UK1. Piedrahita to Hoyos, Sierra de Gredos, Avila, Spain. *C. R. Fraser-Jenkins* 3777, 23/July/1972. BM!

UK3. Avila, interseccion del Rio Alberche con la carretera del Puerto de Menga, Spain. *J. A. Devesa, J. Pastor & S. Talavera* 5980/78, 28/July/1978. SEV!

VK1. El Escorial, Spain. *Isern,* 17/July/1852. MA (155831)!

WK3. Sierra de Cuenca, Spain. *Gandoger,* June/1898, W!

XK1. Puerto de Orihuela, Teruel, Spain. *E. Fuertes, R. Garcia & J. Alvarez* 39c-07110, 5/April/1974. PAMP!

YK1. El Maestrat, S. Juan de Penyaglossa, Torrent del'Avellanar, Sota el Mas de Benages, 1450 m., Spain. *J. Vigo,* 15/July/1961. BC (146570)!

BE3. Tarragona, Alcanar, Na. Sa. del Remei, Spain. *Teodora,* 2/Aug/1926. BC!

NE4. A cerca de 14.5 km. do ramal para Alvares, na estrada de Sotão a Pampilhosa da Serra, Portugal. *A. & R. Fernandes & J. Matos* 8534, 8/June/1962. M! COI! MA (195073)! MAF (72806)!

PE2. [Rio] Ocreza, Portugal. *J. S. Tavares,* July/1896. COI!

UK4. Jalas & Suominen (1972).

YK2. Jalas & Suominen (1972).

MC3. Serra de Sintra, Portugal. *Valorado* 36. [c. 1839] COI! (the only specimen seen from Sintra; very probably introduced into the Parc da Pena, see also comments under *D. guanchica*).

UN3. Jalas & Suominen (1972).

TH4. Montes de Gata [nr. Fuente-obejuna, Cordoba], Andalucia, Spain. *H. de Greg.* Colmeiro y Penido (1889).

VH4. Cuesta de Santa Elena en Sierra Morena, Andalucia, Spain. Colmeiro y Penido (1889).

WG1. Sierra de La Cabrilla, Spain. *J. Cuatrecasas,* 12/July/1926. MAF (44486)!

UG4. Lucena. *Lagasca.* Colmeiro y Penido (1889).

VG4. Sierra Nevada, 2,400 m., Borreguiles, Monachil valley, Granada, Spain. *C. R. Fraser-Jenkins* 3795-3800, 25/July/1972. BM!

WG2. Almería, Sierra Nevada, Chullo, 2,400 m., Spain. *A. Charpin & J. Fernández-Casas* 10605/1901, 19/July/1974. G!

WG4. «Sierra de Bacarés, Almeria», Spain. *E. Gros* (Herb. Pau), 3/Oct/1929. MA (236)!

VF3. Andalucia, Rio Bermejo, nr. Pampaneira, Alpujarra, 4000', Spain. *D. Brinton-Lee* 931, 5/Aug/1969. BM!

WF1. Jalas & Suominen (1972).

TF4. Reg. submont., Sierra del Aljibe, Jerez, Spain. *Perez-Lara* 36, 26/July/1876. MAF (44472)! (with *Athyrium filix-femina*).

3. **Dryopteris oreades** Fomin, Mon. Jard. Bot. Tiflis (Vestn. Tiflis. Bot. Sada) **18**: 20 (1910).

IMPORTANT SYNONYMS: *Lastrea filix-mas* var. *pumila* Moore (1855). *Aspidium pumilum* (Moore) Lowe (1857), non Mart. & Gal. (1842), nec *Dryopteris pumila* (Gilib.) Krecz. in Grossheim (1939). *Lastrea propinqua* Wollaston (1863), non J. Smith (1841), nec Presl (1849). *Aspidium filix-mas* var. *duriaei* Milde (1867). *Aspidium filix-mas* var. *glandulosum* Milde (1867). *Polystichum pyrenaicum* Miégev., Rev. Cath. Dioc. Tarbes **41**: 763-764 (1873), nom. prov., inval. *Polystichum filix-mas* var. *pyrenaicum* Miégev. (1874). *Nephrodium propinquum* (Woll.) Lowe (1890), non R. Br. (1810), nec Presl (1825). *Aspidium filix-mas* var. *setosum* Christ (1900), p. p., non *Dryopteris filix-mas* var. *setosa* Christ (1909), nec *Dryopteris setosa* (Christ) Miyabe et Kudo (1930), nec (Thunbg.) Akasawa (1959), nec (Pr.) C. Chr. (1905), nec (Bl.) O. Ktze. (1891). *Nephrodium rupestre* Samp. (1909), non *Dryopteris rupestris* (Klotz.) C. Chr. (1905). *Nephrodium filix-mas* «race» *rigidoformis* Rouy (1913). *Dryopteris* × *litardierei* Rothm. (1945).

MISAPPLIED NAME: *Dryopteris abbreviata* (DC.) Newm. ex Manton, sensu Manton (1950), auct. Brit. etc., see under *D. affinis*.

IN WILLKOMM & LANGE: Not distinguished from *Polystichum filix-mas*.

TYPE (lectotype): «D. oreades, teste Fomin. Sources du Seken, region Alpin. *Alboff*. July 1891», in TGM!

DESCRIPTION: Fronds not persistent in winter, becoming twice pinnate, narrowly lanceolate, somewhat compact, markedly upright. Stipe ± short, densely scaly, with pale or somewhat russet-coloured scales, scales becoming somewhat more scattered on the rhachis, but ± covering it, and becoming small, ± narrow, and characteristically pale, extending to the lower surface of the pinna-costae. Lamina bearing scattered glands on the axes, and sometimes slightly sweet scented when young, herbaceous or

slightly crispaceous, pale to mid-green, often slightly greyish green; often with the pinnules somewhat curved up or even twisted. Pinnae sloping upwards, ± symmetrical about their axes or very slightly basiscopically developed below. Pinnules almost all adnate to the costa except the lowest basiscopic one on lower pinnae, which may become stipitate; somewhat compact and usually ± crowded, rectangular-lanceolate, often with their edges turned down so that the apex appears wider or slightly spathulate, rounded or ± obtusely pointed at their apices, though the upper pinnules are often rounded-truncate; bearing obtuse-tipped teeth splayed out around the apex in a divergent, fan-like arrangement (i. e. pointing slightly outwards); pinnules sometimes ± shallowly lobed with rounded lobes at the side. Indusia thick, tall, curved over the sorus and turned down at the sides around the sorus, grey green, glandular at the edges, shrinking somewhat and becoming pale-brown on ripening, mostly persistent. Ripe (dark) spore-samples contain regular spores. Diploid sexual.

HABITAT: An atlantic montane species occurring in open rocky areas and screes, or among bushes at the upper limits of the forest. Confined to non-calcareous rocks (though in a few places in Spain occurring between conglomerate rocks where calcicole species grow on the rocks; e. g. at Três Mares, Peña Labra), often near streams or at least in damp places. From c. 700 to 2000 m. in altitude, though occasionally descending below 700 m. on mountains above c. 1800 m., where montane species can descend to lower levels.

RANGE IN THE AREA: The Pyrenees, the Cordillera Cantabrica to Orense, the mountains connecting the Eastern Cordillera Cantabrica to the Cordillera Central, and throughout the Cordillera Central to the Serra da Estrela in Portugal. Becoming very abundant in the Spanish mountain ranges, probably more so than in any other country in Western Europe. Absent from Macaronesia.

