Repert. 69: 44. 1964. **Col.:** Az-F-639. **H:** Scattered, but locally common on steep, sandy slopes, often along roads [300-1000 m]. **L:** Watson, 1844, 1870; Trelease, 1897; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Silva & Silva, 1974. **D(A):** All islands except MAR and GRA. **D(G):** Endemic to the Azores and Madeira. A record of *Lycopodium plumosum* L. by Forster (1787) might refer to this species.

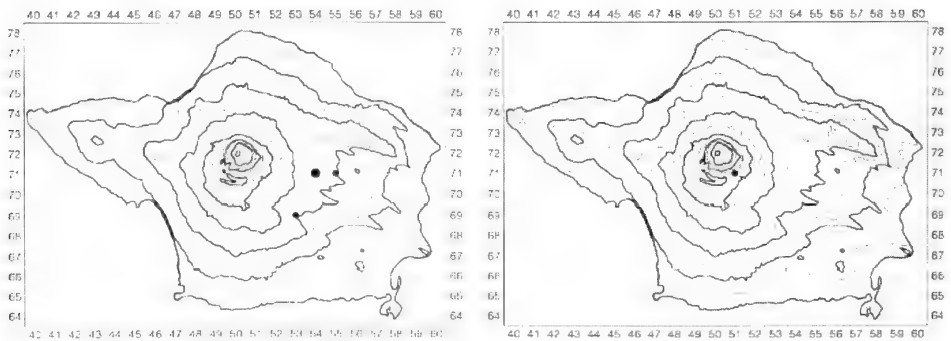
\**Huperzia suberecta* (Lowe) Tardieu, Adansonia II, 10: 20. 1970. **Col.:** Az-F-1060. **H:** Very rare; only two locations in the most humid region of the island, inside the caldera; one specimen growing epiphytic on *Juniperus brevifolia* [800-850 m]. **L:** Watson, 1844; Drouet, 1866; Cunha & Sobrinho, 1938; Sjögren, 1973b. **D(A):** All islands except MAR, GRA and COR. **D(G):** Endemic to the Azores and Madeira.



**Figure 2.** Left *Huperzia dentata* (Herter) Holub; right *Huperzia suberecta* (Lowe) Tard. Blot

*Lycopodiella cernua* (L.) Pic.Serm., Webbia 22: 166. 1968. *Lycopodium cernuum* L., Sp. Pl. 2: 1103. 1753; *Palhinhaea cernua* (L.) Franco & Vasc., Bol. Soc. Brot., Ser. 2, 41: 25. 1967; *Lepidotis cernua* (L.) P.Beauv., Magas. Encycl. 5: 479. 1804. **Col.:** Az-F-1069. **H:** Rare, but locally common in a *Cryptomeria* plantation on former *Sphagnum* moorland. Single specimens in a young *Alnus* plantation near Parque Falca [350-500 m]. **L:** Vasconcellos, 1968; Sjögren, 1973b. **D(A):** FAI, PIC, MIG, TER and FLO. **D(G):** Widely distributed in the tropics and subtropics; introduced to Portugal (Franco & Rocha Afonso 1982) and Sicily (Zangheri 1976).

\**Diphasiastrum madeirense* (J.H.Wilce) Holub, Preslia 47: 108. 1975. *Diphasium madeirense* (J.H.Wilce) Rothm., Feddes Repert. 66: 235. 1962; *Lycopodium madeirense* J.H.Wilce, Nova Hedw. 3(1): 111. 1961. **Col.:** Az-F-500. **H:** Only one location inside the caldera, on steep slope in *Juniperus* forest at 800 m altitude, covering about two square metres. **L:** Previously not reported from FAI. **D(A):** All islands except MAR and GRA. **D(G):** Endemic to the Azores and Madeira. It was previously collected in probably the same location by Jermy *et al.* in 1994. A specimen was deposited in BM (Rumsey, in lit.).



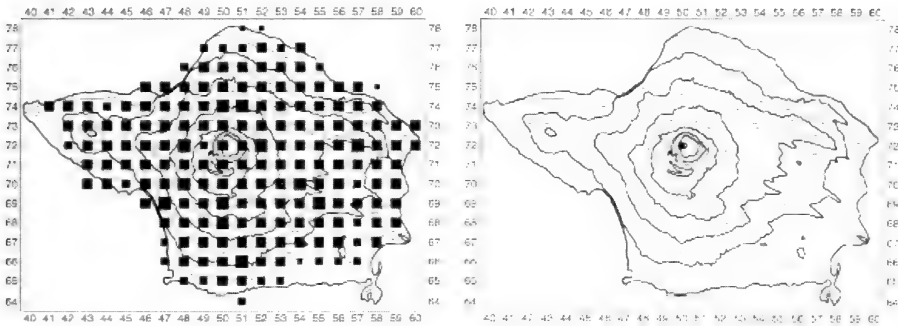
**Figure 3.** Left: *Lycopodiella cernua* (L.) Pic.Serm.; right: *Diphasiastrum madeirense* (J.H.Wilce) Holub.

**SELAGINELLACEAE**

*Selaginella kraussiana* (Kunze) A.Braun, Ind. Sem. Hort. Berol., App., 1859: 22. 1860. *Selaginella denticulata* auct., non (L.) Spring, Flora, Regensburg 21: 149. 1838. **Col.:** Az-F-1061. **H:** Naturalized and very common from the coast up to Cabeço Gordo; in ravines, forests and hedges, on slopes, in coastal cliffs and waste places [10-1000 m]. **L:** Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Tutin & Warburg, 1932; Cunha & Sobrinho, 1938; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Silva & Silva, 1974; Lüpnitz, 1975; Dias, 1996. **D(A):** All islands. **D(G):** Native to tropical and S Africa; introduced to the Canaries, Madeira and W Europe. Given in a list of *plants endémiques, ou à peu près* by Gandoger (1899).

**ISOETACEAE**

\*\**Isoetes azorica* Durieu ex Milde, Fil. Eur. 278. 1867. **H:** Rare in shallow water of the small lake at Fundo da Caldeira [500 m]. **L:** Watson, 1844; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands except MIG, MAR and GRA. **D(G):** Endemic to the Azores.



**Figure 4.** Left: *Selaginella kraussiana* (Kunze) A.Braun; right: *Isoetes azorica* Durieu ex Milde.

**EQUISETACEAE**

*Equisetum telmateia* Ehrh., Hannover. Mag. 21: 287. 1783. *E. fluviatile* sensu H.C.Watson (1843), non L., Sp. Pl. 1062. 1753; *E. maximum* auct., non Lam., Fl. Fr. 1: 7. 1778. **H:** Scattered but locally common in the NW on slopes, in ravines and pastures close to springs; very common at Fundo da Caldeira; small, isolated population on a roadside in the S near Lombega [100-750 m]. **L:** Watson, 1843, 1844; Seubert, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Palhinha 1943, 1966; Franco, 1971; Sjögren, 1973b; Silva & Silva, 1974; Lüpnitz, 1975. **D(A):** All islands except PIC, COR, and GRA. **D(G):** Circumboreal: native to Macaronesia, Europe, Asia, NW Africa and N America.

**OPHIOGLOSSACEAE**

*Ophioglossum azoricum* C.Presl, Tent. Pterid. Suppl.: 49. 1845. *O. lusitanicum* sensu Seub. & Hochst., non L., Sp. Pl. 2: 1063. 1753. **Col.:** Az-F-1062. **H:** Single plants on wet ground along levada [500-650 m]. **L:** Hansen & Sunding 1993. **D(A):** MAR, FAI, FLO, and TER. **D(G):** Native to the Azores, Madeira, W Europe (Iceland to Portugal), Corsica, Sardinia and C Europe.

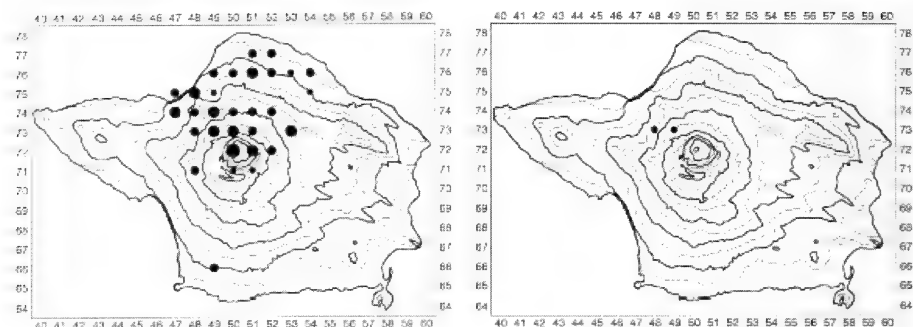


Figure 5. Left: *Equisetum telmateia* Ehrh.; right: *Ophioglossum azoricum* C.Presl.

*Ophioglossum lusitanicum* L., Sp. Pl. 2: 1063. 1753. **Col.:** Az-F-1089. **H:** Scattered in dense moss carpet at Fundo da Caldeira [500 m]. **L:** Simon 1983. **D(A):** FAI, MAR, MIG, TER and FLO (Schäfer, unpubl.). **D(G):** Native to Macaronesia (except CV), Mediterranean region.

#### OSMUNDACEAE

*Osmunda regalis* L., Sp. Pl. 2: 1062. 1753.

*Struthiopteris regalis* (L.) Bernh., J. Bot. (Schrader) 1800: 126. 1801; *Aphylocarpa regalis* (L.) Cav., Anal. Cienc. 5: 164. 1802. **Col.:** Az-F-1062. **H:** Common on steep slopes, in ravines, *Juniperus* and *Laurus* forest, rarely in coastal cliffs [(5-) 500-1000 m]. **L:** Seubert, 1844; Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands except GRA. **D(G):** Native to Macaronesia (in CV nearly extinct), Europe, America, Asia and Africa.

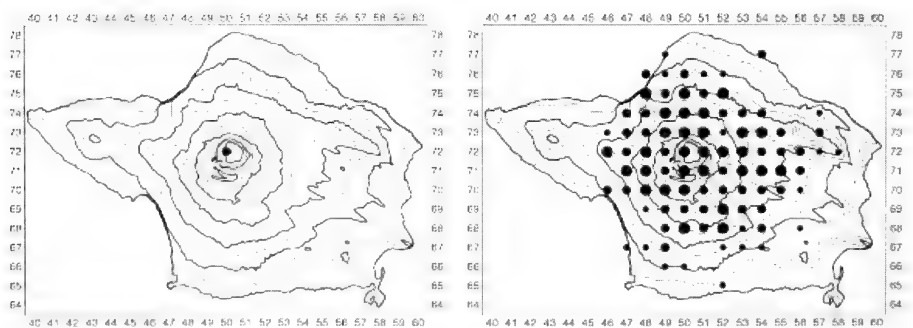


Figure 6. Left: *Ophioglossum lusitanicum* L.; right: *Osmunda regalis* L.

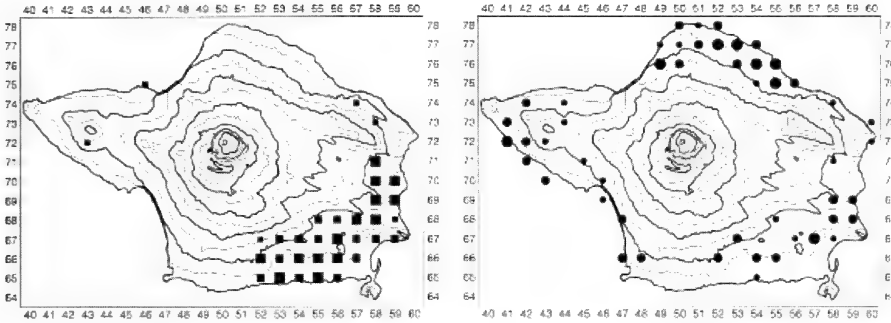
#### ADIANTACEAE

*Pellaea viridis* (Forssk.) Prantl, Bot. Jahrb. Syst. 3: 420. 1882. *Pteris viridis* Forsk., Fl. Aegypt.: 186. 1775; *Pellaea calomelanos* auct., non (Sw.) Link, Fil. Spec.: 61. 1841. **Col.:** Az-F-1065. **H:** Introduced and quite common on walls and slopes in the Horta region [10-350 m]. **L:** Sjögren, 1973b; Vasconcellos, 1968; Franco, 1971. **D(A):** FAI and PIC, also found on MIG and TER (Rumsey, in lit.). **D(G):** Native to the Old World tropics and CV (Lobin *et al.*, 1998); introduced to the Azores and



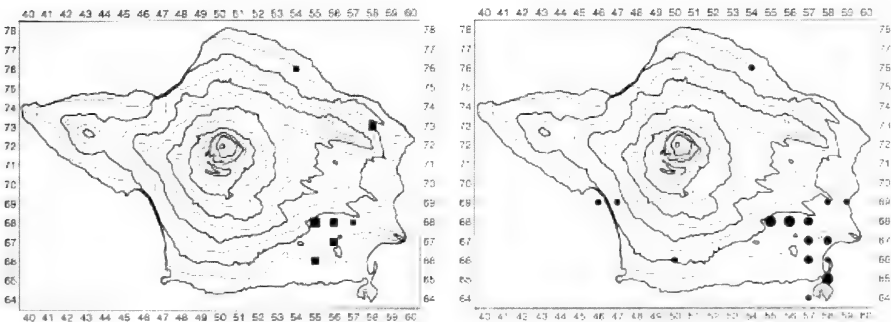
Madeira. According to Caixinhas (1972), all Azorean records of *Pellaea calomelanos* (Sw.) Link refer to *P. viridis*.

***Anogramma leptophylla*** (L.) Link, Fil. Spec.: 137. 1841. **Col.:** Az-F-1068. **H:** Common on slopes and shady walls at low altitudes especially along the N coast [20-250 m]. **L:** Seubert, 1844; Watson, 1844; Drouet, 1866; Trelease, 1897; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands. **D(G):** Native to Macaronesia, tropical Africa, Madagascar, C & S America, Australia and New Zealand.



**Figure 7.** Left: *Pellaea viridis* (Forssk.) Prantl; right: *Anogramma leptophylla* (L.) Link.

***Onychium japonicum*** (Thunb.) Kunze, Bot. Zeit. 6: 507. 1848. *Cryptogramma japonica* (Thunb.) Prantl, Bot. Jahrb. Syst. 3: 413. 1882. **Col.:** Az-F-1063. **H:** Naturalized in the Ribeira de Flamengos and on W exposed slopes near Ribeirinha and Salão [120-250 m]. **L:** Vasconcellos, 1968; Franco, 1971. **D(A):** FAI, PIC and MIG. **D(G):** Native to Japan, China, the Himalayas and Java; introduced to the Azores.



