DRYOPTERIS (PTERIDOPHYTA : DRYOPTERIDACEAE) ON PICO ISLAND IN THE AZORES

by
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ABSTRACT

Fraser-Jenkins, C. R. 1981 : *Dryopteris* (PTERIDOPHYTA : DRYOPTERIDACEAE) on Pico Island. *Arquipélago,* No. 2, pp. ...-.... Ponta Delgada, S. Miguel, Azores.

A brief survey is made of the species and hybrids of ferns of the genus *Dryopteris* on Pico Island. The richness of the island is remarkable, containing as it does 5 species and, so far, 5 hydrids, despite the fact that Central-European, boreal and alpine species are absent as would be expected. Many of the species have been confused in the past and it is only since the recent work of Gibby, Reichstein, Fraser-Jenkins and others that their systematics and the taxonomic distinction between species have been clearly understood. Most of the species are relevant to the European mainland flora, including three ancient ancestral diploid species which have been preserved on the Azores, one of them probably nowhere else.

The 5 new hybrids described in this paper are : *Dryopteris* × *picoensis, D.* × *martinsiae, D.* × *madalenae, D.* × *sjoegrenii* and *D.* × *telesii*. Two new combinations are made, *Polypodium cambricum* subsp. *macaronesicum* (Bobr.) Fraser-Jenkins and *Dryopteris intermedia* subsp. *maderensis* (Milde ex Alston) Fraser-Jenkins.

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PHYTOGEOGRAPHICAL INTRODUCTION

The Azores are the Northern and Western-most islands of the phytogeographical region know as Macaronesia, which in addition includes Madeira and its lesser islands, the Selvagens, the Canaries and the Cape Verdes. The flora of Macaronesia is of considerable interest to botanists as it contains a high proportion of what may be considered tertiary relict endemic species and a number of neo-endemic species which probably arose there. In general the islands become more African in character towards the South so that the Cape Verdes have a predominantly African flora whereas the Azores are mainly European.

But the position is not always straightforward as some of the apparently European-type elements may in fact have relationships via Macaronesia to the African flora and several examples are known of East African species occurring in Macaronesia — the most remarkable is the well-known distribution pattern of *Adiantum reniforme* L., known only from Szechuan in West China, Réunion, Madagascar, Kenga, Malawi, the Cape Verdes and the Canaries, though pliocene fossil deposits contain-

ing it have been discovered in France. It may be more accurate to view many of the ferns of the Lusitanian element in the Atlantic European mainland flora as being connected to the tertiary African or African and European flora via Macaronesia, though some of them, such as *Dryopteris aemula* (Aiton). O.Ktze, *Dryopteris oreades* Fomin and *Hymenophyllum tunbrigense* (L.) Sm., have connections with the Caucasus instead, or in addition, Recently too a considerable number of what were previously considered to be Macaronesian endemics have been found in the European mainland in the Iberian peninsula. Examples of such ferns relatively recently discovered in Spain or Portugal (or both) are *Christella dentata* (Forsk.) Brownsey & Jermy, *Diplazium caudatum* (Cav.) Jermy, *Pteris serrulata* Forsk., *Dryopteris guanchica* Gibby & Jermy, *Culcita macrocarpa* Presl., *Polypodium cambricum* L. subsp. *macaronesicum* (Bobr.) Fraser-Jenkins, comb. nov. (Basionym : *Polypodium macaronesicum* Bobr. Bot. Zhurn *49* : 534545 (1964)), *Cystopteris diaphana* (Bory) Blasdell, *Cheilanthes maderensis* Lowe and *Cheilanthes tinaei* Tod. It is therefore a most interesting, but at present unanswerable, problem as to where the species came from originally and in which direction they migrated ; as far as ferns are concerned there are definite connections between Asia the Caucasus, the Atlantic seaboard and Macaronesia on the one hand and between Asia, Africa, Macaronesia and the Atlantic seaboard on the other. It should not therefore be surprising that relationships between these regions and between the different regions of Macaronesia are often not at all straightforward and not as might be immediately expected. This is shown well by the distribution of the diploid species, *D. azorica* (Christ) Alston, *D. intermedia* (Mühl.) Gray subsp. *maderensis* (Milde ex Alston) Fraser-Jenkins comb. nov. (basionym: *Dryopteris maderensis* Milde ex Alston, Bol. Soc. Broteriana (Ser. 2) 30 : 5-27 (1956)),*D. aemula* and *D. expansa* (Presl) Fraser-Jenkins & Jermy, when compared with that of the polyploid complexes built up from them, namely *D. dilatata* (Hoffm.) Gray, *D. guanchica* and *D. crispifolia* Rasbach, Reichstein &

Vida, only the latter being sympatric with the area that both its parental species occur together in. Many of these species, members of the *D. dilatata* and *D. aemula* groups, are well represented on Pico island in the Azores and have been discussed and worked on by Gibby, Jermy Rasbach, Rasbach, Reichstein & Vida (1977), Gibby & Walker (1978), Gibby, Widén & Widén (1978), Gibby (1979) and Fraser-Jenkins (in press). Further general discussion of such problems is to be found in Bramwell (1972).