RANGE: Confined to non-calcareous rock in Western (Atlantic) Europe [Britain, Ireland, W. Central and S.W. France, N.W. Germany (Olpe), Iberia], parts of the Western Mediterranean (Corsica, Sardinia, Elba, N. Italy) and the Caucasus and N.E. Turkey, in association with mountains. Absent from Scandinavia, Iceland, Greenland and the Faroes, from where it has been reported

in error for small plants of *D. filix-mas* following LÖVE & LÖVE (1961), LÖVE (1970), LYE (1969) and SAHLIN (1962). The Icelandic records were based on a single cytological check on a plant of unknown garden origin which may have been *D. affinis,* and reports of *D. oreades* as being a Northern European element, which originated with LÖVE & LÖVE's report from Iceland, were in error (all the relevant voucher specimens have been seen by the author). The records given in JALAS & SUOMINEN (1972) from S. England, N. France, E. Germany, Czechoslovakia, West Germany (except Kreis Olpe) and N. Italy (except the Appenino Modenese) are also incorrect (all the relevant voucher specimens have been located and seen by the author). It has also been erroneously reported from the Alps [HESS, LANDOLT & HIRZEL (1967)] and S.E. France [JERMY in RICKARD (1974)]. For its range in France, see FRASER-JENKINS (1977: 318).

NOTES: The misapplication of the name, *D. abbreviata,* and whereabouts of its type (in BORD), were first pointed out by VIVANT (1974 & 1976), who had noticed that *D. oreades,* at that time known as *D. abbreviata* auct., does not grow in the low-lying area of the Department of Landes, from where *Polystichum abbreviatum* DC. was described. For details of the nomenclature of *D. oreades* see FRASER-JENKINS & JERMY (1976) and (1978). As can be seen from the above, this species has been much confused with *D. filix-mas* and *D. affinis.* It remains confused partly because the descriptions given in floras have for so long been based on DE CANDOLLE's original description of a small specimen of *D. affinis* as his *Polystichum abbreviatum* [the lectotype of this, selected here, is from St. Sever, Landes collected by DUFOUR and deposited at Bordeaux (BORD), now on semi-permanent loan to Herb. J. Vivant, Orthez (!) and is probably the frond from which a single pinna has been taken and deposited in G (!)]. Thus small dwarf plants of *D. filix-mas* and *D. affinis* are frequently mistaken for *D. oreades,* which, however, may become a large plant in favourable conditions. Small size is therefore not emphasised here as a feature of *D. oreades. D. oreades* has been shown to be part-ancestral to *D. filix-mas* (see under that species), along with *D. caucasica.* Its nearest relative appears to be the diploid sexual species, *D. sichotensis* Kom., from the Far-East, which has often been confused with *D. filix-mas. D. oreades* has

been reported in error for *D. filix-mas* or *D. affinis* from various places in Spain, for example: Uberuaga, Vizcaya [ALSTON in LAÍNZ (1961), specimen in MA (!) is *D. affinis* subsp. *affinis*]; Garcibuey, Salamanca [FERNÁNDEZ-DIEZ (1975), specimen in SA (!) is *D. affinis* subsp. *borreri*]; and the Sierra Nevada [ROTHMALER (1945), specimens in JE! are *D. filix-mas;* ESTEVE-CHUECA & FERNÁNDEZ-CASAS (1972), specimen in herb. FERNÁNDEZ-CASAS, Fac. Cienc., Univ. Auton. Madrid (!) is *D. filix-mas;* CHARPIN & FERNÁNDEZ-CASAS (1975), specimen in G (!) is *D. filix-mas* [see also CHARPIN & FERNÁNDEZ-CASAS (1978), who agree with the present author's determination written on their specimen at G in 1977]; TORRES & ESTEVE-CHUECA (1975), specimens coll. J. VARO, 1972, in herb. ESTEVE-CHUECA, Fac. Cienc., Univ. Lab., Alcalá de Henares (!), GDA (!) and herb. Fac. Cienc., Univ. Granada (!) are *D. filix-mas*]. The reports of *D. oreades* (sub *D. abbreviata*) from a population partly in N. Portugal and partly in Orense, Spain by LAÍNZ (1965 and 1966), require confirmation as no specimen was made (LAÍNZ and RIGUEIRO RODRÍGUEZ, pers. comm. 1981) and on a visit to the Picos de Fonte Fria, S. of Requías, by the present author in 1981, following detailed instructions indicated by LAÍNZ (pers. comm.), only *D. filix-mas* and *D. affinis* subsp. *affinis* and subsp. *borreri* were found.

MAP: 5.

VOUCHER SPECIMENS:

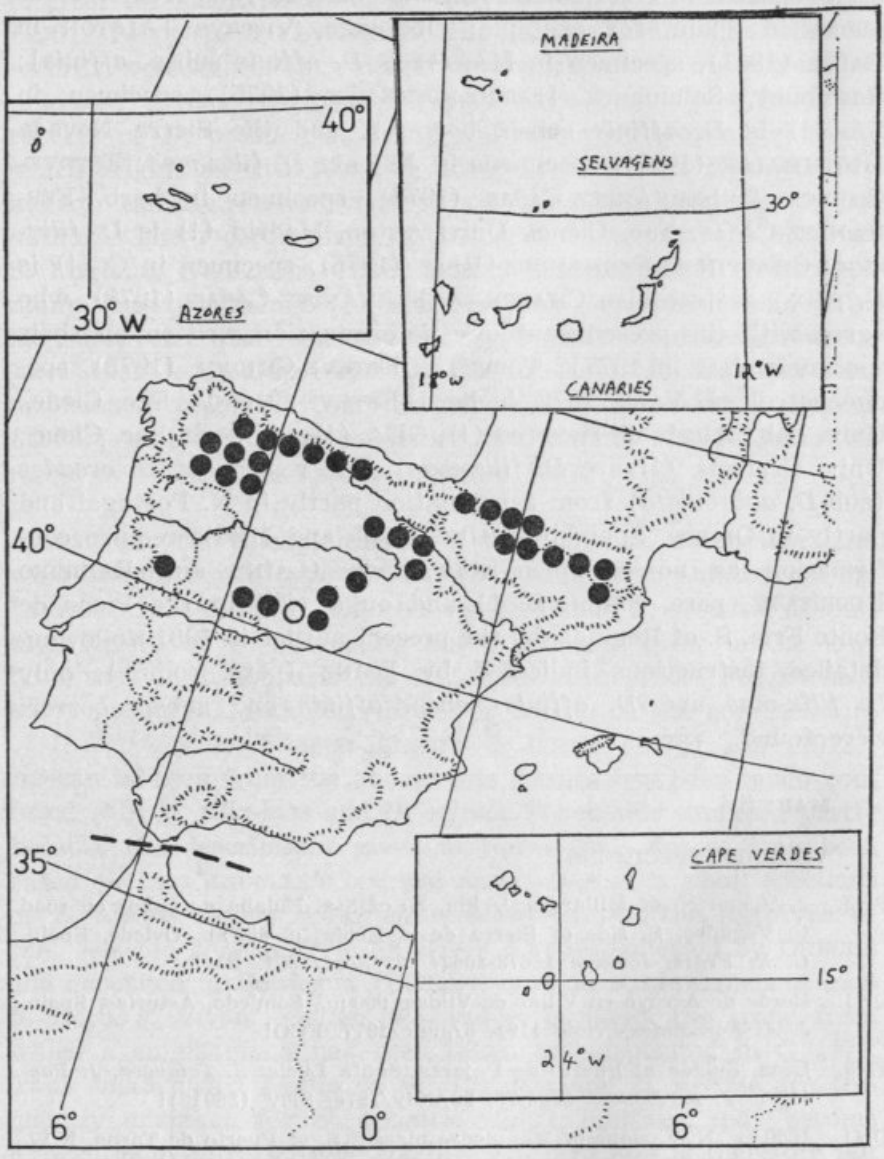
PH3. c. ½ km. N. of Millardos, ½ km. N. of Sta. Eulalia de Oscos on road to Vegadeo, S. side of Sierra de la Bobia, c. 650 m., Oviedo, Spain. *C. R. Fraser-Jenkins* 10673-10674, 27/Sept/1981. BM!