**Figure 8.** Left: *Onychium japonicum* (Thunb.) Kunze; right: *Adiantum capillus-veneris* L.

***Adiantum capillus-veneris*** L., Sp. Pl. 2: 1096. 1753. **Col.:** Az-F-485, Az-F-592. **H:** Common around Horta (Monte Queimada, Ribeira de Flamengos) and sometimes elsewhere in coastal cliffs. Found also on old walls in villages and in cultivation [2-250 m]. **L:** Trelease, 1897; Palhinha, 1943, 1966; Vasconcellos, 1968; Franco, 1971;

Sjögren, 1973b; Lüpnitz, 1975. **D(A)**: FAI, MIG, GRA, TER, MAR and FLO. **D(G)**: Native to Macaronesia, W & S Europe.

*Adiantum hispidulum* Sw., J. Bot. (Schrader) Göttingen 1800 (2): 82. 1801. **Col.**: Az-F-929. **H**: Introduced and common on walls, in ravines and other shady places [10-750 m]. **L**: Palhinha, 1966; Franco, 1971; Sjögren, 1973b; Silva & Silva, 1974. **D(A)**: FAI, PIC, MIG, MAR, GRA, FLO (Fazenda, Santa Cruz ( Schäfer, unpubl.)) and COR (Rumsey, in lit.). **D(G)**: Native to the tropics and subtropics of the Old World; introduced to Madeira, Azores, Australia and New Zealand.

*Adiantum raddianum* C.Presl, Tent. Pterid.: 158. 1836. *A. cuneatum* Langsd. & Fisch., Ic. Fil. 23, t. 26. 1810. **Col.**: Az-F-1064. **H**: Introduced and common in shady ravines around Praia do Norte and Castelo Branco; very common in the Ribeira de Flamengos; scattered along the NE coast [2-400 m]. **L**: Vasconcellos 1968; Franco 1971. **D(A)**: FAI, PIC, MIG MAR, GRA and FLO. **D(G)**: Native to S America; introduced to the Azores, Madeira and GB.

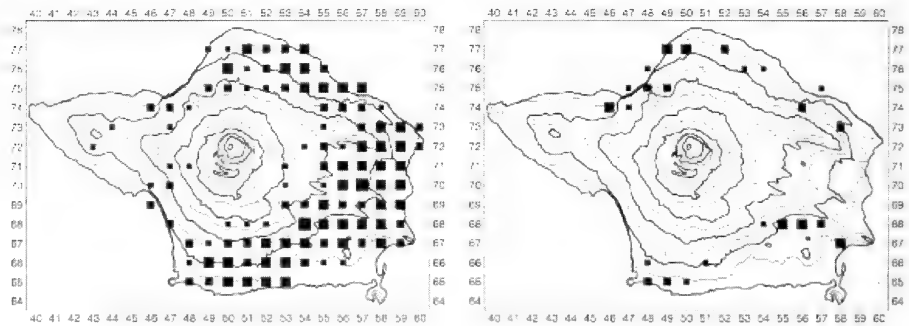


Figure 9. Left: *Adiantum hispidulum* Sw.; right: *Adiantum raddianum* C.Presl.

## PTERIDACEAE

*Pteris incompleta* Cav., An. Cien. nat. Madrid 2: 107. 1801. *P. arguta* Aiton, Hort. Kew. 3: 458. 1789; *P. palustris* Poir. in Lam., Encycl. Meth. Bot. 5: 722. 1804; *P. serrulata* auct., non Forsk., Fl. Aegypt.: 187. 1775. **Col.**: Az-F-1066. **H**: Common to very common in shady ravines, *Myrica-Pittosporum* forest, *Cryptomeria* plantations and amongst *Erica* shrubs [30-800 m]. **L**: Seubert, 1844; Watson, 1843, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Dias, 1996. **D(A)**: All islands except GRA. **D(G)**: Native to Macaronesia, Morocco, Portugal (Sintra), SW Spain.

*Pteris tremula* R.Br., Prodr. Fl. N. Holl.: 154. 1810. **Col.**: Az-F-487, Az-F-670. **H**: Introduced and common in *Myrica-Pittosporum* shrub on former gardens in the W; single plants on roadsides and slopes in the S/SE [50-380 m]. **L**: Vasconcellos, 1968. **D(A)**: FAI, MIG, MAR, GRA and TER. **D(G)**: Native to Australia, New Zealand, S Africa, Norfolk and Fiji Islands; introduced to the Azores and Madeira.

*Pteris vittata* L., Sp. Pl. 2: 1074. 1753. **Col.**: Az-F-1068. **H**: Introduced and common in Horta on walls and cobblestones; scattered around other coastal settlements [1-200 m]. **L**: Vasconcellos, 1968; Sjögren, 1973b; Franco, 1971; Silva & Silva, 1974. **D(A)**:

FAI, TER, MIG and JOR. **D(G)**: Native to W Canaries, CV, Mediterranean region, Old World tropics, Australia and Polynesia; introduced to the Azores, Madeira and S America.

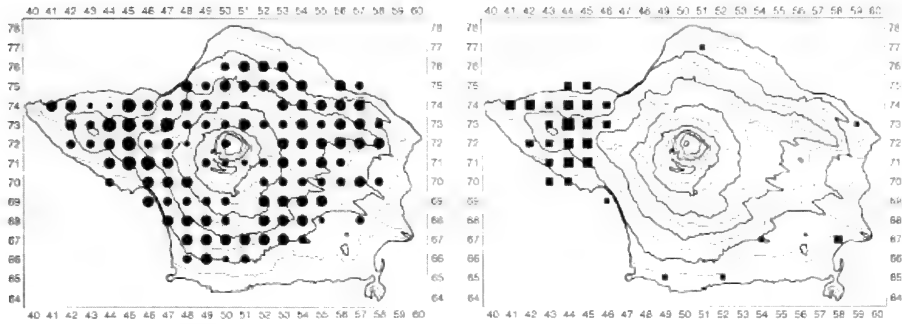


Figure 10. Left: *Pteris incompleta* Cav.; right: *Pteris tremula* R.Br.

**HYMENOPHYLLACEAE**

*Hymenophyllum tunbrigense* (L.) Sm. in Sowerby, Engl. Bot. 3: 162. 1794. *Trichomanes tunbridgense* L., Sp. Pl. 2: 1098. 1733. **Col.:** Az-F-629. **H:** Scattered on slopes, in ravines and shady forests above 400 m; usually epiphytic on old *Juniperus* and *Ilex*, most common inside the caldera; sometimes on wet rocks [350-880 m]. **L:** Watson 1843, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha 1943, 1966; Sjögren, 1973b; Lüpnitz, 1975; Dias, 1996. **D(A):** All islands except COR and GRA; **D(G):** Native to Macaronesia, W Europe, N Italy, Luxembourg, E Germany (extinct); reported from N America and S Africa.

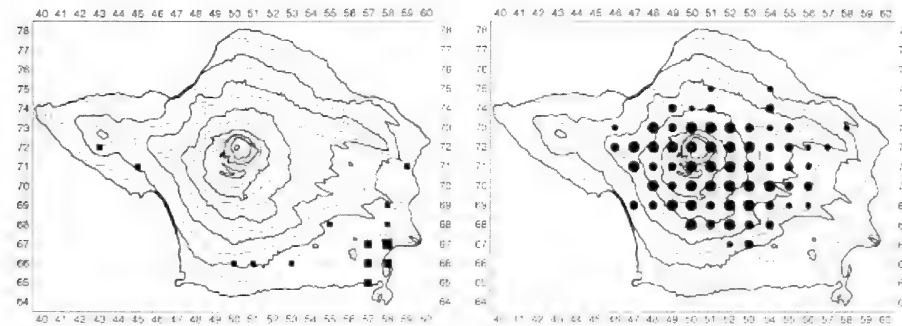
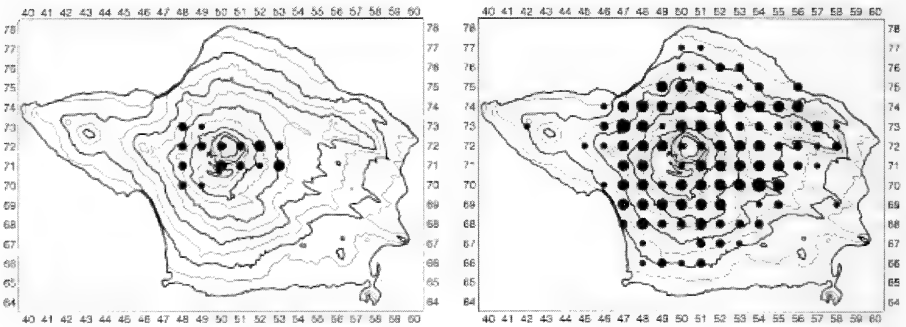


Figure 11. Left: *Pteris vittata* L.; right: *Hymenophyllum tunbrigense* (L.) Sm.

*Hymenophyllum wilsonii* Hook., Brit. Fl.: 450. 1830. *H. unilaterale* auct., non Bory, Willd. Spec. 5: 521. 1810. **Col.:** Az-F-641, Az-F-1057. **H:** Local in ravines and inside the caldera; growing epiphytic on *Juniperus*, *Erica* and *Cryptomeria*, often together with *H. tunbrigense* [650-880 m]. **L:** Fernandes & Fernandes, 1980. **D(A):** All islands except JOR, MAR and GRA. **D(G):** Native to Macaronesia, N and W GB and France, Ireland, Faeroes, Iceland.

*Trichomanes speciosum* Willd., Sp. Pl. 5: 514. 1810. *Vandenboschia speciosa* (Willd.) G.Kunkel, Bull. Soc. Bot. Suisse 76: 48. 1966. **Col.:** Az-F-1058. **H:** Present in almost every shady ravine, in *Myrica-Pittosporum* forest, *Cryptomeria* plantations,

*Juniperus* forest and laurisilva remnants; sometimes even epiphytic and on rocks, but rarely fertile. Missing only in the W (except Furna Ruim) and along the coast [140-790 m]. L: Seubert, 1844; Watson, 1843, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha 1943, 1966; Franco, 1971; *Only in the central caldera* (Sjögren, 1973b); Lüpnitz, 1975; Dias, 1996. **D(A)**: All islands. **D(G)**: Native to Macaronesia, GB, Ireland, W France, Spain and Portugal (Serra de Valongo). Gametophytes extending into C Europe (Rasbach *et al*, 1995). According to Fernandes & Fernandes (1983), all records of the pantropical *Trichomanes radicans* Sw. from the Azores are in error for this species.



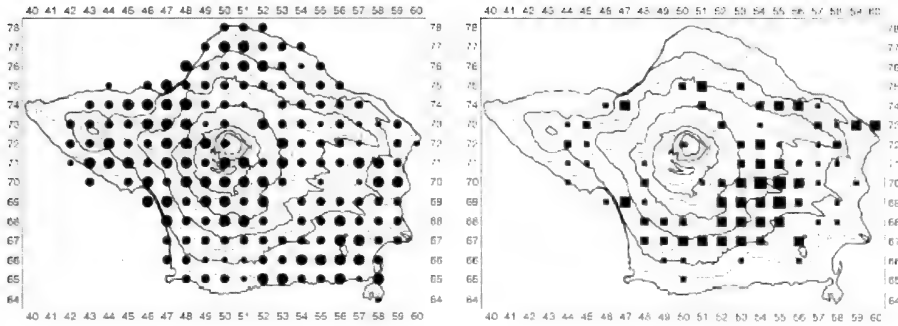
**Figure 12.** Left: *Hymenophyllum wilsonii* Hook.; right: *Trichomanes speciosum* Willd.

### POLYPODIACEAE

\*\**Polypodium azoricum* (Vasc.) R.Fern., Bol. Soc. Brot., Ser. 2, 42: 242. 1968. *P. vulgare* L., Sp. Pl. 2: 1085. 1753. subsp. *azoricum* Vasc., Bol. Soc. Brot. 42: 159, 1968; *P. australe* Fée, Mem. Fam. Foug. 5: 236. 1852. subsp. *azoricum* (Vasc.) E.Nardi, Webbia 31:92, 1977. **Col.**: Az-F-1071. **H**: Common on walls and growing epiphytically e. g. on *Ilex*, *Laurus* and *Populus*, [10-960 m]. **L**: Watson, 1844, 1870; Seubert, 1844; Drouet, 1866; Trelease, 1897; Palhinha, 1943, 1966; Vasconcellos, 1968; Franco, 1971; Sjögren, 1973b; Silva & Silva, 1974; Lüpnitz, 1975; Dias, 1996. **D(A)**: All islands. **D(G)**: Endemic to the Azores. According to Vasconcellos (1968), all records of *Polypodium vulgare* L. and *P. australe* Fée from the Azores should be referred to this species. Some authors include *P. azoricum* in *P. macaronesticum* A.E.Bobrov.

### DICKSONIACEAE

*Sphaeropteris cooperi* (Hook. ex F.Muell.) R.M.Tryon, Contr. Gray Herb. 200: 24. 1970. *Alsophila cooperi* Hook. ex F.Muell., Fragm. Phyt. Austral. 5: 117. 1866; *Cyathea cooperi* (Hook. ex F.Muell.) Domin, Pterid.: 262. 1929. **Col.**: Az-F-1050. **H**: Introduced and common in the SE region in forest clearings, ravines and on slopes. Invading the caldera [120-680 m]. **L**: Silva & Silva 1974. **D(A)**: FAI, TER, MAR, GRA, MIG and FLO (Schäfer, unpubl.). **D(G)**: Native to Australia (Queensland and New South Wales); naturalized in the Azores and Madeira.

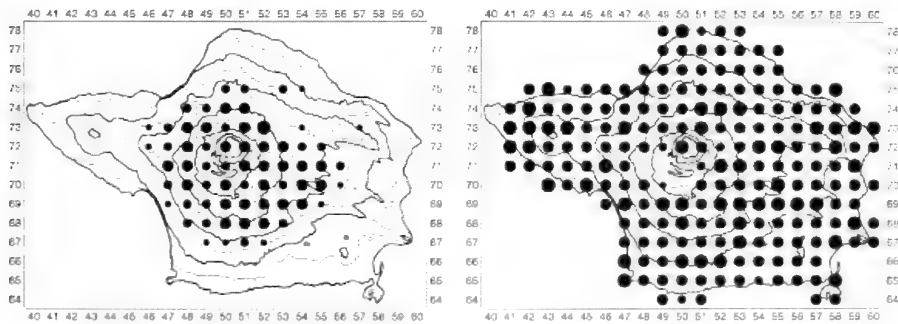


**Figure 13.** Left: *Polypodium azoricum* (Vasc.) R.Fern.; right: *Sphaeropteris cooperi* (Hook. ex Muell.) R.M.Tryon.

*Culcita macrocarpa* C.Presl, Tent. Pterid.: 135. 1836. *Dicksonia culcita* L'Hér., Sert. Angl. 31. 1788; *Balanium culcita* (L'Hér.) Kaulf., Enum. 229. 1824. **Col.:** Az-F-1075. **H:** Common above 300 m in ravines, laurisilva, natural pastures and inside the caldera [350-980 m]. **L:** Seubert, 1844; Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands except GRA. **D(G):** Native to Macaronesia, Spain (Algeciras, Galicia, Asturias) and Portugal (Serra de Valongo).