SPECIES PRESENT ON PICO ISLAND

Dryopteris species are distinguishable by their having a kidney-shaped indusium, though this may shrivel considerably when the spores ripen and may be partially deciduous. The centre of distribution of this genus is in West China.

Group A. *D. wallichiana* group: Frond narrow, once to twice pinnate ; pinnules more or less rectangular.

1. *Dryopteris affinis* (Lowe) Fraser-Jenkins, Fern Gaz. 12(1) : 56 (1979), subsp. *affinis*. In the present paper : Pl. I, fig. 1a, 1b (var. *azorica*).

This species was until recently known as *D. borreri* (Newm.) Newm. ex von Tavel, or *D. pseudomas* (Woll.) Holub et Pouzar, neither of which names is legitimate according to the International Code of Botanical Nomenclature (Stafleu 1978). *Dryopteris affinis* is an apomictic species containing a number of different subspecies, both diploid and triploid, which are thought to contain various different combinations of genomes (see Fraser-Jenkins 1980a). It is confined to the European type flora from

Macaronesia to the Caspian coast of Iran and North-West to Britain and South Norway and is probably closely related to the distinct pan subtropical montane species, *D. wallichiana* (Spreng.) Hyl. (= *D. paleacea* Hard. Mazz.).

On Pico island (as in the rest of Macaronesia and as is predominantly the case in mainland Portugal) there is only one subspecies, subsp. *affinis,* which is diploid and occurs in the Azores only as a local variety, var. *azorica* Fraser-Jenkins, Willdenowia 10 : 107-115 (1980). In the present paper : Pl. I, fig. 1a, ib. var. *azorica* is confined to the Azores, Portugal, North-West Spain and S-.W. France (rare) and subsp. *affinis* occurs in the Canaries (La Gomera only), Madeira, Azores (Flores, Graciosa, São Jorge, Faial, Pico, Terceira and São Miguel), Morocco, Portugal, Spain, France, Britain (England, Wales and Scotland), Ireland, ? Norway, Germany, Switzerland, Italy, Austria, N.E. Turkey, West Transcaucasia and the Caucasus. The plant from Germany Eastwards is var. *disjuncta* (Fomin) Fraser-Jenkins, Willdenowia 10:107-115 (1980). It probably contains one genome in common with *D. wallichiana* and one in common with *D. oreades,* neither of which occurs in Macaronesia. In the past century it was confused with *D. filix-mas* (L.) Schott which again does not occur in Macaronesia. It is extremely common on Pico above c. 300 m. altitude and is the last species of *Dryopteris* to ripen its spores.

Group B. *D. aemula* group : Fronds triangular-lanceolate, 2-3 times pinnate, segments with mucronate teeth, spores not bearing spinules.

2. *Dryopteris aemula* (Aiton) O. Ktze., Rev. Gen. Pl. 2 : 812 (1891). In the present paper : Pl. 1, fig. 2.

This can be distinguished from the other wide-fronded species in the Azores by its finer segments and markedly black or dark purplish-brown lower half of the stipe with conco-

lorous russet-brown scales ; the lamina and axes are highly glandular. Although it is distinct enough from the diploid species in the *D. dilatata* group to be in a group of its own, a number of allopolyploid species exist between the two which, as might be expected, tend to obscure the distinction somewhat ; however, as they all have small spinules on the perispore they fall into the *D. dilatata* group and are placed there. There are examples of such intergroup allopolypoids between almost all the groups in *Dryopteris,* but they can usually be placed in one group or the other except when, as in a very few cases, their origins are from very widely distinct groups, in which case they must be arbitrarily dealt with. They do not make the groups any less valid.

D. aemula is a diploid sexual species, part parental to *D. guanchica* and *D. crispifolia* (see Gibby, Widén & Widén 1978), to both of which it gives one of its characteristics, a remarkable scent of fragrant hay when dried. It varies slightly being generally more finely dissect on Madeira and less finely dissect in the Azores and elsewhere. It occurs in the Canaries (La Gomera only), Madeira, Azores (every island, including Graciosa), North Spain, S.W. and N.W. France, Britain (England, Wales and Scotland), Ireland, N.E. Turkey and S.W. Transcaucasia. A rather similar species, *D. gymnophylla* (Bak.) C. Chr. occurs in N.E. China, Japan and far-Eastern U.S.S.R. *D. aemula* has been recorded from the Cape Verdes in error. Some confusion exists in herbaria between *D. aemula* and members of the *D. dilatata* group. It is extremely common on Pico above c. 300 m. altitude and is the second- last species to ripen its spores.

Group C. *D. dilatata* group : Fronds triangular-lanceolate, 2-3(-4), times pinnate, segments with mucronate teeth, spores bearing small spinules on the perispore. On Pico the *D. dilatata* group also have stipe-scales with darker central and basal areas than margins and tips.

3. *Dryopteris dilatata* (Hoffm.) Gray, Man. Bot. North U.S. : 631 (1848). In the present paper : Pl. I, fig. 3.