QH1. Borde de Arroyo en Villar de Vildas, 900 m., Somiedo, Asturias, Spain. *J. A. Fernandez-Prieto* 1191. 5/June/1977. FCO!

TN3. Léon, Subida al Puerto de Pajares, Santa Lucia. *S. Talavera, J. Pastor & J. A. Devesa* 6080-78, 29/July/1978. SEV (38015)!

UN1. 1650 m., N.W. slope of Mampodre massif, S. of Puerto de Tarna, N.W. of Riaño, Léon, Spain. *C. R. Fraser-Jenkins* 10612-10614 and 10616-10624, 18/Sept/1981. BM!

UN3. Infra lacum, Curavacas, Palencia, Spain. *Laínz,* 15/July/1962. Herb. Gijón! and c. 1800 m., S.E. side of Puerto de Tres Mares, S. side of Peña Labra, W. of Reinosa, Santander, Spain. *C. R. Fraser-Jenkins* 10602-10604 and 10607, 18/Sept/1981. BM!


MADEIRA
SELVAGENS
40°
30°
30°W
AZORES
12°W
CANARIES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 5.

VN1. Top of Puerto Estacasas de Trueba, between Vegas de Pas and Espinosa de Los Monteros, 1160 m., Santander, Spain. *C. R. Fraser-Jenkins* 10599, 17/Sept/1981. BM!

XN1. Mt. Okolin, Lanz [E. of Puerto de Velate], Spain. *J. C. Bascones,* 3/Oct/1975. PAMP! (with *D. affinis* ssp. *affinis*).

XN3. Basses Pyrénées, St. Engrâce, Mont Lacoura, 1906 m., France. *J. Vivant,* 5/July/1955. P! Herb. Vivant, Orthez!

YN1. Col de Lurde to Morilas, Les Eaux Bonnes, 1840 m., France. *P. Montserrat & L. Villar* 2341, 16/July/1979. JACA!

BH3. Ruisseau Dets Coubous, 3.5 km. E. of Barèges, 1550 m., Hautes Pyrénées, France. *F. Badré* 1641, 21/July/1975. P!

PH2. Bosque de la Rogueira, como a 1100 m., [Caurel], Spain. *Laínz,* 1/July/1965. Herb. Gijón!

PH4. De Grada a Piornedo, Sierra de Ancares, Lugo, Spain. *F. J. Fernández-Diez,* 23/Aug/1979. SA (19235)! and *S. E. Gonzáles-Crespo,* 24/Aug/1979. Herb. S. E. González-Crespo, Fac. Ciencias, Univ. Santiago de Compostela!

QH2. 3 ½ km. NE. of Carbon del Sil. 5 km. N.E. of Paramo del Sil, S.W. of Palacios del Sil, N.W. side of Sierra de Jistredo, N.N.E. of Ponferrada, Léon, Spain. *C. R. Fraser-Jenkins* 10744-10746, 30/Sept/1981. BM!

YN2. Mts. above Panticosa, Aragonese Pyrenees, Spain. *D. A. Webb,* 30/June/1953. BM!

BH4. Junto Majada, El Gato, Gistain, 1920 m., Spain. *P. Montserrat* 5788, 18/Aug/1978. JACA!

CH2. Rencluse, Huesca, Spain. *E. Garronte,* 14/July/1865. LY!

CH4. Valley E. of Port Dret, Andorra. *E. F. Warburg* 1145, 7/Aug/1959, OXF! and Vall de Cardos, Sota el Llac d'Areste, Spain. *J. Vigo, J. Tondella et al.,* 26/Sept/1970. BC (607301)!

DH2. Vallée de Galbe, Sous Carruby, Pyr. Or., 1800 m., France. *L. Conill,* 11/April/1921. TL!

PG1. c. 1300 m., below Requeixo, N.W. side of Mt Seixo, S.E. of Chandreja de Queija, Sierra de Queija, E.S.E. of Orense, Orense, Spain. *C. R. Fraser-Jenkins* 10718-10723, 30/Sept/1981. BM!

PG3. Rivadelago, faldes del Moncalvo y barrancos del Rio Jera, Zamora, Spain. *M. Losa,* June/1947. BCF (266)!

QG1. Sierra Teleno, Peñabellose, Maragata, 1900 m., Spain. *F. Bernis,* 19/July/1947. MA (258 & 257)! and June/1946. MA (256)!

VM3. Burgos, Sierra de Neila, supra lacum 'Laguna Negra' dictum, 1950 m., Spain. *J. Fernández-Casas* 1313, 8/Aug/1976. MA (208551)! MAF (102047)! Herb. Gijón! Herb. Fernández-Casas, Fac. Cienc., Univ. Auton., Madrid!

WM1. El Muchachón, Picos de Urbion, Soria, Spain. *Valdés-Bermejo,* 15/July/1975. MAF!

WM3. Nava Lagunillo, Arnedillo, 1100-1200 m., Spain. *L. M. Medrano,* 2/Aug/1979. PAMP!

DG1. Nuria, Pirineos, Gerona, Spain. *A. M. Hernandez* 1728, 7/July/1970. MGC!

NG4. Picos de Fonte Fria, no concelho de Montalegre, Trás-os-Montes e Alto Douro, Portugal (S. of Requías, Muiños, Orense, Spain). Lainz 1965 & 1966).

WM4. Santuario de Sierra de Moncayo, S. of Tarazona, Zaragoza, Spain. *C. R. Fraser-Jenkins* 3811, 29/July/1972. BM!

VL3. Pico del Lobo, Sierra de Ayllón, Segovia, 1950 m., Spain. *S. Rivas-Martinez & C. Saenz de Rivas,* 12/July/1970. MAF!

VL2. Pico de Peñalarra, Sierra de Guadarrama, Spain. *A. Lawalrée* 5503, 14/Feb/1953. BR!

PE1. Lagoa Comprida, nr. Seia, Serra da Estrela, E. of Coimbra, Beira, Portugal. *C. R. Fraser-Jenkins* 4920, 7/June/1976. BM!

TK3. Subida al Calvitero, Sa. de Bejar, Salamanca, Spain. *Martinez, Navarro, Mayor & Diaz,* 29/July/1975. FCO (00175)!

UK1. Hoyos de Espinos, Sierra de Gredos, Spain. *T. Reichstein* 1299. Herb. T. Reichstein, Basel!

UK3. Jalas & Suominen (1972).

VK1. El Escorial, Madrid, Spain. *A. Aterido,* 27/July/1941. MA (135715)!

4. **Dryopteris tyrrhena** Fraser-Jenkins & Reichstein in Fraser-Jenkins, Reichstein & Vida, Fern Gaz. **11** (2 & 3): 177-198 (1975).

IMPORTANT SYNONYMS: *Aspidium nevadense* Boissier, Elench. Plant. Nov. etc.: 93-94 (1838), non *Dryopteris nevadensis* (Bak.) Underw. (1893). *Aspidium rigidum* var. *pinnatisectum* Milde (1868). *Dryopteris villarii* var. *nevadensis* (Boiss.) Heywood (1961), non sens. Heywood. *Dryopteris* × *cebennae* Fraser-Jenkins, Candollea **32**(2): 317-319 (1977), pro parte, incl. type (see FRASER-JENKINS 1981).

IN WILLKOMM & LANGE: Not separated from *Polystichum rigidum* var. *australe.*

TYPE (Holotype): From the Sierra Nevada, Spain, in G!