**HYPOLEPIDACEAE**

*Pteridium aquilinum* (L.) Kuhn in Kersten, Reisen Ost-Afr. 3(3): 11. 1879. *Pteris aquilina* L., Sp. Pl. 2: 1073. 1753. **Col.:** Az-F-1080. **H:** Very common weed of neglected pastures; common in ravines, forest clearings and inside the caldera, [2-1000 m]. **L:** Forster, 1787; Seubert, 1844; Watson, 1843, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha, 1966; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands. **D(G):** Cosmopolitan.



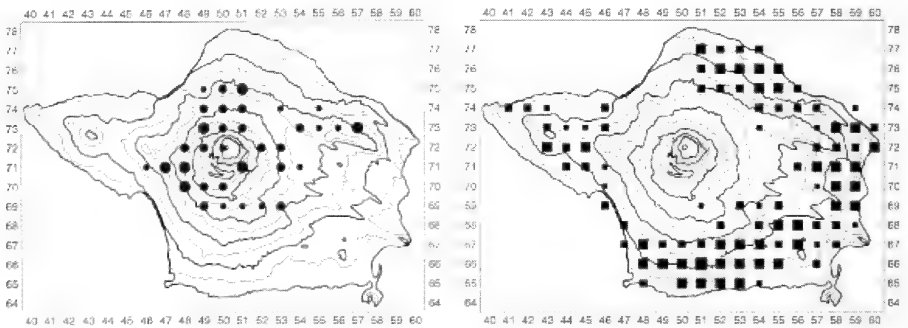
**Figure 14.** Left: *Culcita macrocarpa* C.Presl; *Pteridium aquilinum* (L.) Kuhn.

**THELYPTERIDACEAE**

*Stegnogramma pozoi* (Lag.) K.Iwats., Acta Phytotax. Geobot. Kyoto 19: 124. 1963. *Polypodium tottum* Willd., Sp. Pl. ed. 5, 1: 201. 1810; *Hemionitis pozoi* Lag., Gen. Sp. Nov.: 33. 1816; *Thelypteris pozoi* (Lag.) C.V.Morton, Bull. Soc. Bot. Fr. 106: 234. 1959. **Col.:** Az-F-632, Az-F-763. **H:** Rare on N exposed slopes above 400 m; locally common in some ravines with dense *Cryptomeria* forest in the NW [380-800

m]. **L:** Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Palhinha, 1966; Vasconcellos, 1968; Franco, 1971; Sjögren, 1973b; Dias, 1996. **D(A):** FAI, PIC, TER, MIG and FLO. **D(G):** Native to the Azores, Madeira, NE Spain, SW France, tropical and S Africa, Comores and S India. Sjögren (1973b) calls this fern a recently introduced species. However, Fernandes & Fernandes (1983) conclude after the examination of numerous sources, that it is most likely an old native of the Azores.

**Christella dentata** (Forssk.) Brownsey & Jermy, Brit. Fern Gaz. 10: 338. 1973. *Cyclosorus dentatus* (Forssk.) Ching, Bull. Fan Inst. Biol. Peking 8: 206. 1938; *Lastrea dentata* (Forssk.) Romariz, Rev. Fac. Cienc., Lisboa, 2. Ser., 3: 96. 1953. **Col.:** Az-F-319. **H:** Common on slopes and in ravines at low altitudes and close to settlements [20-350 (-650) m]. **L:** Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Palhinha, 1943, 1966; Sjögren, 1973b; Franco, 1971. **D(A):** All islands except COR. **D (G):** Native to tropical & subtropical regions of the Old World; naturalized in several locations in America, the Azores and Madeira.

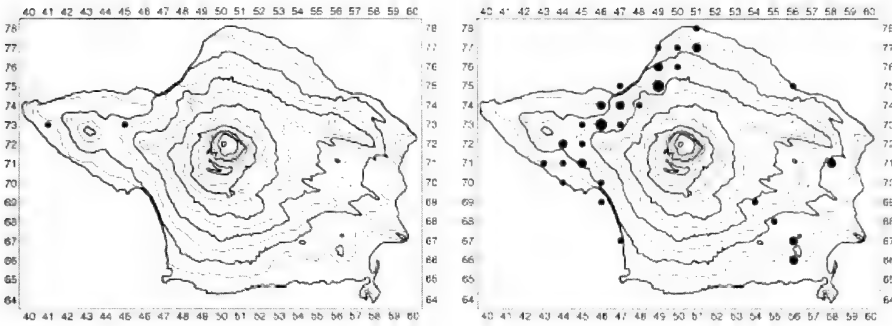


**Figure 15.** Left: *Stegnogramma pozoi* (Lag.) K.Iwats.; right: *Christella dentata* (Forssk.) Brownsey & Jermy.

### ASPLENIACEAE

**Asplenium adiantum-nigrum** L., Sp. Pl. 2: 1081. 1753. **Col.:** Az-F-1079. **H:** Found in *Pittosporum* forest on young lava flows, on W exposed slopes and a wall near Praia do Norte [100-350 m]. **L:** Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Palhinha, 1943, 1966; Fernandes, 1984. **D(A):** All islands. **D(G):** Native to Macaronesia, Europe, N America, Africa and Asia. Some of the records before 1984 might refer to *Asplenium onopteris* L. as determination without measurement of the spore length is not reliable.

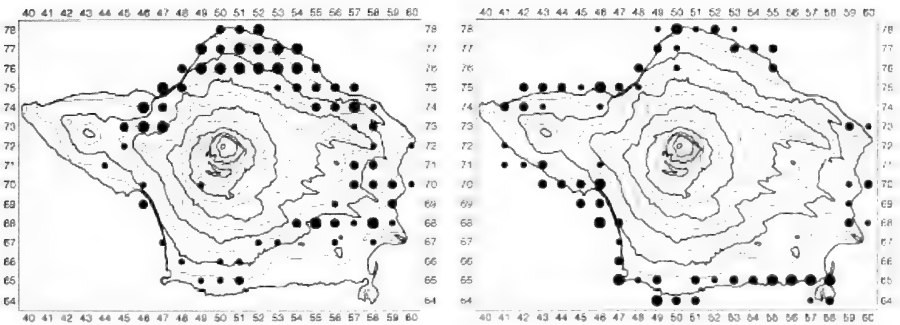
\*\***Asplenium azoricum** (Milde) Lovis, Rasbach, K.Rasbach & Reichst., Amer. Fern J. 67(3): 84. 1977. *A. anceps* sensu H.C.Watson (1844), non Lowe ex Hook. & Grev., Icon. filic. 2: t. 195. 1831. **Col.:** Az-F-619, Az-F-846. **H:** On N and W exposed walls and in dense *Myrica-Pittosporum* shrub between Capelo and Cedros and in a few locations in the S [150-350 m]. **L:** Collected at FAI in 1894, 1963, 1973 (Lovis *et al.*, 1977). **D(A):** All islands. **D(G):** Endemic to the Azores.



**Figure 16.** Left: *Asplenium adiantum-nigrum* L.; right: *Asplenium azoricum* (Milde) Lovis, Rasbach, K.Rasbach & Reichst.

*Asplenium hemionitis* L., Sp. Pl. 2: 1078. 1753. *A. palmatum* Lam., Encycl. 2: 302. 1786. **Col.:** Az-F-1058. **H:** Usually found at altitudes lower than 400 m in ravines and hedges, on slopes and in N exposed walls. It is common in the N/NW parts of FAI, rare in the S [20-280 (-750) m]. Never seen in association with *Lactuca watsoniana*, *Frangula azorica*, and *Trichomanes speciosum* as reported by Sjögren (1973b) and Fernandes & Fernandes (1980). **L:** Seubert, 1844; Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands except GRA. **D(G):** Native to Macaronesia (in CV very rare), W Portugal (Sintra, Mafra), N Africa.

*Asplenium marinum* L., Sp. Pl. 2: 1081. 1753. **Col.:** Az-F-1078. **H:** Scattered on coastal rocks around the island; single plants on seawind exposed slopes at higher altitudes, [0-150 (-500) m]. **L:** Forster, 1787, Watson, 1843, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha, 1943, 1966; Sjögren, 1973b; Lüpnitz, 1975; Dias, 1996. **D(A):** All islands. **D(G):** Native to the coasts of Macaronesia and W Europe but presence on CV is doubtful (Lobin *et al.* 1998).

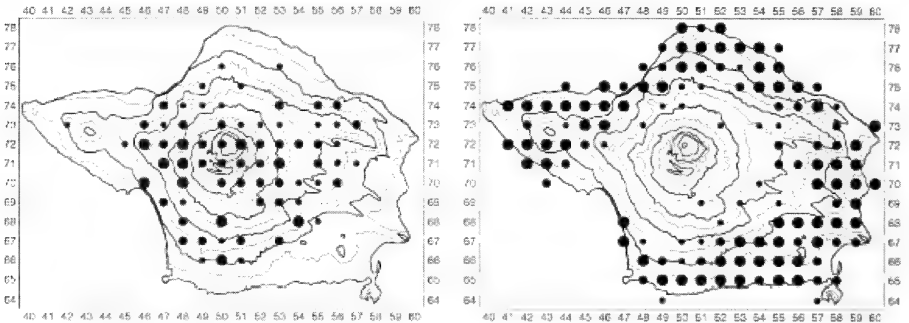


**Figure 17.** Left: *Asplenium hemionitis* L.; right: *Asplenium marinum* L.

*Asplenium monanthes* L., Mant. Pl.: 130. 1767. **Col.:** Az-F-251. **H:** Scattered and usually in small populations in steep ravines and on wet rocks in shady *ribeiras*; rare in *Myrica-Erica* forest on young lava flows in the W [100-680 m]. **L:** Seubert, 1844; Watson, 1844, 1870; Trelease, 1897; Palhinha, 1943, 1966; Franco, 1971. **D(A):** All

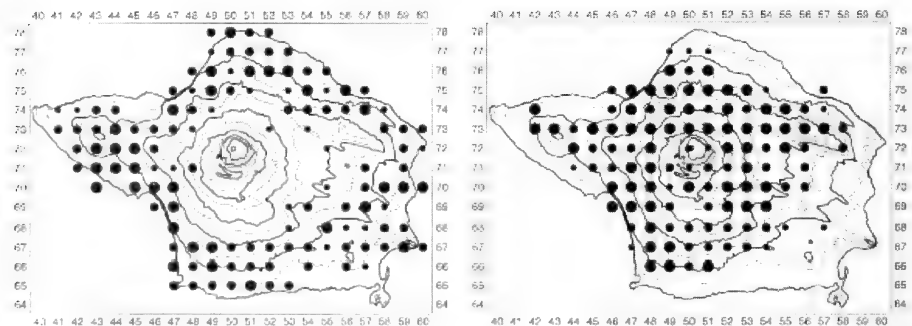
islands except MAR and GRA. **D(G)**: Native to Macaronesia, Africa and C & N America.

*Asplenium obovatum* Viv., Fl. Lybyc. Spec.: 68. 1824. subsp. *lanceolatum* (Fiori) P.Silva, Agron. Lusit. 20(3): 217. 1959. *A. lanceolatum* Huds., Fl. Angl., ed. 2: 454. 1778; *A. billotii* F.W.Schultz, Flora, Regensburg 28: 738. 1845. **Col.:** Az-F-431, Az-F-1054. **H:** Common on walls and on rocks and slopes at low altitudes [10-550 m]. **L:** Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Palhinha, 1943, 1966; Sjögren, 1973b; Lüpnitz, 1975. **D(A)**: All islands. **D(G)**: Native to Macaronesia, W Europe, Mediterranean region and N Africa.



**Figure 18.** Left: *Asplenium monanthes* L.; right: *Asplenium obovatum* Viv. subsp. *lanceolatum* (Fiori) P.Silva.

*Asplenium onopteris* L., Sp. Pl. 2: 1081. 1753. **Col.:** Az-F-931, Az-F-1031. **H:** Common on slopes and in *Myrica-Pittosporum* forest; rare on walls and in rock crevices [5-510 m]. **L:** Drouet, 1866; Vasconcellos, 1968; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A)**: All islands. **D(G)**: Native to Macaronesia (except CV), S, W and parts of C Europe, N Africa.



**Figure 19.** Left: *Asplenium onopteris* L.; right: *Asplenium scolopendrium* L.

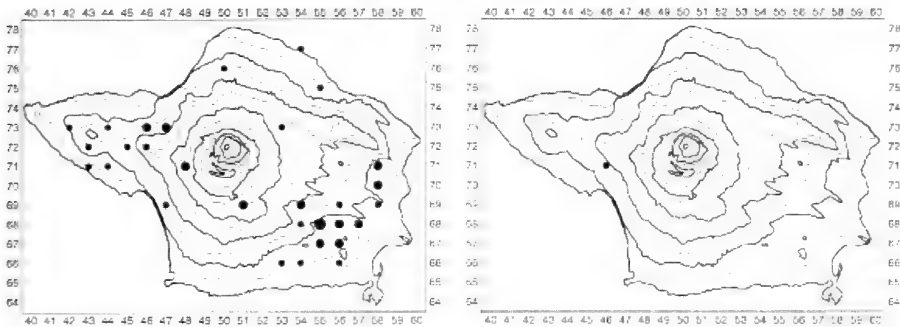
*Asplenium scolopendrium* L., Sp. Pl. 2: 1079. 1753. *Scolopendrium officinale* Lam. & DC., Fl. Fr. 2: 552. 1805; *S. officinarum* Sw., J. Bot. (Schrader) 1800: 61. 1801; *Phyllitis scolopendrium* (L.) Newman, Hist. Brit. Ferns ed. 2: 10. 1844. **Col.:** Az-F-1085. **H:** Common but usually in small populations in hedges, ravines and laurisilva



[(50-) 180-750 m]. **L:** Seubert, 1844; Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands. **D(G):** Native to Macaronesia, Europe.

*Asplenium trichomanes* L., Sp. Pl. 2: 1080. 1753. subsp. *quadrivalens* D.E.Mey. emend. Lovis, Brit. Fern Gaz. 9: 152. 1964. **Col.:** Az-F-586, Az-F-1055. **H:** Scattered on walls and in crevices of old buildings especially in the SE; never found in natural habitats [30-350 (-600) m]. **L:** Trelease, 1897; Palhinha, 1966; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands except GRA and COR. **D(G):** Native to Macaronesia, Europe, Africa, N America, Australia and New Zealand. Records from COR (Sjögren, 1979) are based on misidentifications of *A. azoricum* (Milde) Lovis, Rasbach, K.Rasbach & Reichst. (Rumsey, in lit.).