D. dilatata has been referred to as *D. austriaca* (Jacq.) Woynar in error (see Fraser-Jenkins 1980b). It is distinguishable from other species by its tall upright fronds with long stipes and only a very few, very insignificant scales on the lower surface of the pinnule costae, if at all. The lowest pinnules are longer than in *D. azorica* and the lamina is flat and dark green. *D. dilatata* is an allotetraploid sexual species derived from the European mainland and circumboreal species, *D. expansa,* on the one hand and *D. azorica* on the other (see Walker 1955 and Gibby & Walker 1978). Genomically it is the same as the North American *D. campyloptera* (Kunze) Clarkson, but the two are easily distinguishable and constitute good distinct species. The plant on Pico is slightly different from the European mainland plant, being rather more delicate and having narrow and rather widely spaced upper pinnae and the tips of the rather short and well-spaced lowest pinnule segments are more abruptly tapered. It is confined to the European type flora, occurring in the Azores (Pico only), Portugal, Spain, France, Britain (England, Wales and Scotland), Ireland, Faroes, S. Norway, S. Sweden, S.W. Finland, Denmark, Belgium, Luxemburg, Holland, Germany, Switzerland, N. Italy, Corsica, Austria, Jugoslavia, Czechoslovakia, Poland, Romania, South-West U.S.S.R., Bulgaria, N. Greece, N. Turkey, West Transcaucasia, the Caucasus and N. Iran. In the Azores (and elsewhere) it has been mistaken for *D. azorica* and *D. crispifolia* ; the many Azores records of it up until 1973 are unreliable, and, from the scarcity of herbarium specimens, probably incorrect. Its rarity on the Azores also led to its being overlooked by Gibby, Jermy, Rasbach, Reichstein & Vida (1977), but three specimens collected by Sjögren in 1968 at Bocas de Fogo, Pico, reported by him (1973) and subsequently sent to Prof. T. Reichstein and thence to the author in 1978 and also two collected by I. B.

Gonçalves from the same place in 1968 (in LISI and MGC), were correctly identified by Sjögren (1973) as *D. dilatata*. A visit by the author to Pico in 1979 failed to locate the place, but on a second visit in July 1980, *D. dilatata* was found growing in some quantity in all the craters of the Bocas de Fogo, between Casa de Abrigos and the television mast on the North side of the peak at c. 1000 m. altitude (CRFJ nos. 10080, 10081, 10082, 10084, 10086, 10087 10091 10090, 10095, 10097, 10098, 10100, 10101, 10105, 10106, 10111, 10117, 10123, 10125, 10126 and 10127). It was growing in the presence of *D. azorica, D. aemula, D. crispifolia* and *D. affinis* subsp. *affinis,* with scattered plants of the hybrids *D.* × *sjoegrenii* Fraser-Jenkins (= *D. azorica* × *D. dilatata*) *D.* × *telesii* Fraser-Jenkins (= *crispifolia* × *D. dilatata*) and *D.* × *martinsiae* Fraser-Jenkins (= *D. aemula* × *D. crispifolia*). So far it has not been found anywhere else on Pico or in the Azores and seems to be a most uncommon plant. The fact that it is slightly different from most plants on the mainland and perhaps less vigorous and invasive is of some interest and living plants have been collected and are under investigation by Dr. Gibby at the British Museum (Natural History), London. No *D. expansa* has been found on the Azores despite the considerable altitude of the peak of Pico and it is probable that the Pico population of *D. dilatata* may have come from mainland Europe and diverged slightly with time, though still remaining generally very close.

4. *Dryopteris azorica* (Christ) Alston, Bol. Soc. Brot. (ser. 2), 30 : 14 (1956). In the present paper: Pl. IV, fig. 4.

D. azorica is close to *D. dilatata* but readily distinguishable by its less upright paler green fronds with more crowded, rectangular, ultimate segments which are less sloping and usually approach an angle of 90° to the costa. The ultimate segments bear longer mucronate teeth and the underside of the pinnule

and pinnulet costae bears small but easily noticeable scattered, pale to mid-brown scales, as does *D. crispifolia*. In open places the pinnulets turn down on either side of the costa ; in sheltered places the fronds can be very large and darker green.

It is a diploid sexual species, part parental to *D. dilatata* and sharing the same genome as *D. intermedia* sub. *intermedia* from North America and *D. intermedia* subsp. *maderensis* from Madeira (see Walker 1955, Gibby & Walker 1978 and Gibby, Widén & Widén 1978), but it is readily distinguishable by its larger andless finely dissect segments and deserves specific rank.

It is probably an endemic, confined to the Azores, where it occurs on Flores, São Jorge, Faial, Pico, Terceira, São Miguel and Santa Maria, but a few Portuguese specimens of *D. dilatata* are extremely close to *D. azorica* and need investigation.

D. azorica has been much confused under the name *D. dilatata* in herbaria. On Pico it is extremely common above c. 200 m. altitude.

5. *Dryopteris crispifolia* Rasbach, Reichstein & Vida in Gibby, Jermy, Rasbach, Rasbach, Reichstein & Vida, Bot. J. Linn. Soc. (London) 74(3) : 266-274 (1977). In the present paper : Pl. II, fig. 5.