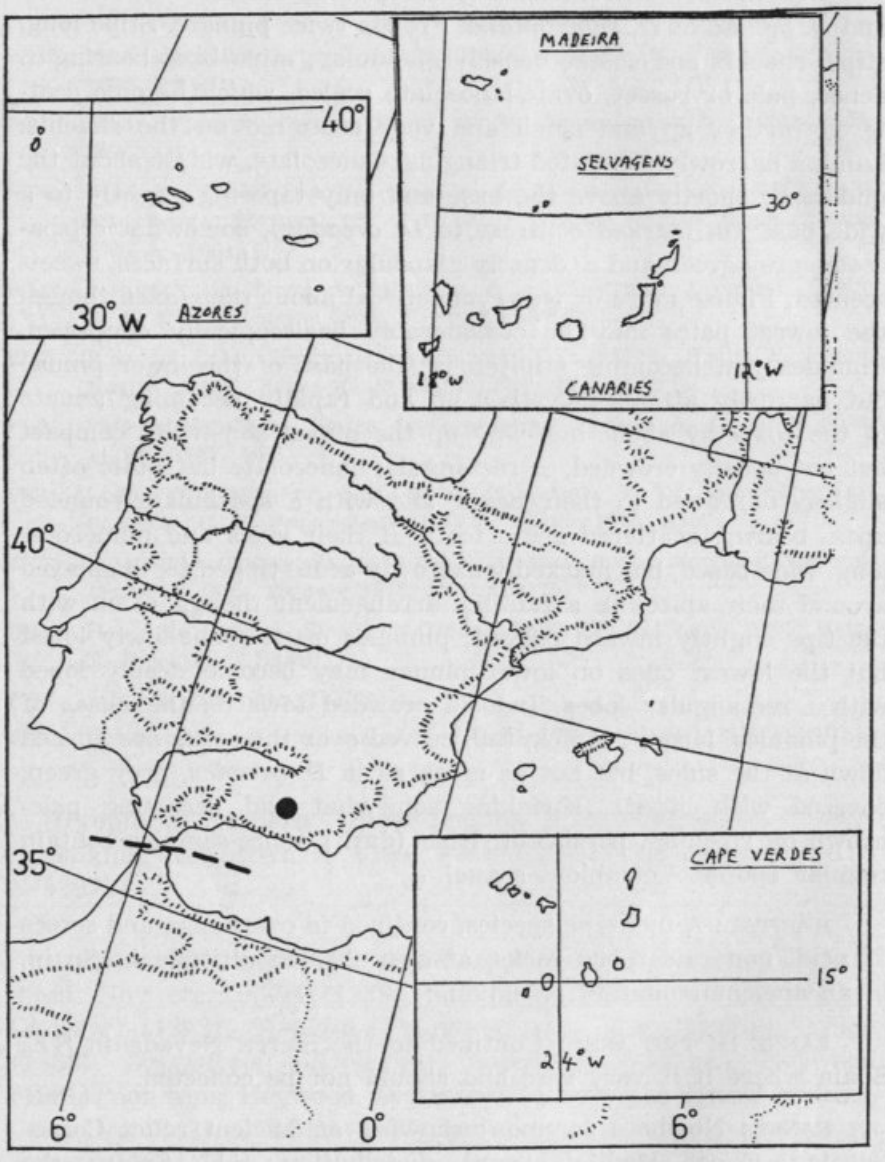
DESCRIPTION: Intermediate in morphology between *D. oreades* and *D. pallida* or *D. submontana*. Fronds twice pinnate. Stipe long, stipe, rhachis and costae densely glandular; stipe base bearing ± dense, pale or russet, ovate-lanceolate scales, which become scattered further up and small and very scattered on the rhachis. Lamina narrowly elongated triangular-lanceolate, widest about the middle or shortly above the base and only tapering slightly to a wide base (in marked contrast to *D. oreades),* somewhat crispaceous, grey-green and ± densely glandular on both surfaces, sweet-scented. Pinnae more or less symmetrical about their axes though the lowest pairs may be considerably basiscopically developed. Pinnules just becoming stipitate at the base of the lower pinnae but narrowly attached further up and rapidly becoming adnate to the costa by about half-way up the pinna, somewhat compact but not usually crowded, ± rectangular lanceolate but quite often slightly narrowed to their bases, and with a spathulate rounded apex, bearing scattered acute teeth at their sides and numerous, long, wide based, but markedly narrowly-acute-tipped teeth splayed around their apices in a fan-like arrangement though often with the tips slightly inward curved; pinnules often ± shallowly lobed but the lowest ones on lower pinnae may become deeply lobed with ± rectangular lobes. Indusia crowded towards the bases of the pinnules, large, ± thick, tall, curved over the sorus and turned down at the sides, but not as much as in *D. oreades,* grey green, covered with glands, shrinking somewhat and becoming pale-brown on ripening, persistent. Ripe (dark) spore-samples contain regular spores. Tetraploid sexual.

HABITAT: A montane species, confined to overhangs and screes of acid, non calcareous rocks, at over 2000 m altitude in Spain, in an ancient mountain refugium.

RANGE IN THE AREA: Confined to the Sierra Nevada in S.E. Spain where it is very rare and should not be collected.

RANGE: Nowhere common; showing an ancient relict Cerno-Sardian (West Mediterranean) distribution. S.E. Spain; the Cevennes and Eastern Alpes Maritimes in France; Liguria in Italy; Corsica; Sardinia; Capraia and Elba.

NOTES: *Dryopteris tyrrhena* is a new name for *Aspidium nevadense* Boiss. as there is already a *Dryopteris nevadensis.*


MADEIRA
SELVAGENS
40°
30°
30°W
AZORES
18°W
CANARIES
12°W
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 6.

Unfortunately the type of *D.* × *cebennae* Fraser-Jenkins, but not the other specimens cited, was *D. tyrrhena,* as was part of the description, thus the name is placed into the synonymy of *D. tyrrhena.* The tetraploid apomictic species from S.W. France which was part of the original concept of *D.* × *cebennae* has been renamed *D. ardechensis* Fraser-Jenkins (1981) and could be derived from *D. affinis* subsp. *affinis* and *D. tyrrhena* or from *D. affinis* subsp. *affinis* and *D. submontana,* though other possibilities exist.

D. tyrrhena is almost certainly an allotetraploid species derived from the two diploid sexual species, *D. oreades* and *D. pallida,* though further study is required to investigate which subspecies of *D. pallida* was involved, subsp. *pallida* or perhaps subsp. *balearica.*

MAP: 6.

VOUCHER SPECIMEN:

VG4. c. 2300 m., S. side of Upper Dilar valley, W. Sierra Nevada, Granada, Spain. *C. R. Fraser-Jenkins* 4369, 6/Aug/1974. BM!

5. **Dryopteris submontana** (Fraser-Jenkins & Jermy) Fraser-Jenkins, Candollea 32(2): 305-319 (16/Dec/1977).

BASIONYM: *Dryopteris villarii* subsp. *submontana* Fraser-Jenkins & Jermy, Fern Gaz. 11: 338 (12/Dec/1977).

IMPORTANT SYNONYMS: *Polystichum nivale* Miégev., Rev. Cath. Diocese Tarbes 41: 763-764 (1873), nom. prov., inval. *Polystichum rigidum* var. *bertolonii* and var. *hypodematium* Trevis. (1874). *Aspidium rigidum* var. *cuneilobum* Borbás ex Luerssen (1886). *Aspidium pallidum* lus. *furcatum* Bicknell ex Fiori (1943).

MISAPPLIED NAMES: *Dryopteris villarii* var. *nevadensis* sensu Heywood (1961).