*Asplenium x rouyi* Viane, Biol. Jb. Dodonaea 59: 163. 1991. *Scolopendrium lobatum* Rouy, III. Pl. Eur. Rar.: t. 100. 1896. (*A. onopteris* L. x *A. scolopendrium* L.). **Col.:** Az-F-876. **H:** Found together with the parents at Cabeço Verde near Ribeira do Cabo at 500 m altitude. **L:** Schäfer & Rasbach, 2000. **D(A):** FAI. **D(G):** Previously found only once in continental Portugal. The plant disappeared in spring 2000, when Cabeço Verde was almost completely destroyed with support from the local forestry department. Fronds of the hybrid were deposited in B and AZU.

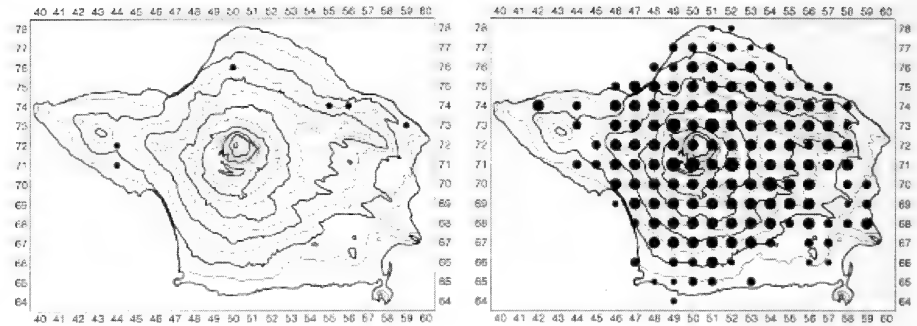


**Figure 20.** Left: *Asplenium trichomanes* L. subsp. *quadrivalens* D.E.Mey. emend. Lovis; right: *Asplenium x rouyi* Viane.

*Asplenium x ticinense* D.E.Mey., Ber. dt. bot. Ges. 73: 391. 1961. (*A. adiantum-nigrum* L. x *A. onopteris* L.). **Col.:** Az-F-649, Az-F-1029. **H:** Found together with the parents on a young lava flow near Capelo and in four other locations in the N and NE on W exposed slopes in pastures below 300 m altitude. **L:** Previously not reported from FAI. **D(A):** FAI, MAR, FLO. **D(G):** Reported from the Azores, Madeira, Ireland and C Europe.

## WOODSIACEAE

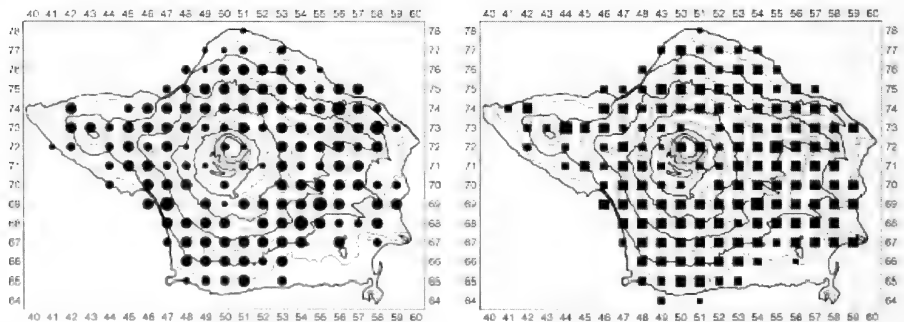
*Athyrium filix-femina* (L.) Roth, Tent. Fl. Germ. 3(1): 65. 1799. **Col.:** Az-F-1081. **H:** Common in ravines, forests and natural pastures [(20-) 130-1000 m]. **L:** Watson, 1844; Trelease, 1897; Palhinha, 1943, 1966; Vasconcellos, 1968; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands. **D(G):** Native to Macaronesia (except CV) and circumboreal.



**Figure 21.** Left: *Asplenium x ticinense* D.E.Mey.; right: *Athyrium filix-femina* (L.) Roth.

***Diplazium caudatum*** (Cav.) Jermy, Brit. Fern Gaz. 9: 161. 1964. **Col.:** Az-F-1077. **H:** Common in shady ravines and *Pittosporum* forest [(30-) 150-600 (-800) m]. **L:** Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975. **D(A):** All islands. **D(G):** Native to Macaronesia and SW Spain.

***Deparia petersenii*** (Kunze) M.Kato, Bot. Mag., Tokyo 90: 37. 1977. *Diplazium allorgei* Tardieu, Notul. Syst. 7: 150. 1938; *Lunathyrium petersenii* (Kunze) H.Ohba, Sci. Rep. Yokosuka Mus. 11: 53. 1965. **Col.:** Az-F-642. **H:** Naturalized and very common on slopes, in ravines, forests and tree plantations [30-900 m]. **L:** Gonçalves, 1962 (Sjögren, 1973b); Vasconcellos, 1968; Franco, 1971; Silva & Silva, 1974. **D(A):** All islands. **D(G):** Native to tropical and subtropical Asia; naturalized in the Azores and Madeira. *Deparia* was first collected in the Azores by B. Carreiro on MIG (Christ, 1906). It was misidentified for many years and even described as a new endemic species by Tardieu-Blot (1937). Sledge (1975, 1977) was the first botanist who could determine this interesting species correctly, more than 70 years after its introduction to the islands!



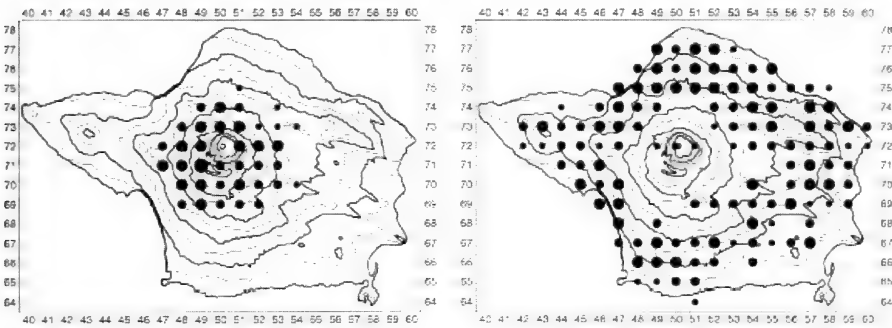
**Figure 22.** Left: *Diplazium caudatum* (Cav.) Jermy; right: *Deparia petersenii* (Kunze) M.Kato.

***Cystopteris diaphana*** (Bory) Blasdell, Mem. Torrey Bot. Club 21(4): 47. 1963. *C. azorica* Fée, Mem. Fam. Foug. 5: 300. 1852. nom. nud.; *C. fragilis* auct., non (L.) Bernh., J. Bot. (Schrader) 1: 27. 1806.; *C. fragilis* (L.) Bernh. var. *azorica* (Fée)

T.Moore, Ind. Fil.: 282. 1861; *C. viridula* (Desv.) Desv., Mem. Soc. Linn. Paris 6: 264. 1827. **Col.:** Az-F-277, Az-F-298. **H:** Rare in crevices of wet rocks in very shady ravines and craters. Restricted to the most humid habitats of the island, [(350-) 500-950 m]. **L:** Seubert, 1844; Watson, 1843, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Palhinha, 1943; Franco, 1971; Sjögren, 1973b; Silva & Silva, 1974; Lüpnitz, 1975. **D(A):** All islands except GRA and MAR. **D(G):** Native to Macaronesia (except CV), Spain, Portugal, E Africa, Mexico and S America.

**DRYOPTERIDACEAE**

*Polystichum setiferum* (Forssk.) Woy., Mitt. Naturw. Ver. Steierm. 49: 181. 1913. [*Aspidium aculeatum* Sw., J. Bot. (Schrader) 2: 37. 1802; *P. aculeatum* auct., non (L.) Roth, Tent. Fl. Germ. 3: 79. 1799]. **Col.:** Az-F-1052. **H:** Common on slopes and in hedges between pastures [50-480 (-750) m]. **L:** Seubert, 1844; Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b. **D(A):** All islands. **D(G):** Native to Macaronesia (except CV) and temperate & tropical regions of the Old World.

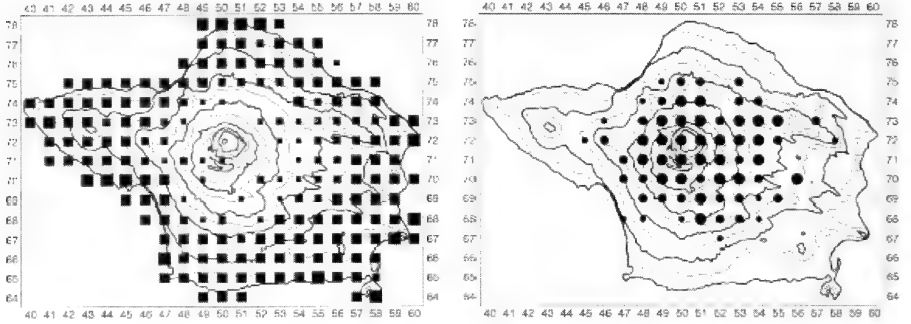


**Figure 23.** Left: *Cystopteris diaphana* (Bory) Blasdell; right: *Polystichum setiferum* (Forssk.) Woy.

*Cyrtomium falcatum* (L.f.) C.Presl, Tent. Pterid.: 86. 1836. *Polystichum falcatum* (L.f.) Diels, Nat. Pfl. 1: 194. 1899; *P. acrostichoides* auct., non (Michx.) Schott, Gen. Fil.: 9. 1834. **Col.:** Az-F-1059. **H:** Naturalized and very common in coastal areas: in rock crevices, walls and on slopes. Common in shady ravines up to 500 m, scattered along roads and on walls up to 1000 m. Above 500 m, this species is restricted to man made habitats [0-600 (-1000) m]. **L:** Tutin & Warburg, 1932; Palhinha, 1943, 1966; Vasconcellos, 1968; Sjögren, 1973b; Silva & Silva, 1974; Lüpnitz, 1975. **D(A):** All islands. **D(G):** Native to Asia (Japan, Taiwan, Korea, China, India), S Africa and Polynesia; introduced to Macaronesia (Azores, Madeira, Selvagens, Canaries).

*Dryopteris aemula* (Aiton) O.Kuntze, Rev. Gen. Pl. 2: 812. 1891. **Col.:** Az-F-1070. **H:** Common, but usually above 500 m; on steep slopes, in hedges, ravines, *Cryptomeria* plantations, *Juniperus* forest, laurisilva and natural pastures [(300-) 500-1000 m]. **L:** Seubert, 1844; Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Silva & Silva, 1974; Lüpnitz, 1975; Fraser-Jenkins, 1982; Dias, 1996. **D(A):** all islands. **D(G):** Native to

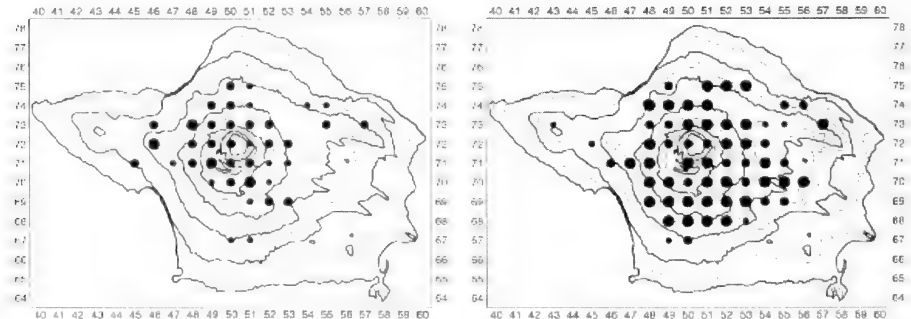
Macaronesia (Gomera, Madeira, Azores), GB, NW France, Spain, Turkey and the Caucasus; records from CV were erroneous (Fraser-Jenkins 1982).



**Figure 24.** Left: *Cyrtomium falcatum* (L.f.) C.Presl; right: *Dryopteris aemula* (Aiton) O.Kuntze.

*Dryopteris affinis* (Lowe) Fraser-Jenk., Fern Gaz. 12: 56. 1979. subsp. *affinis* Fraser-Jenk., Willd. 10: 108. 1980. **Col.:** Az-F-762, Az-F-820. **H:** Scattered, but locally common in natural pastures and ravines at high altitudes, in *Cryptomeria* plantations, and isolated in a *Myrica-Pittosporum* forest close to Arieiro [(320-) 600-900 m]. **L:** Palhinha, 1943, 1966; Sjögren, 1973b; Dias, 1996. **D(A):** All islands except COR and MAR. **D(G):** Macaronesia (except CV), W Europe, Germany, Austria, Turkey, Caucasus. Records of *Dryopteris filix-mas* from FAI (Lüpnitz, 1975) probably refer to this species.

**\**Dryopteris azorica*** (Christ) Alston, Bol. Soc. Brot., Ser. 2, 30: 14. 1956. *D. dilatata* (Hoffm.) A.Gray, Man. Bot. North U.S.: 631. 1848. subsp. *azorica* (Christ) P.Silva & Q.Silva, Agron. Lusit. 36: 17. 1974. **Col.:** Az-F-1019. **H:** Common in ravines and old *Cryptomeria* plantations, *Pittosporum* forest and laurisilva [400-850 m]. **L:** Alston, 1956; Palhinha, 1966; Franco, 1971; Silva & Silva, 1974; Fraser-Jenkins, 1982. **D(A):** All islands except GRA. Collected on COR by Rumsey in 1998 (BM) (Rumsey, in lit.). **D(G):** Endemic to the Azores.

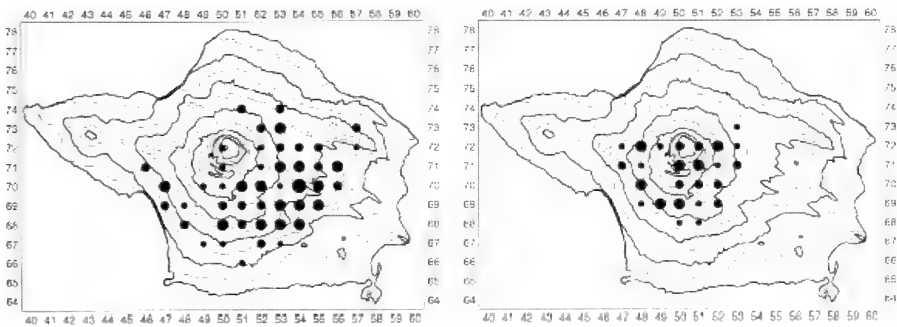


**Figure 25.** Left: *Dryopteris affinis* (Lowe) Fraser-Jenk. subsp. *affinis* Fraser-Jenk.; right: *Dryopteris azorica* (Christ.) Alston.

**\*\**Dryopteris crispifolia*** Rasbach, Reichst. & Vida, Bot. J. Linn. Soc. 74: 270. 1977. **Col.:** Az-F-254, Az-F-1051. **H:** Scattered, but locally common in old *Cryptomeria* plantations, on slopes and in ravines, especially in the SE [(250-) 350-780 m]. **L:** Described in 1977, previously collected by Gonçalves in 1963, 1971, 1973 (Gibby *et al.*, 1977). **D(A):** FAI, FLO and PIC; (reports from MIG probably in error for *Dryopteris azorica* (Christ) Alston (Fraser-Jenkins 1982)). **D(G):** Endemic to the Azores. This species is tetraploid and probably derived from *D. aemula* and *D. azorica* (Gibby *et al.*, 1977).