This species is intermediate in morphology between *D. aemula* and *D. azorica* and is normally immediately distinguishable from other Azores species by its highly crispaceous fronds (especially sterile ones) with the pinnules turned up at the tips and all the pinnules turned down at their sides and up at their apices, which is a remarkable effect. The pinnule segments are crowded and lobed, overlapping, and widest at their bases, tapering to an acute or rounded apex ; the lamina is glandular on the axes and nearly four times pinnate. There are small russet-brown scales (as in *D. azorica*) on the axes

on the lower surface of the lamina and the stipe scales are dark with vaguely paler edges. It is a sexual tetraploid species most probably derived from *D. aemula* and *D. azorica* (see Gibby, Jermy, Rasbach, Reichstein & Vida 1977, Gibby, Widén and Widén 1978 and Gibby 1979). In the Caldeira on Faial, as well as normal plants, a form exists which has flat fronds with more spaced out segments and strongly resembles the hybrid *D.* × *martinsiae* (= *D. aemula* × *D. crispifolia*), but it has good spores ; it is slightly intermediate towards *D guanchica* from the Canaries, Portugal and Spain, which lattes is genomically identical (probably being derived from *D. aemula* and *D. intermedia* subsp. *maderensis*) but markedly different morphologically and deserves specific rank. Another similar but distinct species, *D. callolepis* C. Chr., from E. and S.E. Africa, Madagascar and Réunion is also tetraploid and chemically identical (see Widén, Faden, Lounasmaa, Vida, von Euw & Reichstein 1973 and Gibby, Widén & Widén 1978) and may well represent a third species containing the same genomes. If so it may be taken as a strong indication that *D. crispifolia* and *D. guanchica* are examples of Macaronesian species with African connections, one of which, *D. guanchica,* has been able to reach or survive in mainland Europe, but it should be noted that it seems highly likely that *D. crispifolia* must have arisen independently on the Azores and it is morphologically more different from *D. callolepis* than *D. guanchica* is.

D. crispifolia is an endemic confined to the Azores and occurs on Faial and Pico only. It is common above c. 300 m. on Pico. A report by Gibby (1979) from São Miguel was in error for *D. azorica.*

HYBRIDS PRESENT ON PICO ISLAND

Hybrids occur sporadically but rather frequently in the Azores and especially on Pico where many related species grow together. In general it appears that hybrids between related species of *Dryopteris* are fairly common, while those between unrelated ones are not at all common — an exception to this rule being the ease with which the North American *D. marginalis* (L.) Gray hybridises with all species, and it is possible that hybrids involving the apomictic *D. affinis* and related species in the *D. wallichiana* group world-wide may be somewhat more common than might be expected.

Hybrids can be detected in the field by their intermediate frond morphology and sometimes by hybrid vigour (large size) and slightly unusually coloured pinkish-brown ripe sori, but they must be confirmed using a microscope to examine a ripe spore-sample. The spores in *Dryopteris* hybrids, instead of having normally shaped and mostly regular inner spores, are abortive and irregular, normally with a thick, dark perispore with many smaller fragments. (Care must be taken to exclude dust and earth which can be confusing.) This is a result of the failure of cell-division due mainly to the inability of the chromosomes from different genomes to pair up during meiosis. Chromosome pairing behaviour in hybrids is extremely useful to show genome similarities and dissimilarities between the parents, and hybrids must be synthesised or discovered in order to carry out genome analysis.

The author has found five hybrids on Pico, all of which are new and are described here: —

1. *Dryopteris* × *picoensis* Fraser-Jenkins and Gibby, hybr. nov. (= *D. affinis* subsp. *affinis* × *D. azorica*). Pl. III, fig. 6a, 6b.

Morphologia intermedia inter parentes, *D. affinis* et *D. azorica*. Lamina bipinnatisecta a pinnulis pinnatifidis. Paleae stipitis et rhachidis angustae et nigro fusci. Sporae partim abortivae. Cytotypus triploideus, Holotypus: Azores, Pico, at the edge of the longitudinal road, c. 50 m. West of Casa de Abrigos, S.E. of Madalena, c. 850 m. alt. Coll.: C. R. Fraser-Jenkins, no. 10071, 20-7-1980 (BM).

As *D. affinis* and *D. azorica* are so different morphologically this hybrid is unlike either parent and looks rather similar to the European mainland species, *D. remota* (A. Br.) Druce, though the lamina is slightly more crispaceous and the scales markedly darker. Only one clump has been discovered (first discovered in 1979, CRFJ no. 9642) and it is strongly recommended that the roadside where it grows is not disturbed. An offset of the plant is under investigation by Dr. M. Gibby to see if it can reproduce itself from spores; she has also investigated its cytology and found it to be triploid at mitosis (8/1980, pers. comm.); this is explicable by *D. affinis* being an apomictic diploid which may be expected to pass on both its genomes to the hybrid, whereas *D. azorica*, being a sexual diploid, contributes only one. At first this plant looked similar to another one found by the author near Canero in North Spain which appears to be *D. affinis* subsp. *affinis* × *D. guanchica* or *D.Dilatata* and it was therefore assumed to be probable *D.affinis* subsp. *affinis* × *D. crispifolia*, but it is not only triploid (thus excluding *D. crispifolia* from being a parent) but the frond is

narrower than in the tetraploid Spanish plant and the scales darker as would be expected.

Gibby and Widén will report elsewhere on the chemical results obtained from *D.* × *picoensis* and the N. Spanish plant which tend to confirm their supposed identity.