IN WILLKOMM & LANGE: Not separated from *Polystichum rigidum* and also partly what was referred to under var. *australe.*

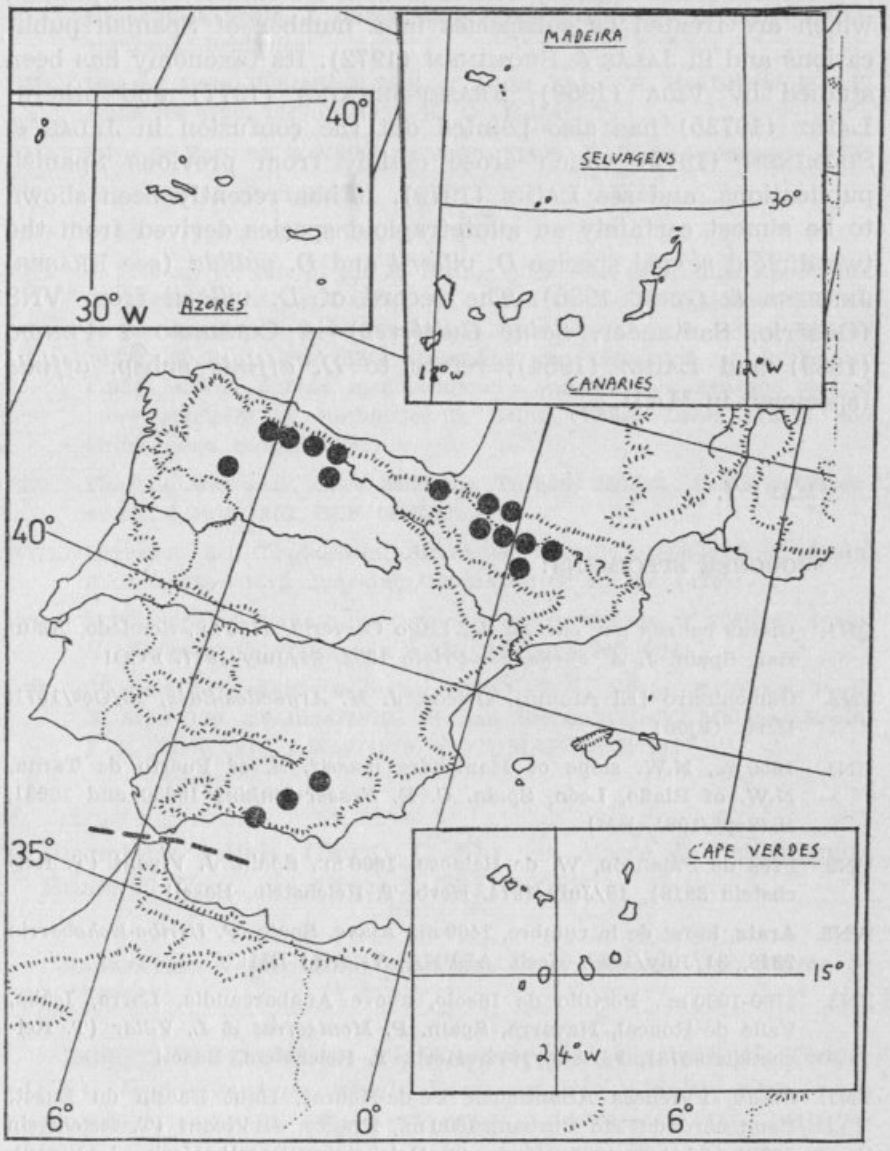
TYPE (Holotype): From England in BM!

DESCRIPTION: This is the only representative of the «*D. villarii*» aggregate occurring in the area, apart from *D. pallida* on the Balearic Islands, so needs not be distinguished in detail here from the other species in the group (see FRASER-JENKINS 1977), but its morphology is exactly intermediate between *D. villarii* (Bell.) Woynar ex Schinz & Thell. and *D. pallida* subsp. *pallida*. Fronds twice pinnate. Stipe very long, stipe, rhachis and costae densely glandular; stipe base bearing dense, ovate, pale, glossy scales, which become scattered further up and small and very scattered on the rhachis. Lamina markedly elongated-triangular, widest at the base, crispaceous, matt, blue-green and ± densely glandular on both surfaces, sweet-scented. Pinnae more or less symmetrical about their axes. Pinnules stipitate towards the base of each pinna, but becoming narrowly attached to the costa by about one-third of the way up the pinna and adnate to the costa near the tips of the pinnae, compact, narrow and ± crowded, narrowly ovate-lanceolate, with acute apices, bearing small, narrowly acute teeth at the sides, which become longer and more acute around the pinnule-apices; pinnules somewhat deeply lobed at the sides with small, crowded, rectangular lobes (rarely almost unlobed, mainly in immature plants or in Eastern Europe). Indusia somewhat thin, curved over the top of the sorus and slightly turned down at the sides, but not completely surrounding the sorus, grey green, covered with glands, shrinking somewhat and becoming pale-brown on ripening, persistent. Ripe (dark) spore-samples contain regular spores. Tetraploid sexual.

HABITAT: Confined to limestone or occasionally calcareous schists, where it grows as a montane species in crevices of open rocks, or in open screes below cliffs. From c. 1000-2000 m. or more in altitude.

RANGE IN THE AREA: The W. and Central Pyrenees, Provincias Vascongadas and Central Cordillera Cantabrica, extending South-West to the Montes Aquilianos in León. Also present disjunctly in S.E. Spain in the Sierras de Segura, Nevada and Tejeda. Absent from the Cordillera Central and from Macaronesia.

RANGE: Britain, S.W. and S.E. France, Spain, across the subalpine regions of Southern Europe to South West Romania, ?Bulgaria, South Turkey, the Western Caucasus and Algeria.


MADEIRA
SELVAGENS
30°
40°
30° W
AZORES
18° W
CANARIES
12° W
40°
35°
CAPE VERDES
15°
24° W
6°
0°
6°

MAP 7.

NOTES: Until recently confused with *D. villarii* or *D. pallida*, which are treated as subspecies in a number of Spanish publications and in JALAS & SUOMINEN (1972). Its taxonomy has been studied by VIDA (1969), FRASER-JENKINS (1977) and others; LAÍNZ (1973*b*) has also pointed out the confusion in JALAS & SUOMINEN (1972) which arose mainly from previous Spanish publications, and see LAÍNZ (1979). It has recently been shown to be almost certainly an allotetraploid species derived from the two diploid sexual species *D. villarii* and *D. pallida* (see FRASER-JENKINS & GIBBY 1980). The record of *D. villarii* from VN3 (Ogarrio, Santander, *Sainz Gutiérrez*) in COLMEIRO Y PENIDO (1889) and LAÍNZ (1954), refers to *D. affinis* subsp. *affinis* (specimen in MA!).

MAP: 7.

VOUCHER SPECIMENS:

QH1. Gleras calizas por encima del Lago Cerveriz, 1750 m., Somiedo, Asturias, Spain. *J. A. Fernández-Prieto* 1202, 24/July/1977. FCO!

TN3. Gamoniteiro [El Aramo], Oviedo. *J. M. Argüelles-Saéz*, 12/Oct/1971. Herb. Gijón!

UN1. 1650 m., N.W. slope of Mampodre massif, S. of Puerto de Tarna, N.W. of Riaño, León, Spain. *C. R. Fraser-Jenkins* 10630 and 10631, 18/Sept/1981. BM!

UN3. Près de Palancón, W. de Reinosa, 1600 m., Spain. *J. Vivant* (T. Reichstein 3818), 18/July/1974. Herb. T. Reichstein, Basel!

WN3. Aratz, karst de la cumbre, 1400 m., Alava, Spain. *P. Urribe-Echebarria* 2318, 31/July/1980. Herb. AEPNA, Vitoria! BM!

XN3. 1700-1900 m., Portillo de Insolo, above Añabarcaudia, Larra, Isaba, Valle de Roncal, Navarra, Spain. *P. Montserrat & L. Villar* (T. Reichstein 3673), 28/Aug/1972. Herb. T. Reichstein, Basel!

YN1. Ossau, Pyrénées Atlantiques, Pé-de-Hourat, Haut Bassin du Baset, flanc nord du Pic Durban, 1600 m., France. *J. Vivant* (T. Reichstein 3932), 26/Aug/1975. Herb. T. Reichstein, Basel! Herb. J. Vivant, Orthez!