### LOMARIOPSIDACEAE

**\**Elaphoglossum semicylindricum*** (T.E.Bowdich) Benl, Botanica Macaronésia 6: 59. 1980. *Elaphoglossum hirtum* auct., non (Sw.) C.Chr., Ind. Fil.: 308. 1906. **Col.:** Az-F-626, Az-F-1056. **H:** Rare, often very small populations and restricted to single trees; usually in deep, shady ravines above 600 m and inside the caldera; growing epiphytically on *Ilex*, *Laurus*, *Juniperus*, *Vaccinium* and rarely on steep slopes [580-880 m]. **L:** Seubert, 1844; Watson, 1844, 1870; Drouet, 1866; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975; Dias, 1996. **D(A):** All islands except COR, MAR, GRA. **D(G):** Endemic to the Azores and Madeira.



**Figure 26.** Left: *Dryopteris crispifolia* Rasbach, Reichst. & Vida; right: *Elaphoglossum semicylindricum* (T.E. Bowdich) Benl.

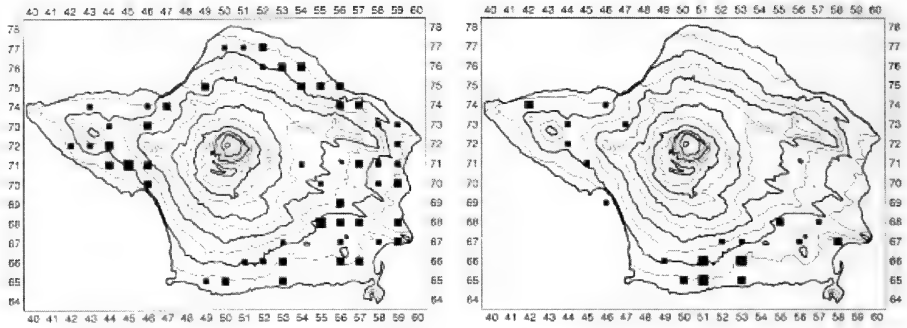
### OLEANDRACEAE

***Nephrolepis cordifolia*** (L.) C. Presl, Tent. Pterid.: 79. 1836. **Col.:** Az-F-1082. **H:** Widely cultivated and locally naturalized on roadsides in *Myrica-Pittosporum* forest, in ravines, on walls and waste places close to settlements; sometimes epiphytic on *Populus* [10-480 m]. **L:** Previously not reported growing spontaneously at FAI. **D(A):** FAI, MIG, MAR, GRA and FLO (Schäfer, unpubl.). **D(G):** Native to the tropics of Africa, Asia and America; locally naturalized in Macaronesia. *Nephrolepis* was first found growing spontaneously in the Azores in 1987 at MIG (Hansen, 1992).

### BLECHNACEAE

***Doodia caudata*** (Cav.) R.Br., Prodr.: 151. 1810. **Col.:** Az-F-282. **H:** Introduced and quite common in a few *ribeiras* in the S; scattered on slopes in *Myrica-Pittosporum*-shrub in the W [5-350 m]. **L:** Vasconcellos, 1968. **D(A):** FAI, PIC, MAR, GRA, TER

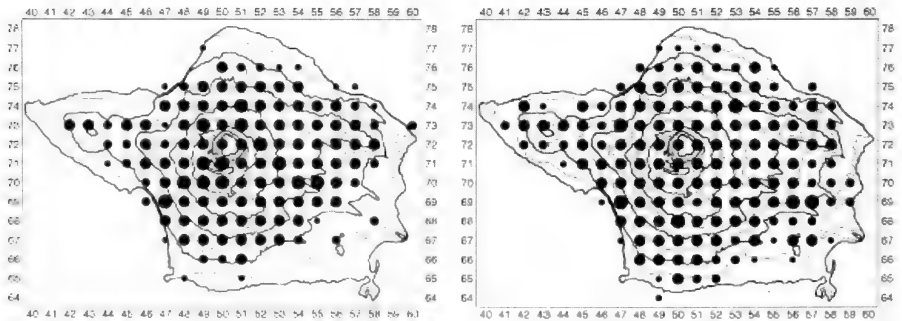
and MIG. **D(G)**: Native to Australia, New Zealand and Tasmania; naturalized in the Azores and Madeira.



**Figure 27.** Left: *Nephrolepis cordifolia* (L.) C. Presl; right: *Doodia caudata* (Cav.) R.Br.

***Blechnum spicant*** (L.) Roth, Ann. Bot. 10: 56. 1794. **Col.:** Az-F-1071. **H:** Common on slopes, in forests and natural pastures [(5-) 200-1000 m]. **L:** Seubert, 1844; Watson, 1843, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975; Dias, 1996. **D(A):** All islands except GRA. **D(G):** Macaronesia (except CV), Europe, N Africa, Asia and N America.

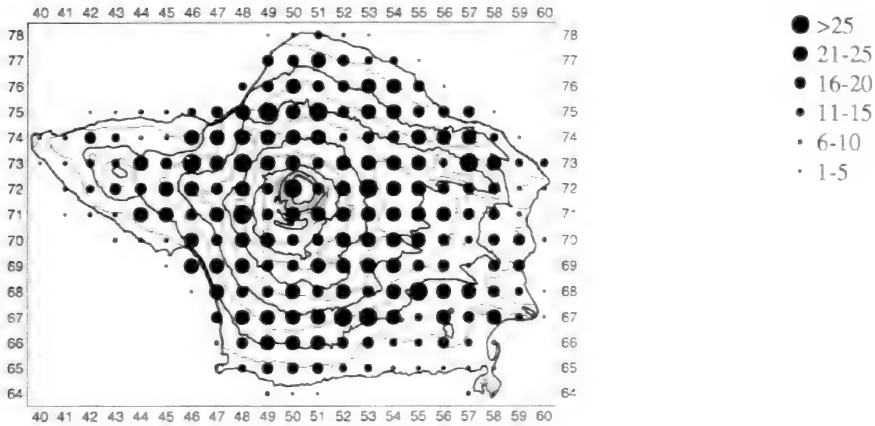
***Woodwardia radicans*** (L.) J.E.Sm., Mem. Acad. Sci. Turin 5: 412. 1793. **Col.:** Az-F-1076. **H:** Common in ravines, on slopes, in old *Pittosporum* forest, laurisilva and *Erica* shrub [60-950 m]. **L:** Watson, 1843, 1844; Seubert, 1844; Drouet, 1866; Watson, 1870; Trelease, 1897; Cunha & Sobrinho, 1938; Palhinha, 1943, 1966; Franco, 1971; Sjögren, 1973b; Lüpnitz, 1975; Dias, 1996. **D(A):** All islands except GRA. **D(G):** Native to Macaronesia (except CV), Spain, Portugal (Gerês, Sintra) S Italy, Sicily, Corsica, Crete, Himalayas, China, Japan, Phillipines, Java, C America.



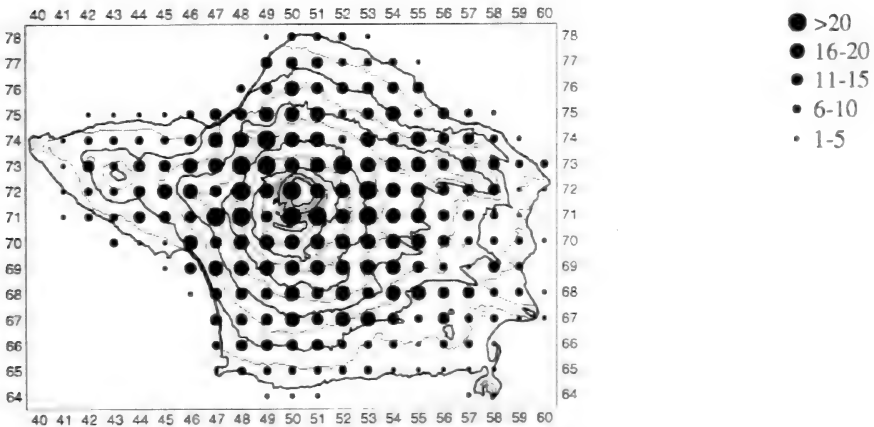
**Figure 28.** Left: *Blechnum spicant* (L.) Roth; right: *Woodwardia radicans* (L.) J.E.Sm.

**Diversity maps**

The distribution data of the pteridophytes of Faial Island was used to create three synthetical distribution maps, showing the  $\alpha$ -diversity, i. e. the number of taxa per km<sup>2</sup>. In Figure 29, the diversity of pteridophytes in general is shown, using the distribution data of all 54 taxa found on the island. The maximum was found to be 29 taxa per km<sup>2</sup>. There are three centres of diversity at low altitudes – in the SE (Flamengos region), the NW (Praia do Norte, Ribeira Funda) and in the NE (Salão) – and two at high altitudes: the caldera and the slopes in the N/NW. The surroundings of the capital Horta and the region of the Capelinhos Volcano in the W are extremely poor in pteridophytes.

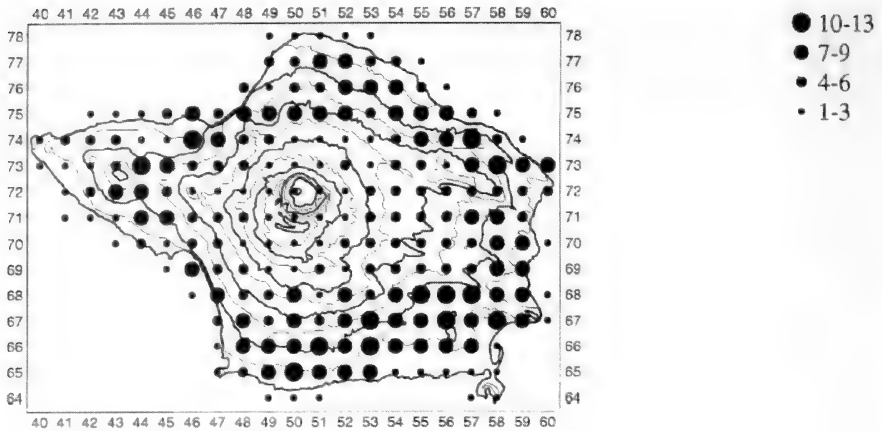


**Figure 29.** Pteridophytes on Faial Island (taxa/km<sup>2</sup>).



**Figure 30.** Indigenous pteridophytes on Faial Island (taxa/km<sup>2</sup>).

In Figure 30, only the data of the 41 probably indigenous taxa were used. The maximum of indigenous pteridophytes on Faial Island is 23 per km<sup>2</sup>. The number of indigenous pteridophytes increases at higher altitudes, reaching maximum values in the caldera and in the NW from 500 to 700 m a.s.l.



**Figure 31.** Neophytic pteridophytes on Faial Island (taxa/km<sup>2</sup>).

Finally, a synthetical distribution map of the 13 neophytes among the pteridophytes of Faial Island was created (Figure 31). The centres of neophyte diversity in pteridophytes are located in and around some coastal settlements, especially Flamengos, Castelo Branco, Praia do Norte and Salão. The number of introduced ferns is reduced above 500 m but a few are present even at the highest altitudes.

### DISCUSSION

Seventy five percent of the pteridophytes of Faial Island are classified as indigenous species, five of them being endemic to the Azores, four of them endemic to Madeira and the Azores. The low rate of neophytes in pteridophytes is in contrast to rates of more than eighty percent of exotic species in the total flora of the island (Schäfer, 2000a). All the neophytic pteridophytes were introduced as ornamental plants, especially in the past 100 years, but soon spread from private gardens to natural habitats. Most of these taxa are restricted to lower altitudes and the surroundings of settlements either due to climatical reasons or, especially in slow spreading taxa, due to historical reasons. A similar decline in the number of neophytes at higher altitudes was found for the complete flora of Faial (Schäfer, 2000b). The percentage of pteridophytes in the flora in total increases at higher altitudes due to the rapidly decreasing number of spermatophyte taxa. By comparing the diversity maps with a precipitation map of Faial Island (Schäfer 2000a), the centers of diversity of the indigenous pteridophytes were found to be located in the most humid regions of the island. There is no correlation with different kinds of agriculture or the distribution of *Cryptomeria* plantations on Faial.

Four pteridophytes were found in more than eighty percent of all UTM squares: *Pteridium aquilinum*, the neophytes *Cyrtomium falcatum* and *Selaginella kraussiana* and the endemic *Polypodium azoricum*. These species are found especially in intensively cultivated areas, in pastures, on walls or in hedges between pastures. They have a very broad altitudinal range. On the other hand, the indigenous species *Huperzia suberecta*, *Ophioglossum azoricum*, *Lycopodiella cernua* and *Elaphoglossum semicylindricum* were found to be restricted to very few locations on the island. These species are in danger of extinction on Faial but are more common on other islands of the archipelago, especially on Flores.



Four pteridophytes, reported from Faial by Vasconcellos (1968) could not be found during this study: *Adiantum aneitense* Carruth., *Pteris multifida* Poir., *Pityrogramma calomelanos* (L.) Link var. *aureoflava* (Hook.) Weath. ex Bailey and *Pityrogramma chrysophylla* (Sw.) Link. These species were reported as escapes from cultivation and might have disappeared. Furthermore, *Pteris cretica* L. and *Oreopteris limbosperma* (All.) Holub reported by Sjögren (1973a) were not found in 1999. *Pteris cretica* is a neophyte in the Azores and was either overlooked or has disappeared outside private gardens. *Oreopteris limbosperma* might still exist somewhere inside the caldera. It is native to the Azores and a common fern of high altitudes e. g. on Flores. A single report of *Davallia canariensis* (L.) J.E.Sm. from the Caldera by Cunha & Sobrinho (1938) repeated in Cunha (1939) was in error for *Calocitica macrocarpa*.

### CONCLUSIONS

There is no dominance by exotic species in the fern flora of Faial Island. However, neophytic species like *Sphaeropteris cooperi* and *Deparia petersenii* spread in a very short period of time from coastal gardens to the most important reserves of the island including Caldeira Grande. Though less obvious, these species are, like *Hydrangea* and *Hedychium*, a threat to the endangered endemic flora of the Azores and their populations should be controlled with mechanical, biological and in a few places with chemical methods. In future, populations of any further garden escapes should be destroyed before they can become established.

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## BOOK REVIEW

**Papers from the Pteridophyte Biogeography Symposium, International Botanical Congress, St Louis, Missouri, 2 August 1999. R.C. Moran (ed.) 2001.** *Brittonia* 53(2):171-375. ISSN 0007-196X. Available as a back issue from The New York Botanical Garden, Bronx, NY 10458-5126, USA, price USD14.00 plus p&p.