2. *D.* × *martinsiae* * Fraser-Jenkins, hybr. nov. (= *D. aemula* × *D. crispifolia*). Pl. III, fig. 7.

Morphologia intermedia inter *D. aemula* et *D. crispifolia*. Segmentes laminae confertae a paucis parvis paleis rufis ad paginam inferam obtectae. Paleae stipitis rufae sed fusciorae ad partem superam earum. Sporae abortivae.

Holotypus: Azores, Pico, 3rd crater up of the Bocas de Fogo, between Casa de Abrigos and the television mast, N. side of the peak of Pico, S.E. of Madalena, c. 1000 m. alt. Coll.: C. R. Fraser-Jenkins, no. 10107, 20-7-1980 (BM).

Easily recognisable, but must be confirmed from its abortive spores as the flat-fronded form of *D. crispifolia* on Faial looks very similar. Not as common as *D.* × *madalenae* and so far only two collections other than the type have been detected: —

i) Azores, São Jorge, E. of Pico do Paul, 500 m. Coll.: E. Sjögren, no. 780711-88 11-7-1978 (UPS).
ii) Azores, Pico, Furnas de Capitão, West side of the peak of Pico, c. 2 km S.W. of Casa de Abrigos, S.E. of Madalena, c. 1100 m. alt. Coll.: C. R. Fraser-Jenkins, no. 9653, 22-7-1979 (BM).

Offsets of the type plant and no. 9653 are under investigation by Dr. M. Gibby in London.

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* Named after Helen Rost Martins of the University of the Azores, Department of Oceanography and Fisheries, Horta, Faial, who kindly suggested that I should write on Azores Dryopteris for « Arquipélago ».

3. *Dryopteris* × *madalenae* Fraser-Jenkins, hybr. nov. (= *D. azorica* × *D. crispifolia*). Pl. III, fig. 8.

Morphologia intermedia inter *D. azorica* et *D. crispifolia*). Segmentes laminae aliquantum confertae et rectangulae ; paleae stipitis fuscis a marginibus pallidioris. Sporae abortivae. Holotypus : Azores, Pico, edge of the longitudinal road, c. 2 km. W. of Casa de Abrigos, S.E. of Madalena, c. 550 m. alt. Coll. : C. R. Fraser-Jenkins, no. 9628, 22-7-1970 (BM).

Often rather difficult to separate from *D. crispifolia* as the stipe scales are not markedly different, but it is less crispaceous and shows more features of *D. azorica* than *D. crispifolia*. It is very close to *D.* × *telesii* but the segments are slightly more crowded. Offsets of several plants are under investigation by Dr. M. Gibby in London. Spores fully abortive. Sporadic but not uncommon, especially along the longitudinal road in Pico. Probably occurs on Faial too, but has not so far been found there. Other specimens from Pico are CRFJ 9624, 8626, 9687, 9688, 10113, 10114, 10115, 10121 and 10129.

4. *Dryopteris* × *sjoegrenii* * Fraser-Jenkins, hybr. nov. (= *D. azorica* × *D. dilatata*). Pl. IV, fig. 9.

Morphologia intermedia inter *D. azorica* et *D. dilatata* et similior ad *D. dilatata*. Frondes altiorae et segmentes ultimae rectanguliorae confertiorae que quam in *D. dilatata* azorica. Sporae abortivae.

Holotypus : Azores, Pico, third crater up of the Bocas de Fogo, between Casa de Abrigos and the television mast, N.

* Named after Professor E. Sjögren of Uppsala, who first correctly indicated the presence of *D. dilatata* in the Azores, in the place where the hybrid also grows.

side of the peak of Pico, S.E. of Madalena, c. 1000 m. alt. Coll.: C. R. Fraser-Jenkins, no. 10108, 20-7-1980 (BM).

Isotypes: ditto. Paratypes: ditto. CRFJ no. 10112.

Very close to *D. dilatata* though the fronds are usually larger. The ultimate segments are more crowded, rectangular and larger than in the Azorean *D. dilatata*. Spores abortive, but not with such thick black perispores as in *D.* × *madalenae* or *D.* × *telesii*. It occurs with its parents apparently only at the Bocas de Fogo craters North of the peak of Pico. Others plants are CRFJ nos. 10079, 10085, 10088, 10089, 10090, 10093, 10094, 10096, 10122 and 10124.

5. *Dryopteris* × *telesii* * Fraser-Jenkins, hybr. nov. (= *D. crispifolia* × *D. dilatata*). Pl. IV, fig. 10.

Morphologia intermedia inter *D. crispifolia* et *D. dilatata*. Frondes altissimae, pallidiorae quam in *D. dilatata* et segmentes ultimae dissectiorae, latioraeque ad basses, ab apicibus acutibus. Sporae abortivae.

Holotypus: Azores, Pico, third crater up of the Bocas de Fogo, between Casa de Abrigos and the television mast, N. side of the peak of Pico, S.E. of Madalena, c. 1000 m. alt. Coll: C. R. Fraser-Jenkins, no. 10103, 20-7-1980 (BM).

Isotypes: ditto. Paratypes: ditto, CRFJ. no. 10102.