UN4. Peña Redonda [W. of Cervera], Palencia, 1750-1930 m., Spain. *P. Montserrat* 5906 & 5785, 10/Aug/1972. JACA!

XN4. Bisaurin, Aragués, 1850 m., Spain. *P. Montserrat* 4176, 16/Aug/1967. JACA!

YN2. Parc National d'Ordesa, Grande Cascade de Cotatuero, Pyrénées Espagnoles, Spain. *J. Duvigneaud,* 25/July/1957. BR! B! Herb. J. Duvigneaud, Bruxelles!

BH4. Huesca, Peña Montañesa, N.E. of Ainsa, Spain. *P. Montserrat & N.Y. Sandwith* 4720, 13/July/1956. K! G! JACA!

CH2. Silva de Bertrem in Vallée de Aran, Spain. *P. P. de Lapeyrouse.* BM!

CH4. Jalas & Suominen (1972).

DH2. Jalas & Suominen (1972).

PG3. c. 1200 m., W. side of the N. facing calcareous cliff, «Los Apostoles», E. of «Campo de Las Danzas», S. of San Esteban de Valdueza, Montes de Los Aquilianos, S. of Ponferrada, León, Spain. *C. R. Fraser-Jenkins* 10730, 30/Sept/1981. BM! (following the indication of Rothmaler (1954), sub *D. pallida,* made without a voucher specimen and located more precisely by Rothmaler in Laínz (1960), Laínz (1973) and Laínz, pers. comm., 1981).

BG3. Paso de Marradas, entre peñascos, Turbón, 2300 m., Spain. *P. Montserrat,* 9/July/1952. BCF (4962)!

WG1. Barranco del Guadalentin, Sierra de Cabrilla, 1800-2000 m., Spain. *E. Reverchon* 1372, June-July/1906. GM! G! P! MA (426)!

VG4. N.W. slope of Dornajo bei Granada, Sierra Nevada, c. 2050 m., Spain. *H. Metlesics* (T. Reichstein 3023), 26/July/1969. BM!

VF1. Sierra Tejeda, parte septentr., 1,300-1,400 m., Spain. *E. Huter, Porta & Rigo* 120, 25/June/1879. P! and Sierra Tejeda, Malaga, Spain. *J. M. Nieto* 5915, 4/Nov/1979. MGC! MAF (105479)!

6. Dryopteris pallida (Bory) C. Chr. ex Maire & Petitmengin, Étude Pl. Vasc. réc. Grèce **2**: 238 (1908).

BASIONYM: *Nephrodium pallidum* Bory, Exped. Sci. Morée **3**: 287 (1832).

IMPORTANT SYNONYMS: *Aspidium rigidum* var. *australe* Tenore (1830). *Hypodematium nivale* Bory ex Fée (1852), nom. nud. *Nephrodium australe* (Ten.) Guadagno in Fiori & Bég. (1917). *Dryopteris australis* (Ten.) Guadagno (1918). *Dryopteris villarii* var. *australis* (Ten.) Maire (1952). *Dryopteris villarii* subsp. *pallida* (Bory) Heywood (1964).

IN WILLKOMM & LANGE: Reported in error for *D. submontana* and *D. tyrrhena,* sub *Polystichum rigidum* var. *australe.*

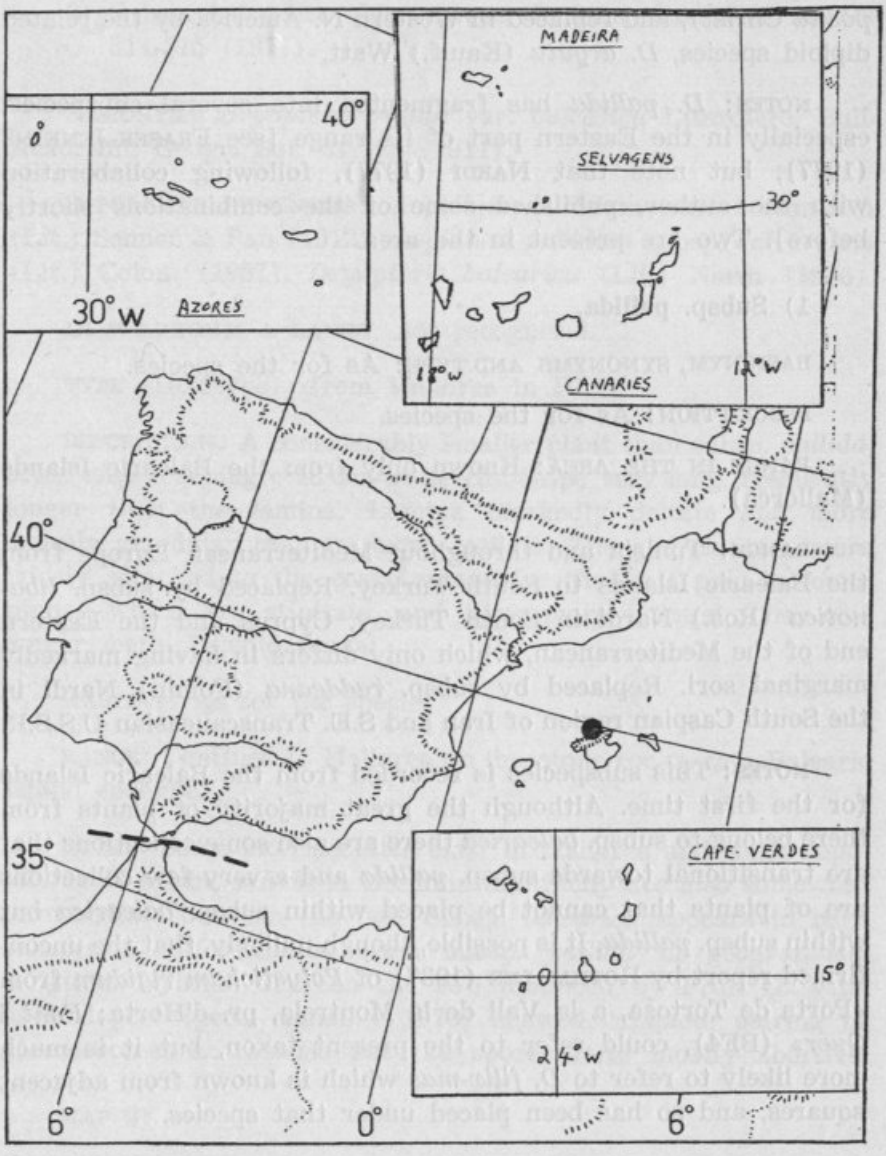
TYPE (Lectotype): S. Greece «Nephrodium pallidum Bory. Morée nr. 1335. Ravin des racines du Manglava. Bory de St. Vincent gère» (P!). Paratypes: (P!).

DESCRIPTION: Fronds twice pinnate, often a third time deeply pinnatifid. Stipe very long, stipe base ± densely clothed in ovate, glossy, pale scales, which become scattered above and ± absent from the rhachis. Lamina crispaceous-coriaceous, pale- to mid-green, noticeably paler below; ± sparsely glandular on the axes and on the lower surface (though the stipe and rhachis may be more densely glandular, especially in young fronds, which are sweet-scented). Pinnae becoming somewhat asymmetrical below with the lower basiscopic pinnules on the lowest pinna developed and somewhat longer than those on the acroscopic side. Pinnules stalked to half way up the pinna (except in subsp. *balearica* and in small plants from exposed places), becoming narrowly attached further up, long, more or less parallel-sided or sloping, with acute or obtusely pointed apices, which become rounded higher up in the frond, bearing small, triangular, acute-tipped teeth around the edges and apices, those on the apices being the longest and sometimes with narrowly acute tips; pinnules varying from almost unlobed at the sides to deeply lobed with small, crowded, rectangular or rounded lobes. Indusia somewhat thin, curved over the top of the sorus, grey green, bearing glands, shrinking somewhat and becoming pale-brown on ripening, persistent. Ripe (dark) spore-samples contain small regular spores. Diploid sexual.