This is an interesting issue of *Brittonia* containing six papers of relevance to the biogeography of fossil and extant ferns.

Margaret Collinson (Cainozoic ferns and their distribution, pp. 173-235) reviews the Cainozoic (65-1.8 Ma) distribution of fossil ferns and relates this to their present-day distribution. The macro- and mesofossil records are reappraised, and evidence considered from a few highly diagnostic spores. Anyone who found her 1996 paper useful or interesting must read this next instalment which again presents a well researched and well thought out review.

Judith Skog's paper (Biogeography of Mesozoic leptosporangiate ferns relates to extant ferns, pp. 236-269) goes further back in time, with a survey of fossil ferns from the Mesozoic (248-65 Ma). It concentrates on three aspects: the position of the continents, inferred rainfall patterns, and suggested wind patterns and climatic conditions during the time and appearance and distribution of the leptosporangiate fern families in the Mesozoic. A thought-provoking paper for modern biogeographers.

Barbara Parris (Circum-Antarctic continental distribution patterns in pteridophyte species, pp. 270-283) and Patrick Brownsey (New Zealand's pteridophyte flora – plants of ancient lineage but recent arrival?, pp. 284-303) look at the present distributions of pteridophytes in southern latitudes. Parris discusses four major austral continental distribution patterns and finds that long distance dispersal rather than continental drift is a likely explanation for the patterns. Brownsey considers the modern pteridophyte flora of New Zealand and concludes that ferns have greater dispersal potential than flowering plants, and that pteridophyte distributions are more heavily influenced by temperature, rainfall and geothermal activity than by geological history.

The last two papers concern tropical plants. Robbin Moran and Alan Smith (Phytogeographic relationships between neotropical and African-Madagascan pteridophytes, pp. 403-351) studied the floristic affinities between neotropical and Afro-Madagascan pteridophytes by assessing three hypotheses: the boreotropics hypothesis, continental drift and long-distance dispersal, with the last seeming to account for most examples discussed. In the final paper in this issue of *Brittonia*, Cynthia Dassler and Donald Farrar (Significance of gametophyte form in long-distance colonization by tropical, epiphytic ferns, pp. 352-369) consider the significance of gametophyte form in long distance colonization by tropical, epiphytic ferns and propose that gametophytic gemmae are a significant aid to this.

### Reference

COLLINSON, M.E. 1996. "What use are fossil ferns?" – 20 years on: with a review of the fossil history of extant pteridophyte families and genera. pp. 349-394. In: J.M. Camus, M. Gibby & R.J. Johns (eds) *Pteridology in perspective*. Royal Botanic Gardens, Kew.

## NOTES ON GRAMMITIDACEAE (FILICALES) OF SRI LANKA AND THE DESCRIPTION OF THREE NEW SPECIES

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Key words: Sri Lanka, Grammitidaceae, *Ctenopteris epaleata*, *Grammitis sledgei*, *Prosaptia ceylanica*.

### ABSTRACT

Three new species of Grammitidaceae are described from Sri Lanka; they are *Ctenopteris epaleata*, *Grammitis sledgei* and *Prosaptia ceylanica*. Lectotypes are chosen for *Polypodium mediale*, *P. moultonii*, *P. subfalcatum* var. *glabrum*, *P. thwaitesii*, *P. wallii*, *Trichomanes contiguum* and *Vittaria sulcata*.

### INTRODUCTION

An account of the family Grammitidaceae (Filicales) has recently been completed for the Flora of Ceylon which contains seven genera and 22 species, three of which are undescribed. One species that is also known from South India has been described previously (Parris, 2001). The three new species are described here. Lectotypes are chosen here for seven taxa that occur in Sri Lanka.

### DESCRIPTIONS

*Ctenopteris epaleata* Parris, sp. nov. *C. perplexae* Parris et *C. repandulae* (Mett.) C.Chr. & Tardieu similis, sed paleis in rhizomate destitutis, laminis ad marginem non crispatis et crenatis, rhachidibus adaxialibus non prominentibus differt. Typus: Sri Lanka, Central Province, Nuwara Eliya District, Horton Plains, road to World's End, c. 6°47'30"N 80°48'30"E, c. 2090 m alt., 15 Nov. 1976, *Faden* 76/282 (holotypus K; isotypi GH, UC, US).

Rhizomes ± erect, radial, stipes in whorls of 3, not articulated to rhizome, scales absent. Stipes winged to base or 1-11 x 0.2-0.9 mm; with pale yellow-brown to pale red-brown simple eglandular hairs 0.2-1.8 mm. Laminae 24-200 x 3-28 mm, narrowly lanceolate, narrowly oblanceolate, narrowly elliptic or linear-elliptic in outline, obtuse to acuminate at apex, long-attenuate at base, deeply pinnately divided, longest pinnae 2-20 x 1-6 mm, very narrowly triangular, narrowly oblong or narrowly oblanceolate, obtuse to acute at apex, sessile to decurrent on acroscopic margin, decurrent on basisopic margin at base, entire or lobed, longest lobes 0.7-5.2 x 0.2-2.0 mm, narrowly triangular to very broadly triangular, emarginate, bluntly acute or obtuse at apex, entire; with pale yellow-brown or pale red-brown simple eglandular hairs 0.2-2.1 mm on abaxial surface of lamina, including sometimes as receptacular paraphyses, and both surfaces of rachis, sometimes on both surfaces of pinna mid-vein, margin, and adaxial surface of lamina, and pale yellow-brown to pale red-brown 1-3-forked hairs 0.1-1.2 mm on abaxial surface of rachis, sometimes on abaxial surface of lamina and pinna mid-vein and on margin; rachis slightly prominent to prominent on abaxial surface of lamina, concolorous with it or slightly darker, level to

slightly sunken on adaxial surface, darker than it; lateral veins simple or 1<sup>st</sup> acroscopic vein sometimes 1-forked, free, each vein ending marked by a hydathode 0.1-0.7 x 0.1-0.2 mm. Sori 0.7-2.1 x 0.6-1.6 mm, usually on surface of lamina, rarely slightly sunken in broad shallow depressions, discrete to confluent when mature, in 2 rows per pinna, 1 each side of pinna mid-vein, rarely only 1 row, on acroscopic side of pinna, 1-7 per row on longest pinnae. Sporangia 150-230 µm, glabrous; indurated cells of annulus 7-15. Spores 21-40 µm diam.

*Paratypes*: Sri Lanka: Central Province: Knuckles Mt, Sledge 1072 (L, WELT), Walker T.245 (BM), Walker T.250 (BM): Nuwara Eliya District: Adam's Peak, Matthew s. n. (K); Hakgala, Sledge 632 (K p. p.), Sledge s. n. (WELT); Hakgala to Nuwara Eliya road, Ballard 1277 (K); Horton Plains, Pearson 616 (CGE); Horton Plains, World's End, Piggott 2688 (K); Horton Plains, Little World's End, Braggins 82/367 (AKU); Horton Plains, Horton Plains Farm Headquarters, Fosberg 49977 (GH, K, L, US); Horton Plains, forest behind Farr Inn, Fosberg 53300 & Sachet (US); Pattipola end of Horton Plains, Braggins 82/401 (AKU); road to Ohiya near Anderson Bungalow, Braggins 82/392 (AKU); Kandapola Forest Reserve, Sledge 1330 (A, K p. p.); Nuwara Eliya, Freeman 302, 303, 308, 309 (all BM); Pedrotalagalla, Gamble 27557 (K); Central Province, Gardner/Thwaites C. P. 3073 (BM p. p., CGE p. p., K p. p., L, PDA p. p.), Beckett 1632 (BM). Localities not traced: Bopatolawa patmas[?], Wall s. n. (PDA); Elk Plains, Ballard 1351a (K). Without locality, herb. Beddome F of B I t. 188 (BM), ex herb. Ferguson (GH, US), Gardner 58 (BM p. p.), Gardner 1147 (CGE p. p.), Gardner 1282 (K p. p.), Gardner 1290 (B, PDA p. p.), Hutchison s. n. (B), Macrae 431B (CGE), 431 p. p. (BM), Robinson 184 (K), Vincent s. n. (CGE), Wall s. n. (GH, UC p. p.), no collector, no. 171 (PDA), no collector, no date, (K p. p.), no data (B).

Endemic to Kandy and Nuwara Eliya Districts in Central Province, Sri Lanka. Pendulous epiphyte on mossy tree trunks in dense mossy forest and disturbed remnant mossy forest, sometimes associated with *Indocalamus*, sometimes growing with bryophytes, recorded as rare and as common; from c. 1220-2700 m alt.

*Ctenopteris epaleata* is distinguished from both of its relatives, *C. perplexa* Parris and *C. repandula* (Mett.) C. Chr. & Tardieu, by the absence of rhizome scales, margin never crisped and crenate and rachis not prominent adaxially. It has rather smaller sporangia and spores than *C. perplexa* and does not have the sori slightly prominent on the adaxial surface of the lamina as does *C. repandula*. In addition it reaches rather higher altitudes than either of these species. The related Malesian species *C. subfalcata* (Blume) Kunze differs from the three Sri Lankan species in its much denser laminar indumentum.

The chromosome counts recorded from Sri Lanka for *Ctenopteris sp.* and *C. subfalcata* (Manton & Sledge 1954), which apparently lack voucher specimens, may refer either to *C. epaleata* or to *C. perplexa*. Both species are known from Hakgala, the source of the cytological material, and both were collected there by Sledge, who was a co-collector of the cytological sample. Sledge (1960) mentions the variability of the pubescence and the degree of serration in what he refers to as *Ctenopteris subfalcata*, but was unable to detect any correlated differences. He did not note the correlation of presence of rhizome scales and adaxially prominent rachis which distinguishes *C. perplexa* from *C. epaleata*.

***Grammitis sledgei* Parris, sp. nov.** *G. mediale* (Baker) Ching affinis, sed differt pilis laminae longioribus, costis adaxialibus minus prominentibus, hydathodis minus

manifestis, pilis sporangiorum longioribus et sporis parvioribus; *Typus*: Sri Lanka, Sabaragamuwa Province, Ratnapura District, by Kalu Ganga below Adam's Peak, 430 m, 9 March 1954, *Sledge* 1281 (holotypus BM; isotypus US). *Grammitis medialis* sensu Sledge, Bull. B. M. (Nat. Hist.) Bot. 2(5): 151 quoad Gardner 1283/Thwaites C. P. 1283 p. p., *Sledge* 1281, Wall in herb. Hance et herb. J.Sm.

Rhizomes short-creeping to long-creeping, dorsiventral, stipes in 2 rows, sometimes articulated to rhizome, stipes 0.2-4.0 mm apart in each row; scales 0.5-2.5 x 0.3-1.1 mm, ovate to narrowly lanceolate, obtuse to acuminate at apex, pale to medium red-brown, sometimes dark brown at point of attachment, glabrous, neither clathrate nor iridescent. Stipes 2-11 x 0.2-0.9 mm, with whitish or pale to dark red-brown simple eglandular hairs 0.1-0.3 mm. Laminae 17-67 x 2-5 mm, narrowly oblanceolate, linear-oblanceolate or linear-elliptic, acute to obtuse at apex, long-cuneate to long-attenuate at base, entire; with medium to dark red-brown simple eglandular hairs 0.1-0.6 mm on abaxial surface of mid-vein and margin, sometimes on abaxial surface of lamina adjacent to margin and mid-vein and amongst sori, and adaxial surface of lamina and mid-vein; mid-vein level to slightly sunken and darker than lamina, or slightly prominent and concolorous to darker on adaxial surface, slightly prominent to prominent, concolorous or darker, on abaxial surface, fertile veins 1-forked, free, each vein ending sometimes marked by a hydathode 0.1-0.2 x 0.1 mm. Sori 0.7-2.2 x 0.4-2.0 mm, on surface of lamina or slightly sunken in broad shallow depressions, discrete to confluent when mature, in 2 rows, 1 each side of mid-vein, 1-20 in each row, mid-way between mid-vein and margin or slightly nearer to margin or mid-vein. Sporangia 180-270  $\mu\text{m}$ , with 1-4 dark red-brown simple eglandular hairs 140-410  $\mu\text{m}$  at apex adjacent to annulus; indurated cells of annulus 8-17. Spores 27-39  $\mu\text{m}$  diam.

*Paratypes*: Sri Lanka: Sabaragamuwa Province: Ratnapura District: Carney Estate, Gilimale Forest, Braggins 82/535 (AKU); track in Gilimale Forest from Carney road to Kalu Ganga, near Kalu Ganga, Faden 76/458 (GH, K, US); Rakwana, Schmid 1155 (BM); E of Ratnapura, Dotoluoya - Bambarakotuwa Oya, Meijer 869 (K); Tumbagoda above Balangoda, Kostermans 24498 (A, K, L); mile post 6/5 on bridge past Rassagala on Balangoda-Rassagala road, Faden 76/304 (US p. p.); above Agarsland Estate, Braggins 82/454 (AKU); Central Province: Nuwara Eliya District: Rambodde, 1220-1520 m, Wall s. n. (BM); Rambodde & Ponthukorle, Gardner C. P. 1283 (B p. p., BM, K, GH, P p. p., PDA p. p.); Lonach near Norton Bridge, *Sledge* 596 (L). Southern Province: Galle District: Kanneliya Forest reserve, Faden 76/505 (K, US). Without locality, ex herb. Ferguson (GH, US), L 922.1666...877 (L), Nietner s. n. (B, JE), Trimen s. n. (K p. p., UC p. p.), Wall s. n. (BM, GH, K p. p., P p. p.), no collector, no. 162 (PDA p. p.), no collector, herb. J. Smith (BM). Locality not found, Mandagala Mukelanae Hewesse, no collector (PDA).

Endemic to Ratnapura, Nuwara Eliya and Galle Districts, Sri Lanka. Terrestrial on turf banks and rupestral on mossy shaded rocks along rivers in lowland evergreen forest, sometimes growing with bryophytes, recorded as locally common and as common; from c.120-910 m alt. The altitude of 4000-5000 ft (1220-1520 m) noted on Wall s. n. (BM) is higher than any other recorded for this species and may be an error.

In Sri Lanka *G. sledgei* has previously been included (*Sledge* 1960) with *G. medialis*, which differs in its shorter lamina hairs, the mid-vein more prominent on the adaxial surface of the lamina, more obvious hydathodes, sori nearer margin, shorter sporangial setae and larger spores; usually it also occurs at higher altitudes. Like *G. medialis*, *G. sledgei* may be a facultative rheophyte.

***Prosaptia ceylanica* Parris, sp. nov.** A *P. khasyana* (Hook.) C.Chr. & Tardieu paleis rhizomatis parvioribus atrobrunneis vel atris pilis densioribus pallidis vel brunneis fimbriatis, pilis circum marginem sori brevioribus, sporangiis et sporis parvioribus, a *P. barathrophylla* (Baker) M.G.Price soris minus profunde immersis, in lacunis parietibus declivibus sed non verticalibus, pilis circum marginem sori densioribus et pilis ad paginam inferioram laminae minus densis recedit. *Holotypus*: Sri Lanka, Southern Province, Matara District, Sinha Raja Forest above Beverley Estate, Deniyaya, c. 840 m alt., 4 April 1954, Sledge 1413 (K). *P. khasyana* sensu Sledge, Bull. B. M. (Nat. Hist.) 2(5): 157 (1960) quoad Sledge 1413.