Can be recognised from a distance by its tall upright fronds showing hybrid vigour. The fronds are paler than in *D. dilatata* and more finely dissect, the pinnule-segments being well lobed and tapering from a wide base. The stipe is less scaly than

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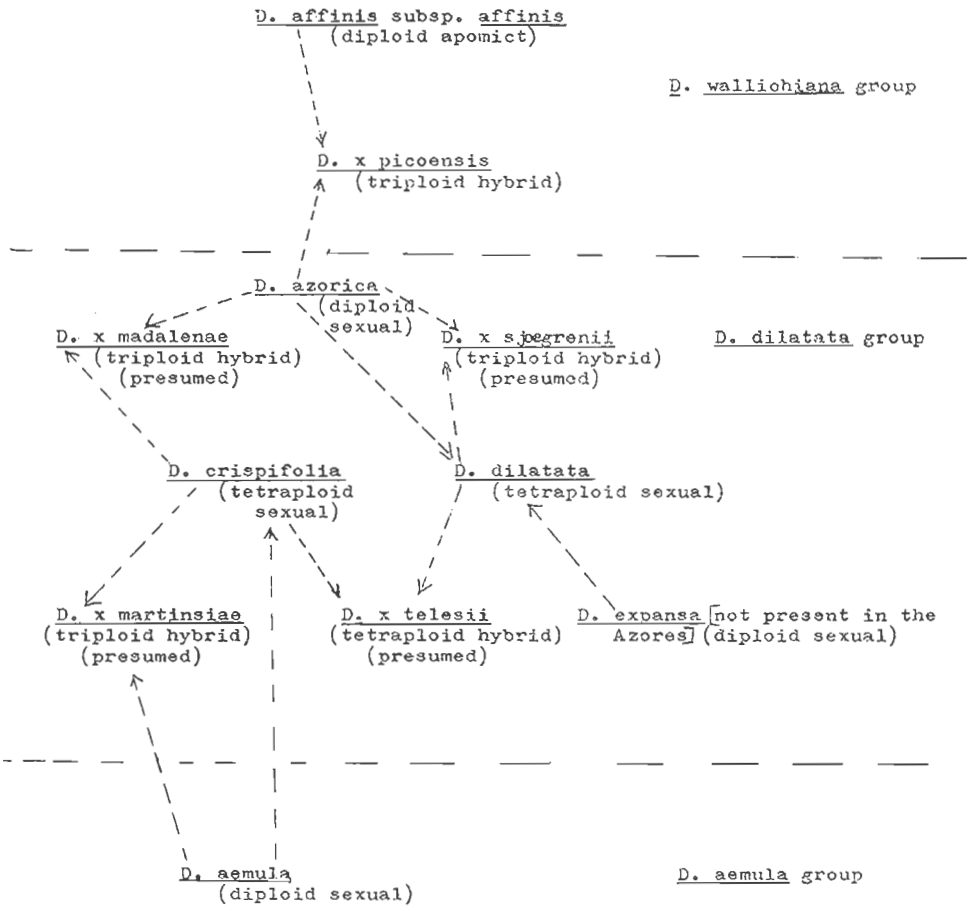
* Named after Mr. Paulo Teles of Madalena.

in *D. crispifolia,* with darker scales, and the lamina is not crispaceous. Spores abortive. It occurs with its parents and in addition to the above plants one other (CRFJ no. 10099) has been found.

ACKNOWLEDGEMENTS

I am most grateful to Professor T. Reichstein for suggesting that I visit Pico in 1979 and very kindly funding my first visit. I am also deeply grateful for the friendship and kind nature of the Pico islanders whom I met and stayed with when I was there in 1979 and 1980 ; for me that was something special in all my wolrd-wide travels. I cannot name them in this botanical context, but one friend is acknowledged in the name of the hybrid *D.* × *telesii*. It is only to be hoped that Pico will not be spoiled in the future by too much development of the island which will not only endanger the ferns but will also in the long run alter and hurt the people themselves.

Systematic relationships of Dryopteris on Pico



REFERENCES

BRAMWELL, D., 1972. Endemism in the Flora of the Canary Islands, in D. H. Valentine (ed.), Taxonomy, Phytogeography & Evolution. Academic Press, London & New York.

FRASER-JENKINS, C. R., 1980a. *Dryopteris affinis* : a new treatment for a complex species in the European pteridophyte flora. Willdenowia *10* (1) : 107-115.

—— 1980b. Nomenclatural notes on *Dryopteris* Adans. 4. Taxon *29* (5-6) : 607-612.

—— (in press) *Dryopteris* in Spain, Portugal and Macaronesia. Bol. Soc. Broteriana.

GIBBY, M. 1979. Paleoendemism and evolution in Macaronesian *Dryopteris*, in D. Bramwell (ed.), Plants and Islands. London.

GIBBY, M., JERMY, A. C., RASBACH, K., REICHSTEIN, T. & VIDA, G., 1977. The genus *Dryopteris* in the Canary Islands and Azores and the description of two new tetraploid species. Bot. J. Linn. Soc. (London) *74* (3) : 251-277.

GIBBY, M. & WALKER, S., 1978. Further cytogenetic studies and a reappraisal of the diploid ancestry in the *Dryopteris carthusiana* complex. Fern Gaz. *11* (5) : 315-324.