HABITAT: A low level Mediterranean species growing in rock crevices and screes and confined to calcareous rocks; from shortly above sea-level to c 700 m altitude.

RANGE IN THE AREA: A westward extension of the range of this low-level Mediterranean species brings it to the Balearic Islands (Mallorca only).

RANGE: Centred on the East Mediterranean: Tunisia, Balearic Islands, Corsica (extinct), Sardinia, Southern Italy, Sicily, Mediterranean regions of S.E. Europe, Turkey, Cyprus, Syria, Lebanon, Israel, the Caspian Coast of Southern Azerbaijan and Northern Iran. Replaced in the West Himalaya by the related diploid species, *D. nigropaleacea* (Fraser-Jenkins) Fraser-Jenkins, comb. nov. [basionym: *Dryopteris pallida* subsp. *nigropaleacea* Fraser-Jenkins,


MADEIRA
SELVAGENS
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40°
30° W
AZORES
18°W
12°W
CANARIES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
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MAP 8.

Candollea 32(2): 316 (1977)] (and a triploid apomict, *D. juxtaposita* Christ), and replaced in Western N. America by the related diploid species, *D. arguta* (Kaulf.) Watt.

NOTES: *D. pallida* has fragmented into several subspecies, especially in the Eastern part of its range [see FRASER-JENKINS (1977), but note that NARDI (1977), following collaboration with the author, published some of the combinations shortly before]. Two are present in the area.

1) Subsp. **pallida.**

BASIONYM, SYNONYMS AND TYPE: As for the species.

DESCRIPTION: As for the species.

RANGE IN THE AREA: Known only from the Balearic Islands (Mallorca).

RANGE: Tunisia and throughout Mediterranean Europe from the Balearic Islands to South Turkey. Replaced by subsp. *libanotica* (Ros.) Nardi in South Turkey, Cyprus and the Eastern end of the Mediterranean, which only differs in having markedly marginal sori. Replaced by subsp. *raddeana* (Fomin) Nardi in the South Caspian region of Iran and S.E. Transcaucasian U.S.S.R.

NOTES: This subspecies is recorded from the Balearic Islands for the first time. Although the great majority of plants from there belong to subsp. *balearica* there are also some collections that are transitional towards subsp. *pallida* and a very few collections are of plants that cannot be placed within subsp. *balearica* but within subsp. *pallida*. It is possible, though unlikely, that the unconfirmed report by ROTHMALER (1937) of *Polystichum rigidum* from «Ports de Tortosa, a la Vall de la Montrela, pr. d'Horta; *Font i Quer*» (BF4), could refer to the present taxon, but it is much more likely to refer to *D. filix-mas* which is known from adjacent squares, and so has been placed under that species.

MAP: 8.

VOUCHER SPECIMEN:

DE4. Majorque, ombre, grotte, 400 m., Balearic Islands. *H. Knoche* 246 (excursion no. 201), 28/June/1909. MPU!

2) Subsp. **balearica** (Lit.) Fraser-Jenkins, Candollea **32**(2): 314-315 (1977).

BASIONYM: *Dryopteris rigida* var. *balearica* Litardière, Bull. Acad. Int. Geogr. Bot. **21**: 23 (1911).

IMPORTANT SYNONYMS: *Aspidium pallidum* var. *balearicum* (Lit.) Sennen & Pau (1912). *Aspidium pallidum* subsp. *balearicum* (Lit.) Colom (1957). *Dryopteris balearica* (Lit.) Nardi (1976).

IN WILLKOMM & LANGE: not recognised.

TYPE (Holotype): from Mallorca in P!

DESCRIPTION: A considerably smaller plant than subsp. *pallida*, often only reaching c 10 cm. in height. Stipe very long, frequently longer than the lamina. Lamina markedly deltate and more densely glandular than in subsp. *pallida*. The pinnules are more widely attached to the costa except for the first pair in lower pinnae which are stipitate, and have more pointed lobes and longer teeth. Diploid sexual.

HABITAT: As for the species.

RANGE: Confined to Mallorca on limestone rocks, as a Balearic Island endemic.

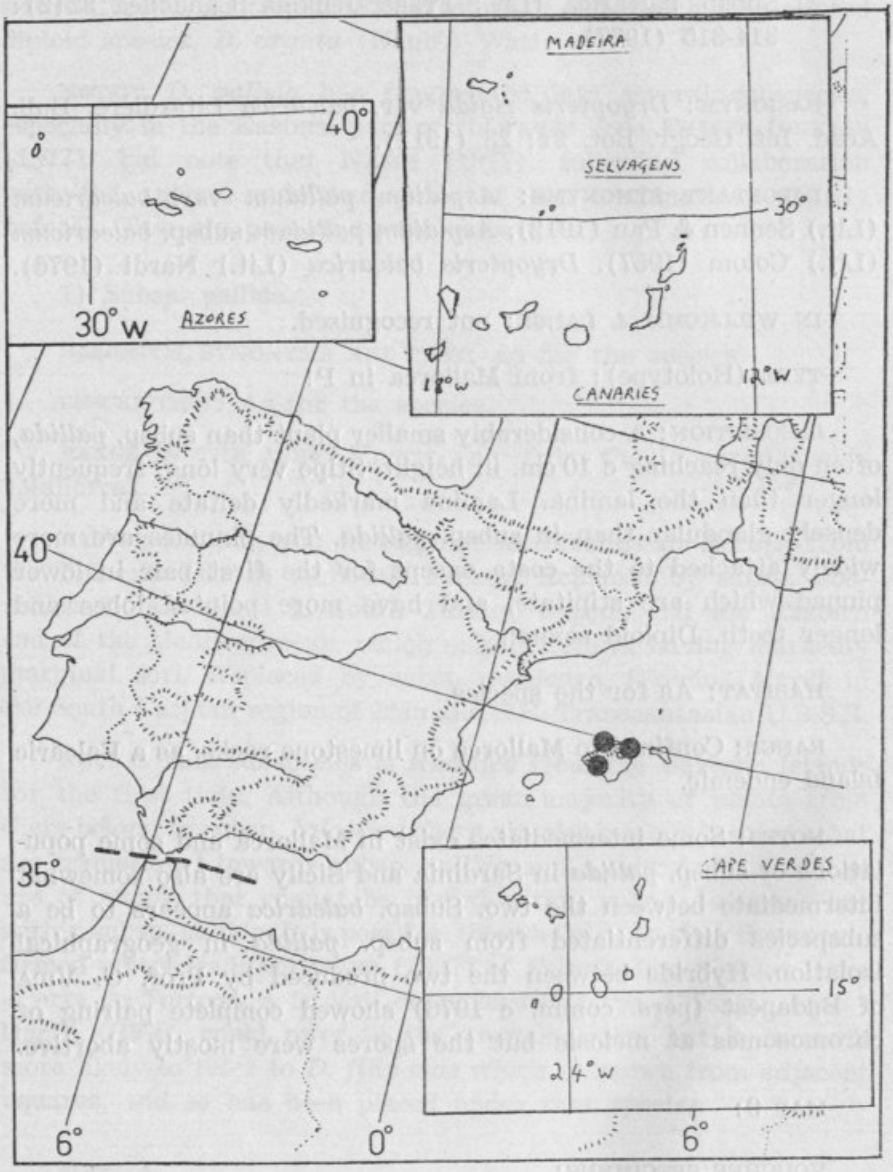
NOTES: Some intermediates exist in Mallorca and some populations of subsp. *pallida* in Sardinia and Sicily are also somewhat intermediate between the two. Subsp. *balearica* appears to be a subspecies differentiated from subsp. *pallida* in geographical isolation. Hybrids between the two produced by Prof. G. VIDA of Budapest (pers. comm. c 1976) showed complete pairing of chromosomes at meiosis but the spores were mostly abortive.