Rhizomes short-creeping, dorsiventral, stipes in 2 rows, articulated to rhizome, phyllopodia 0.3-0.4 mm high, stipes 0.2-0.4 mm apart in each row; scales 0.4-1.1 x 0.1-0.2 mm, broadly to narrowly lanceolate, acute at apex, dark brown to blackish, ciliate with usually whitish, sometimes pale to medium red-brown, simple eglandular hairs 0.1-0.2 mm on margin, clathrate, sometimes slightly iridescent. Stipes 2-3 x 0.3-0.4 mm, with medium to dark red-brown simple eglandular hairs 0.2-0.5 mm. Laminae c. 143+ x 19 mm, narrowly elliptic in outline, apex unknown, attenuate at base, deeply pinnately divided, longest pinnae 9-11 x 3 mm, narrowly triangular, bluntly acute to acute at apex, sessile on acroscopic margin, slightly decurrent on basisopic margin at base, entire or slightly crenulate; with medium to dark red-brown simple eglandular hairs 0.2-0.5 mm on abaxial surface of lamina including rim of soral depressions, margin, and both surfaces of rachis, and pale to medium red-brown 1-2-forked hairs 0.1-0.2 mm on abaxial surface of rachis and lamina; rachis slightly prominent and concolorous on both surfaces of lamina; lateral veins simple, endings without hydathodes. Sori 0.8-1.2 x 0.8-1.0 mm, sunken in sloping-walled depressions in lamina which are slightly prominent on adaxial surface, discrete to contiguous when mature, in 2 rows per pinna, 1 on each side of pinna mid-vein, 4-5 in each row on longest pinnae. Sporangia 130-170 µm, glabrous; indurated cells of annulus 10-12. Spores 27-36 µm diam.

Known only from the Sri Lankan (Matara District) type collection. Growing with bryophytes and *Mecodium*; at c. 840 m alt. *Prosaptia ceylanica* is closely related to *P. khasyana* (Hook.) C.Chr. & Tardieu, of Khasya and Assam, and *P. barathrophylla* (Baker) M.G.Price, of Hainan, Thailand, Cambodia, Vietnam, Peninsular Malaysia, Sumatra, Java, Borneo, Sulawesi and Philippines. From the former it differs in smaller darker rhizome scales with denser indumentum of whitish to pale or medium red-brown simple eglandular hairs, shorter simple eglandular hairs around sorus rim, and smaller sporangia and spores. From the latter it differs in having less deeply sunken sori, in pits with sloping, not vertical walls, more dense circumsoral hairs and less dense hairs on the abaxial surface of the lamina. The rhizome scales of *P. barathrophylla* and *P. ceylanica* are very similar. *Prosaptia fuscopilosa* (F.Muell. & Baker) Parris of Australia has sori which are similarly fairly shallowly sunken into the lamina, but has a denser indumentum on the abaxial surface of the lamina.

**Lectotypification of *Polypodium mediale* Baker.** *Polypodium mediale* Baker in Hook. & Baker, Syn. Fil., ed. 2: 507 (1874). Type: Ceylon, *Wall* s. n. (lecto. K!, chosen here) = *Grammitis medialis* (Baker) Ching.. The type collection of *P. mediale* contained three distinct elements; *Grammitis attenuata* Kunze, *G. medialis* (Baker) Ching and *G. sledgei* Parris. Sledge (1960), separated the material of *G. attenuata*



from the type sheet of *P. mediale* at K, but did not notice that the specimens that he designated as the type of *G. medialis* belonged to two species. Sledge noted that 'Baker was at fault in describing the sori as nearer to the edge of the frond than the midrib', but Baker's description clearly indicates the element of the mixed type collection of *P. mediale*, after Sledge's removal of *G. attenuata*, which is selected here as lectotype. The remaining plants are referable to *G. sledgei*. Another sheet collected by Wall at K, without locality, contains material of *G. medialis*, *G. sledgei* and *G. attenuata* and may be part of the type collection. Material at BM, collected by Wall, circa Hoolankande, is perhaps part of the type collection. In addition, three sheets collected by Wall in P, without locality (although one bears the date 1887), may also be part of the type collection. One of these, dated 1887, contains two plants of *G. medialis*, the other two sheets are mixtures of *G. medialis* and *G. sledgei*. A sheet at PDA, collected by Wall, comm. 1884, without locality, may also be part of the type collection, as may be a sheet at GH collected by Wall without other data.

**Lectotypification of *Polypodium moultonii* Copel.** *Polypodium moultonii* Copel., Philipp. J. Sci., C. Bot. 10(2): 149 (1915). Type: Sarawak, Retuh, Sadong, Feb.-June 1914, native collector, Bur. Sci. 2572 (lecto. MICH!, herb. Copeland 19026, chosen here) = *Ctenopteris blechnoides* (Grev.) W.H.Wagner & Grether. Copeland did not indicate the location of the type of *P. moultonii* when describing it. Part of the type collection is likely to have been in PNH, which was destroyed during World War II, but Copeland often retained type material of his new taxa in his own herbarium, now at MICH. The one sheet of this collection in MICH bears Copeland's red type label and is selected here as lectotype.

**Lectotypification of *Polypodium subfalcatum* var. *glabrum* Beddome.** *Polypodium subfalcatum* var. *glabrum* Beddome, Ferns Brit. India, t. 189, f. b (1866). Type: Ceylon, Thwaites [/Gardner C. P. 1290] (lecto. BM!, chosen here; isolecto. B!, BM!, CGE!, K!, L!, P!, PDA!, UC!) = *Ctenopteris repandula* (Mett.) C.Chr. & Tardieu. I have chosen as lectotype of *Polypodium subfalcatum* var. *B* Beddome the sheet in BM that is from Beddome's herbarium and contains the plant illustrated with the original description of the taxon.

**Lectotypification of *Polypodium thwaitesii* Beddome.** *Polypodium thwaitesii* Beddome, Ferns Brit. India, t. 188 (1866). Type: Ceylon, Thwaites C. P. 3900 (lecto. K!, chosen here; isolecto. BM!, CGE!, GH!, K!, P!, PDA!) = *Ctenopteris thwaitesii* (Beddome) Sledge. The sheet in Kew from Beddome's herbarium that I have selected as lectotype is annotated by him as 'type of tab. 188 FBI', although it does not bear Thwaites' number. The numerous other sheets of the gathering bear the Thwaites C. P. number 3900, but lack any indication that they were examined by Beddome.

**Lectotypification of *Polypodium wallii* Beddome.** *Polypodium wallii* Beddome, Suppl. Ferns S India & Brit. India, 20, t. 380. 1876. Type: Ceylon, Adam's Peak, May 1866, Thwaites C. P. 3921 (lecto. K!, chosen here; isolecto. GH) = *Grammitis wallii* (Beddome) Copel. In the original description of *P. wallii*, Beddome does not cite a locality, apart from Central Provinces, or a collection. Later (Beddome, 1883) he cites Adam's Peak as the locality and Thwaites C. P. 3921 as the collection for *P. wallii*. Thwaites C. P. 3921 was actually gathered from two localities on different dates; the earlier is in May 1866 from Adam's Peak, represented in K, while the later is in July

1868 from Gongala Hill, Morowa Korle, represented in BM, K and PDA. Beddome's (1883) citation of Adam's Peak would imply that only material from that locality should be considered as lectotype. The only collection seen of Thwaites C. P. 3921 from Adam's Peak, May 1866, is in K, but it is not from Beddome's herbarium. It bears, in an unidentified hand, the pencilled annotation 'Beddome says this is *Polyp. Wallii* Bedd. Ic. t. 380'. In the absence of authentic material in Beddome's herbarium or annotated by him, this collection is chosen as the lectotype. The other collection on the same sheet is Thwaites C. P. 3921 from Gongala Hill, July 1868. Copeland (1952) cites the Thwaites collection, Adam's Peak, C.P. 3921 in GH, but I have not seen it there.

**Lectotypification of *Trichomanes contiguum* G. Forst.** *Trichomanes contiguum* G.Forst., Prodr., 84 (1786). Type: [Society Islands] 1 Huahine?, Mefs. Forster, 2 Otaheite, parasitica in arboribus dependens, Dav. Nelson (lecto. BM!, left hand plant, chosen here) = *Prosaptia contigua* (G.Forst.) C.Presl. I have chosen as lectotype the left hand specimen on the sheet in BM labelled '1 Huahine, Mefs[?] Forster 2 Otaheite, parasitica in arboribus dependens, Dav. Nelson', rather than the sheet annotated 'G. Forster's herbarium', '*Trichomanes n. sp.*' because the material on the former is better than on the latter. There are two plants on the type sheet and I have chosen the more complete one as lectotype. Neither plant has a number attributable to the label on the sheet, and neither locality nor collector was given in the original description.

**Lectotypification of *Vittaria sulcata* Kuhn.** *Vittaria sulcata* Kuhn, Linnaea 36: 68 (1869). Type: Ceylania, Thwaites [C. P.] 3807 (lecto. B!, chosen here; isolecto. BM!, CGE!, GH!, K, LE, P!, PDA!, W) = *Scleroglossum sulcatum* (Kuhn) Alderw. The type of this species is often assumed to be Thwaites 3807, from Ceylon (Christensen 1929, Sledge 1960), but two syntypes were included with the original description and no lectotype has been formally selected. One of the syntypes, Society Islands, Tahiti, Lepine s. n. (B!) is apparently represented in only one herbarium, while the other, Thwaites 3807, is well-represented in herbaria. I have chosen the sheet of the latter in B as lectotype.

#### ACKNOWLEDGEMENTS

I am grateful to the curators of the following herbaria for the loan of material – A, AKU, B, BM, CGE, GH, K, L, P, PDA, WELT, UC, US - and to the curator of AK for arranging the loans.

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***POLYSTICHUM* x *LESLIEI* (*P. MUNITUM* x *P. SETIFERUM*)  
(DRYOPTERIDACEAE: PTERIDOPHYTA) DESCRIBED  
AND A SECOND SITE REPORTED**

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Keywords: Cornwall, hybrid-native/alien, *Polystichum x lesliei*, *Polystichum munitum* x *P. setiferum*.

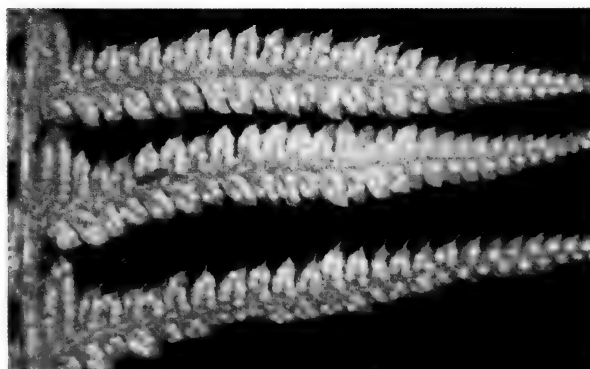
**ABSTRACT**

The new hybrid *Polystichum x lesliei* (*P. munitum* x *P. setiferum*) is described, with field observations. It represents the first reported instance in the British Isles of a spontaneous hybrid between a naturalised alien and a native fern species. This sterile hybrid was known from a sunken lane-bank site in Surrey since 1995 and recently was found again in a similar place in Cornwall.

**INTRODUCTION AND FIELD OBSERVATIONS**

*Polystichum munitum* (Kaulf.) C. Presl (Common sword fern), a native of Western North America, is found in damp woodlands from British Columbia southwards to Guadalupe Island, Mexico (Wagner, 1993). It has long been cultivated in the British Isles and is now widely available in the horticultural trade. It is one of the very few exotic fern species that have successfully become established by self-sown spores into natural habitats in the British Isles, first reported in Hascombe, Surrey (Leslie, 1981; Stace, 1997). However its persistence outside of gardens has been questioned (Stace, 1991; Clement & Foster, 1994). Leslie in 1995 (*pers. comm.*) revisited the Hascombe site and found not only increased numbers of *P. munitum*, but in addition an unusual fern growing close to some native *P. setiferum*. Since there was no other species of *Polystichum* nearby the assumption was made that the single morphologically intermediate plant was a hybrid between *P. munitum* and *P. setiferum*. The new taxon was briefly reported (Stace, 1997; Anon, 2001) but never formally described.

A second specimen of this novel taxon, with its two putative parents, was discovered in 2001 near to Par in Cornwall, despite *P. munitum* not having previously been reported as a naturalised alien in that county (French *et al.*, 1999). However, Hunt (*pers. comm.*) stated that the *P. munitum* had in fact been at the Par site for at least 30 years. The site was in a short alleyway about 50 m long and having on either side a dry boundary bank of about 2 m in height, consisting of a shaley substrate and soil, with mostly native trees and shrubs above. Both boundaries were with gardens from which the *P. munitum* may originally have escaped. There were several large plants of this naturalised alien species, along with several sporelings one or two years old. The mature plants had suffered from tidying and mechanical vegetation clearance activities, the fronds having been cut back, leaving varying degrees of damage. It was



**Figure 1.** *Polystichum* x *lesliei* from near Par, Cornwall. Top, frond *in situ*; middle, top surface of mid pinnae; bottom, underside of mid pinnae. Photographs: M. Stribley.

whilst establishing the extent of the colony that a putative hybrid (Figure 1) was discovered, by one of the authors (P.A.), c. 10 m from the main area of *P. munitum* plants. It was assumed that this was the hybrid *P. munitum* x *P. setiferum*, as *P. setiferum* was growing close by. The site location was at SX 081543.

The only other likely parental taxon, *P. aculeatum*, was discounted as it is extremely uncommon in Cornwall, the nearest known examples growing on derelict mine workings at Minions, over 20 km. away (French *et al.*, 1999). Other ferns in the vicinity included *Pteridium aquilinum*, *Dryopteris filix-mas*, *Dryopteris dilatata*, *Asplenium ruta-muraria*, *Asplenium trichomanes* and *Asplenium scolopendrum*. The discovery of this Cornish plant stimulated research into the previous history of this hybrid, which revealed the earlier Surrey record. With the kind assistance of Dr A. C. Leslie, the original Hascombe, Surrey, site was re-visited in 2001, its current status and identity of the hybrid confirmed, and material collected for comparative/descriptive purposes.