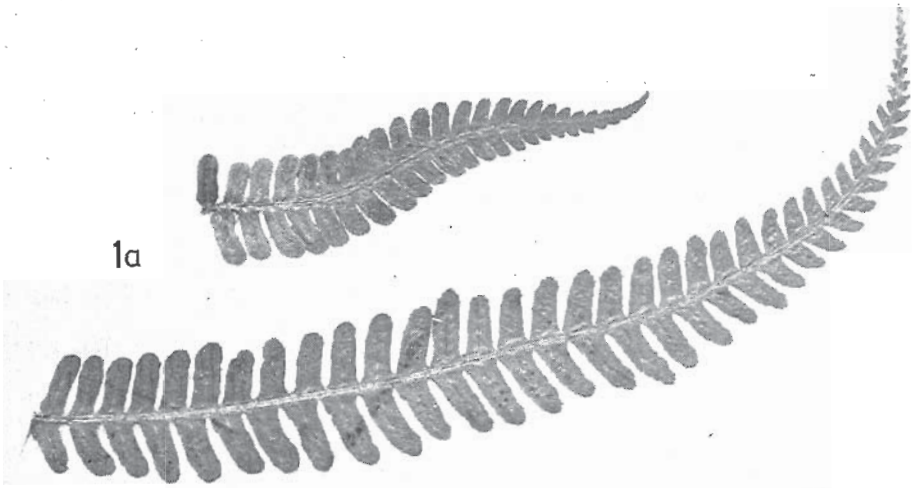
GIBBY, M., WIDÉN, C.-J. & WIDÉN, H. K., 1978. Cytogenetic and phytochemical investigations in hybrids of Macaronesian *Dryopteris* (Pteridophyta : Aspidiaceae). Pl. Syst. Evol. *130* : 235-252.

SJÖGREN, E., 1973. Recent changes in the vascular flora and vegetation of the Azores Islands. Mem. Soc. Broteriana *22* : 1-453.

STAFLEU, F. (ed.), 1978. International Code of Botanical Nomenclature. Leningrad.

WALKER, S., 1955. Cytogenetic studies in the *Dryopteris spinulosa* complex 1. Watsonia *3* (4) : 193-209.

WIDÉN, C.-J., FADEN, R. B., LOUNASMAA, M., VIDA, G., VON EUW, J. & REICHSTEIN, T., 1973. Die Phoroglucide von neun *Dryopteris*--Arten aus Kenya sowie der *D. oligodonta* (Desv.) Pic.-Serm. und *D.* « *dilatata* » von den Canarischen Inseln. Helvetica Chimica Acta *56*(7) : 2125-2151.



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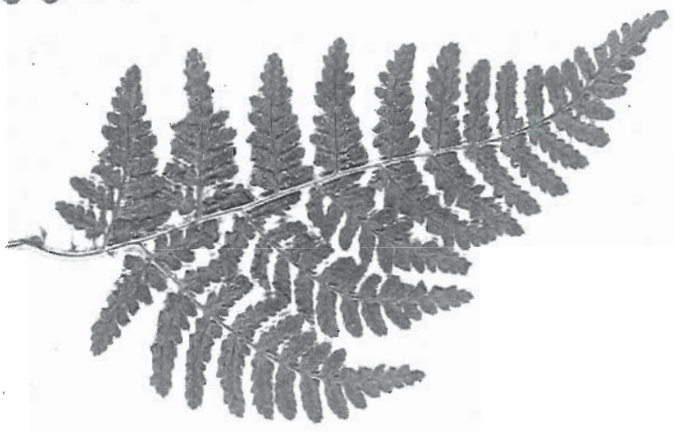
1b



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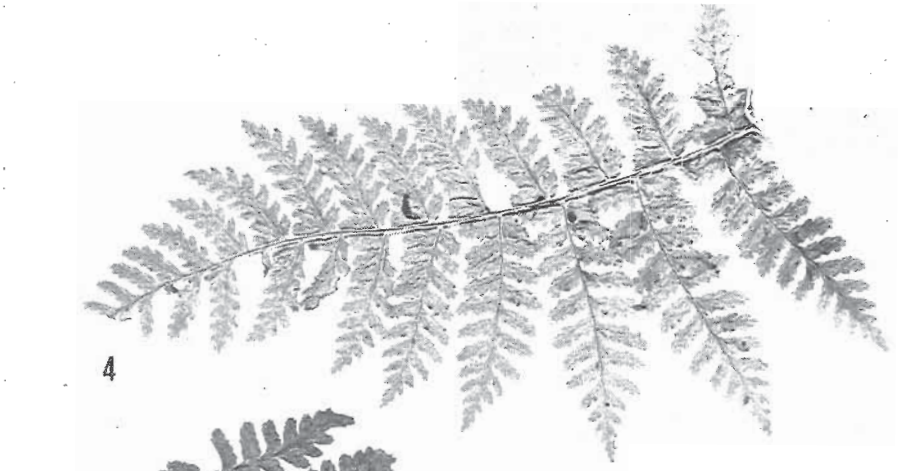

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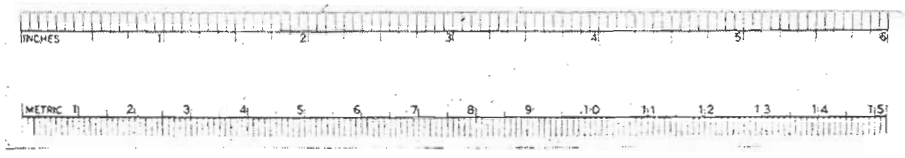

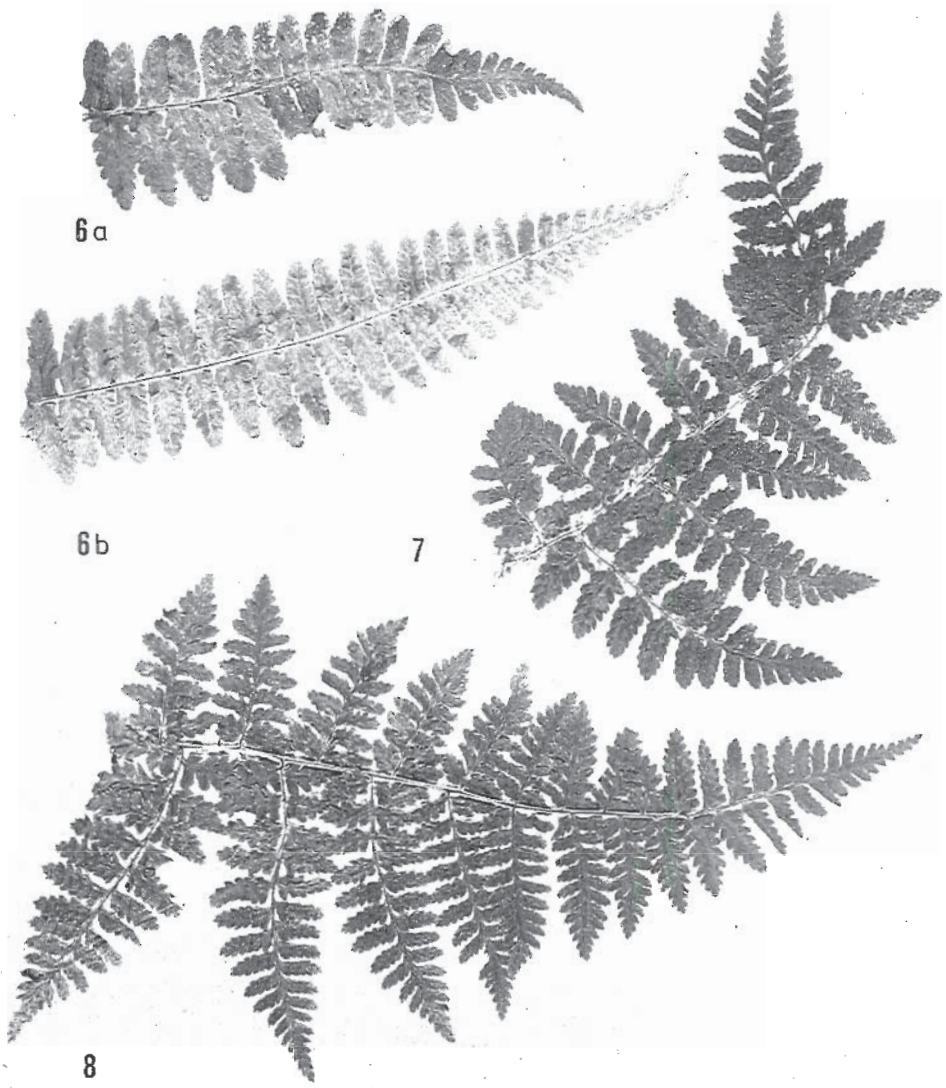
6a
6b
7
8


9
10
INCHES 1 2 3 4 5 6
METRIC 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

PLATE I *

Fig. 1a, 1b. — *D. affinis* spp. *affinis* (var. *azorica*). Median and lowest pinna. CRFJ no. 9684.

Fig. 2 — *D. aemula*. Lowest pinna, CRFJ no. 9629.

Fig. 3 — *D. dilatata*. Lowest pinna. CRFJ no. 10105.

PLATE II

Fig. 4 — *D. azorica*. Lowest pinna. CRFJ no. 10119.

Fig. 5 — *D. crispifolia*. Lowest pinna, CRFJ no 10104.

PLATE III

Fig. 6a, 6b — *Dryopteris* × *picoensis* (= *D. affinis* spp. *affinis* × *D. azorica*). Lowest and median pinna. CRFJ no. 10071.

Fig. 7 — *D.* × *martinsiae* (= *D. aemula* × *D. crispifolia*). Lowest pinna CRFJ no. 10107.

Fig. 8 — *D.* × *madalenae* (= *D. azorica* × *D. crispifolia*). Lowest pinna. CRFJ no. 9687.

PLATE IV

Fig. 9 — *D.* × *sjoegrenii* (= *D. azorica* × *D. dilatata*). Lowest pinna. CRFJ no. 10096.

Fig. 10 — *D.* × *telesii* (= *D. crispifolia* × *D. dilatata*). Lowest pinna CRFJ no. 10103.

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* Photographs taken by José Carlos Silva, University of the Azores, Department of Oceanography and Fisheries, Horta, Faial.