The Surrey locality (SU 996403) was an unmade lane with high banks, deeply shaded by overgrowing trees including *Taxus baccata*, *Corylus avellana* and *Acer pseudoplatanus*. Plants of both *P. munitum* and *P. setiferum* were scattered along much of the lane, with evidence of recent recruitment of both. *P. munitum* was almost exclusively restricted to the shadier southern bank which forms the boundary of the garden from which it had escaped. Within this, underneath a canopy of *A. pseudoplatanus*, upwards of 100 clumps of mature *P. munitum* were seen. Some of these massive clumps were of some antiquity and if not directly planted must have become established many years ago. No recent sporelings were seen in this part of the wood possibly due to the drying out of the woodland by the *A. pseudoplatanus*. Further evidence of this drying was suggested by the death of several established clumps of the *P. munitum* which were by no means the largest in the vicinity. Other associated plants included *Dryopteris dilatata*, *Dryopteris filix-mas*, *Taxus baccata*, and *Circaea lutetiana*. Nearer to the area still actively gardened, a waterfall and grotto were surrounded by a range of ferns, including massive plants of *Dryopteris x complexa*, indicating a strong historical horticultural interest in ferns.

The hybrid of *P. munitum* and *P. setiferum* was not described by the Victorian pteridophiles. This together with its sterility, recent arrival and the character of the sites clearly indicate the 'natural' spontaneous nature of the hybrid's genesis and presence.

#### DESCRIPTION

***Polystichum x lesliei* Rumsey & Acock, hybr. nov.** (*Polystichum munitum* (Kaulf.) C. Presl x *P. setiferum* (Forssk.) Woynar).

Hybrida inter *Polystichum munitum* (Kaulf.) C. Presl et *P. setiferum* (Forssk.) Woynar, characteribus inter parentes media, ab ambobus sporibus abortivis differt; frondes anguste lanceolatus, ad 100 cm. longa, subcoriaceus, bipinnatus (in *P. munito* pinnatus), pinnae pinnatisectus vel pinnatifidus, pinnulae adnatus (non ut in *P. setifero* petiolus). Sori indusiati; indusia erosus pauciciliatus (in *P. setifero* indusium tantum eciliatum, in *P. munito* conspicuum ciliatum).

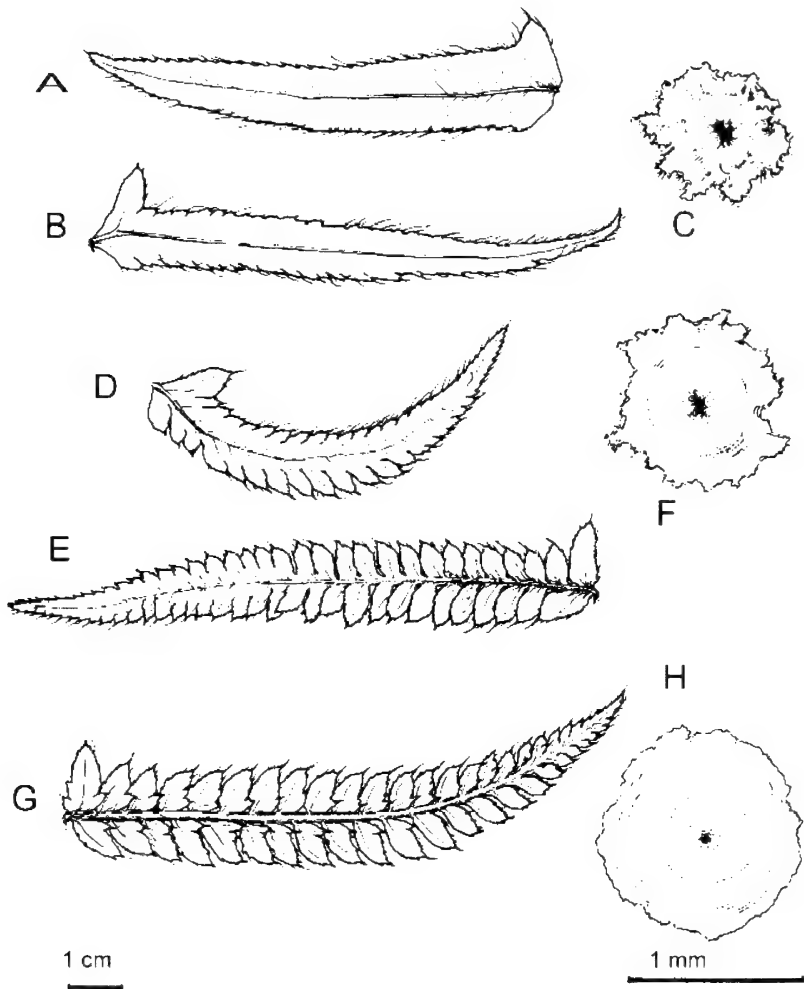
**Holotypus:** Vc.2, E. Cornwall, Tywardreath near Par, on a dry boundary bank of narrow alleyway, close to *P. setiferum* and with *P. munitum* a few metres away, alt. c. 35 m., 23/6/2001. P. Acock *et al.*, s.n. (BM).

**Paratypus:** Vc.17, Surrey, Hascombe – on a shady sunken lane bank, 26/7/2001. F.J. Rumsey, P. Acock & A. C. Leslie. (**BM**). Vc.17, Surrey, one plant with several fronds, with both parents on S. bank of sunken lane, S.E. of Winkworth Hill (SU 996403). 11th March 1995. A. C. Leslie. (**Herb. A.C.L.**)

Plant intermediate in character between its putative parents. Fronds narrowly lanceolate, to at least 100 cm long, with stipe up to  $\frac{1}{4}$  of the frond length, although usually shorter. The stipe, rachis and the undersides of the costae are covered with numerous concolorous chaffy scales not dissimilar from either parent but the pinnule costa and pinnules have more scales than *P. setiferum*. Lamina sub-coriaceous in texture, bipinnate, pinnae pinnatifid to pinnatisect, mostly deflected towards the frond apex, lowest pinnae somewhat reflexed,  $>\frac{1}{2}$  the length of those in mid-frond. The basal acroscopic pinnule(s) broadly stalked, at least in pinnae from the lower third of the leaf, other pinnules adnate, progressively less distinctly divided towards the distal apex. Sterile pinnae of the same shape and size as fertile pinnae. Pinnule apex and serrations with more attenuated, broader based bristle like projections than typical for *P. setiferum*, bristles deflected as in *P. munitum*. Sori arranged as in *P. setiferum*, c. 5 to 8 per pinnule in mid-pinna, with 14 to 22 on the basal acroscopic pinnules. Indusia intermediate between those of the parents in texture, shape and ciliation; irregular in shape with erose margins and a few cilia. Sporangia highly abortive, no good spores seen.

The specific epithet acknowledges the initial discovery of this plant by Dr. A. C. Leslie. We have elected to use the Cornish material as Holotype as it had sporing structures, whereas all available material of the first detected Surrey plant was sterile. The blade of *P. x lesliei* is a dark lustrous green on the upper surface but more glaucous underneath. In texture it is somewhat coriaceous, more akin to typical *P. aculeatum* and without the 'soft' texture of *P. setiferum*. This is particularly evident in recently expanded fronds. The overall shape of the blade is closer to that of *P. munitum*, being linear-lanceolate, with the outline shape of the pinna being similar. The pinnae are however broken into a number of pinnatifid to pinnatisect pinnules, the apices of which are similar to *P. setiferum*.

The acroscopic auricle of the *P. munitum* pinna is replaced in the hybrid by a larger pinnule c.1.5-2 x the length of those distal to it. It is broadly stalked in the pinnae of the lower third of the frond, becoming progressively more adnate in the pinnae towards the frond apex. The other pinnules are all adnate in the hybrid but stalked, at least in the proximal portions, in *P. setiferum*. They lack the basal acroscopic 'thumb' typical of *P. setiferum* (Figure 2). The points and serrations of the pinnules end in a soft spine, more attenuated than in *P. setiferum* but which is kinked and directed towards the frond apex as in *P. munitum*. The sori in *P. munitum* are arranged along the pinna in a row midway between the margins and the costa and only in very large mature plants is there a second row above this. In the hybrid they are arranged around the pinnules as in *P. setiferum*. The indusia are more membranous and more irregularly shaped than in *P. setiferum*. The erose margined indusium of *P. munitum* has many ciliate projections, absent in *P. setiferum* (and the other British species) but sparsely present in the hybrid.



**Figure 2.** A, B: pinnae of *Polystichum munitum*, from Cornwall; C: indusium of *P. munitum*, from Cornwall; D: pinna of *P. x lesliei*, from Surrey; E: pinna of *P. x lesliei*, from Cornwall; F: indusium of *P. x lesliei*, from Cornwall; G: pinna of *P. setiferum*, from Surrey; H: indusium of *P. setiferum*, from Surrey. The 1 cm scale bar is for A, B, D, E and G; the 1 mm bar for C, F and H.

#### **Differences between the known examples of *P. x lesliei***

The Cornish plant exhibited clear hybrid vigour with fronds measuring up to one metre long, although those from the previous year were considerably shorter. The Surrey plant was smaller, with fewer fronds (to c. 75 cm), although only to c. 30 cm when it was first discovered in 1995. It has not been seen to produce fertile fronds, in contrast to the Cornish plant. To what extent this is the result of growing conditions, e.g. the highly shaded nature of the Surrey site, as opposed to genetic or other factors, is unclear. Whilst clearly very similar, the two hybrid plants differ to some extent in degree of pinna dissection, pinnule shape and scaliness (see Figure 2), as well as in

overall stature and fertility, reflecting perhaps the morphological variation demonstrated by the parental taxa as well as plant age and habitat.

### **Distinguishing the hybrid from other taxa**

*P. x lesliei* is unlikely to be mistaken for any other British species or hybrid. It is most similar to another sterile hybrid *P. x lonchitiforme* (Halácsy) Bech. (*P. setiferum* x *P. lonchitis*) currently known only from the Ben Bulbin area of Ireland. This differs in its shorter, less dissected fronds and pinnae, the lowermost of which are distinctly less than ½ the length of the longest pinnae (a distinction which will also discriminate *P. x lesliei* from *P. aculeatum*). *P. x bicknellii* (H. Christ.) Hahne (*P. setiferum* x *P. aculeatum*), a similarly vigorous, abortive-spore producing plant that can be distinguished by its texture, shape and its more dissected pinnae. Rush (1984) noted that the artificially produced hybrid between another N. American simple-pinnate Sword fern, *P. acrostichoides* (Michx.) Schott and *P. setiferum* has been in cultivation. This might be expected to differ from *P. x lesliei* in its shorter maximum frond length, springing only in the top half of the frond, and the relative size of the fertile and sterile pinnules, that being the most noticeable difference between *P. acrostichoides* and *P. munitum*.

### **CONCLUSIONS**

Both *Polystichum munitum* and *P. setiferum* are morphologically variable diploids which may form hybrids where they occur sympatrically with congeneric taxa, and these in turn have given rise to a complex array of allopolyploids, many of which backcross with their parents (Page, 1997; Wagner, 1993). The North American *P. munitum* only meets the Eurasian *P. setiferum* in gardens and in the very rare instances where it has become naturalised. In both of the known British sites where it has (apparently) self sown into a wild situation, spontaneous hybrids have occurred.

Disturbed shady lane-bank habitats such as those described here provide suitable opportunities for fern recruitment and hence hybridisation when gametophytes of two taxa occur in close proximity. Hybridisation, while not uncommon between the native British species, does not occur at all sites where the parents grow together. How then can we account for the formation of *P. x lesliei*? All *Polystichum* taxa investigated thus far have been shown to have highly outcrossing mating systems (Soltis *et al.*, 1989). If both taxa demonstrate outbreeding it would raise the incidence of fertilisation between gametophytes (in this case of separate species). Previously allopatric species may produce gametophytes with similar niche requirements, selection against competition and interspecific hybridisation not having arisen as it may have done between sympatric taxa. This would almost certainly increase the incidence of hybridity in these cases. Unfortunately there is too little information about the detailed ecological requirements of most fern gametophytes to allow such conclusions. But if true, the lack of other alien/native hybrids in the British Isles could be explained by the very low incidence of naturalisation of genera with native examples with which to hybridise, eg. *Cyrtomium*, *Dicksonia*, *Matteuccia*, *Onoclea*, *Phymatosorus*, *Pteris*, etc. Only *Adiantum* and *Blechnum* would seem to offer opportunities.

Hybrids are certainly not the evolutionary dead ends that their sterile nature suggests, as the vast preponderance of allopolyploid fern taxa testifies. They thus deserve our consideration and conservation. By their very nature the habitats which



favour hybrid production are dynamic and losses occur through natural processes. It is greatly to be hoped that unscrupulous collectors do not also cause such losses.

#### ACKNOWLEDGEMENTS

We wish to express our thanks to Mr M. Sibley for allowing us the use of his photographs and to Dr A. C. Leslie for taking us to the original site and his help in the preparation of this paper.

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## INSTRUCTIONS FOR AUTHORS

Manuscripts on all aspects of pteridology are welcome and should be sent to: Dr M. Gibby, Director of Science, Royal Botanic Garden Edinburgh, 20A Inverleith Row, Edinburgh EH3 5LR, UK. Telephone: 0131-248-2973; eMail: M.Gibby@rbge.org.uk

**PAPERS** should not usually exceed 20 printed pages and are generally expected to be considerably shorter. Review articles, as well as reports of original research, are encouraged. Short notes are acceptable e.g. new records. The senior author should supply a fax and eMail address to facilitate correspondence.

**TYPESCRIPTS** should be submitted in English (British), double spaced, preferably on A4 paper and in 10-point Times New Roman font. Two hard copies plus a version on disc (PC: WORD 97 in WINDOWS) are required. All manuscripts will be refereed.

**THE TITLE** should reflect the content of the paper and be in **BOLD CAPITALS** (11-point) and centrally aligned. Generic and specific names should be in italics and any title containing a generic or specific name must be followed by the family and Pteridophyta in brackets e.g.

### ***TRICHOMANES SPECIOSUM* WILLD. (HYMENOPHYLLACEAE: PTERIDOPHYTA) IN SOUTHERN SPAIN**

**AUTHOR ABBREVIATIONS** should follow Pichi Sermolli's (1996) Authors of scientific names in Pteridophyta, Royal Botanic Gardens, Kew.

**MAIN HEADINGS:** should be in **BOLD CAPITALS** (10-point) and centrally aligned.

**SUBSIDIARY HEADINGS:** should be in **bold**, the first letter of each word in capitals, the rest in lower case and left-aligned.

**AUTHORS' NAMES AND FULL ADDRESSES:** follow the title and are centrally aligned.

**KEY WORDS:** up to ten.

**ABSTRACT:** should reflect the content of the paper.

**FIGURES:** there is no distinction between photographs and line drawings in numbering. All should be presented in a form ready for reproduction, ideally in JPG format (please contact editor with queries), with a scale bar where appropriate. Lettering or numbers (Arabic) should be in the bottom left using uppercase Times Roman and be sufficiently large to be legible if reduction is necessary during printing. The number of photographs allowed in any one issue is limited by cost. Figure captions should be on a separate sheet.

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**REFERENCES:** should follow the style of the current issue of The Fern Gazette, e.g.:-

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