MAP 9:

VOUCHER SPECIMENS:

DF4. Sollér, lieux ombragés, Mallorca, Balearic Islands, Spain. *F. Bianor* 1893, 5/June/1910. P!

ED2. Cala S. Vicente, nr. Pollenza, Mallorca, Balearic Islands, Spain. *G. J. de Joncheere* (WME 41), May/1955. BM! L!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AZORES
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CAPE VERDES
15°
24°W
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0°
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MAP 9.

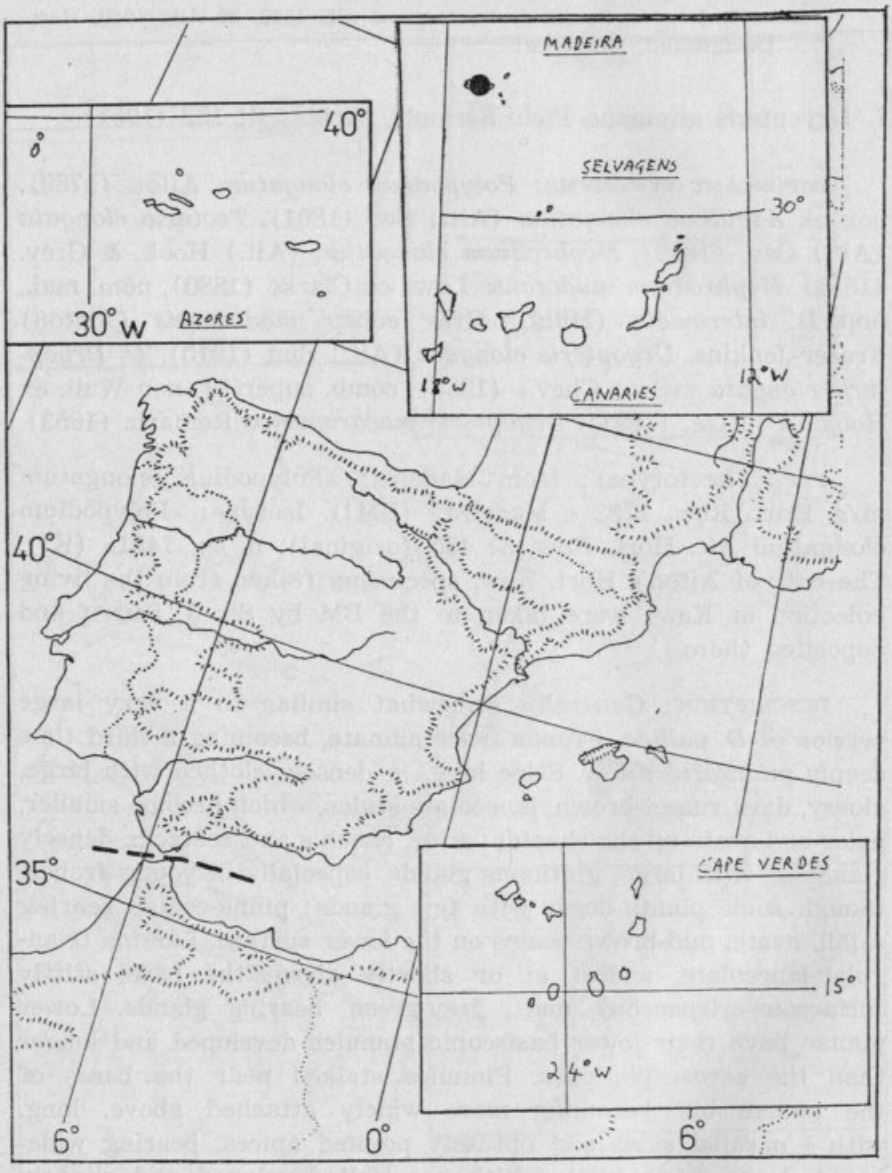
DD3. Alaro, Mallorca, le long de la route vers l'orient, avant Sellerich, Balearic Islands, Spain. *J. Duvigneaud* 69E 1533, 29/Aug/1969. Herb. J. Duvigneaud, Bruxelles!

7. **Dryopteris aitoniana** Pichi Sermolli, Webbia 8: 152 (1951).

IMPORTANT SYNONYMS: *Polypodium elongatum* Aiton (1789), non al. *Aspidium elongatum* (Ait.) Sw. (1801). *Tectaria elongata* (Ait.) Cav. (1802). *Nephrodium elongatum* (Ait.) Hook. & Grev. (1831). *Nephrodium maderense* Lowe ex Clarke (1880), nom. nud., non *D. intermedia* (Mühl.) Gray subsp. *maderensis* (Alston) Fraser-Jenkins. *Dryopteris elongata* (Ait.) Sim (1915), (=*Dryopteris elongata* «(Sw.) Chev.» (1935), comb. superfl.), non Wall. ex Hook.) O. Ktze. (1891). *Dryopteris macaronesica* Romariz (1953).

TYPE (Lectotype): from Madeira: «Polypodium elongatum m/s. Hort. Kew. 1782 e Madeira» (BM!). Isotype: «Polypodium elongatum Ait. Hort. Kew. 3: 465 (original). n. sp. 1481» (K!). The bulk of Aiton's Hort. Kew. specimens (taken from the living colection at Kew) were taken to the BM by Sir J. SMITH and deposited there.

DESCRIPTION: Generally somewhat similar to a very large version of *D. pallida*. Fronds twice pinnate, becoming a third time deeply pinnatifid below. Stipe long, ± densely clothed with large, glossy, dark russet-brown, lanceolate scales, which become smaller, paler and ovate up the rhachis; stipe, rhachis and costae ± densely glandular with large, glutinous glands, especially in young fronds, though some plants occur with few glands; pinna-costae bearing small, ovate, mid-brown scales on the lower surface. Lamina triangular-lanceolate, widest at or shortly above the base, stiffly coriaceous-crispaceous, matt, grey-green, bearing glands. Lower pinnae have their lower basiscopic pinnules developed and longer than the acroscopic ones. Pinnules stalked near the bases of the pinnae but becoming more widely attached above, long, with ± parallel sides and obtusely pointed apices, bearing wide-based, long, acute teeth which are well developed and slightly aristate at the apices; pinnules ranging from very shallowly lobed to deeply lobed, with large, ± rectangular lobes. Indusia very large, tall, thick, grey-green, densely glandular, curved over the top of the sori and slightly turned down at the edges, shrinking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MAP 10.

somewhat and becoming mid-brown on ripening, mostly persistent. Ripe (dark) spore-samples contain regular spores. Diploid sexual.

HABITAT: Lightly wooded slopes and banks on calcareous or non-calcareous rocks, from c. 300-1500 m. altitude.

RANGE: Endemic to Madeira.

NOTES: Presumably an ancient relict-endemic with no very close relatives though it is not unlike a very large version of *D. pallida* subsp. *raddeana* (Fomin) Nardi. Its chemistry also shows some similarities to *D. pallida* [see WIDÉN, VIDA, VON EUW & REICHSTEIN (1971)].

MAP: 10.

VOUCHER SPECIMENS:

11. 500 m, c 2 km S.W. of Portela, S. of Porto da Cruz, Madeira. *C. R. Fraser-Jenkins* 9773, 1/Aug/1979. BM!

8. **Dryopteris remota** (A. Br. ex Döll) Druce, List Brit. Plants: 87 (1908).

BASIONYM: *Aspidium rigidum* var. *remotum* A. Br. ex Döll, Rhein. Fl: 16 (1843).

IMPORTANT SYNONYMS: *Aspidium remotum* (A. Br.) A. Br. (1850). *Aspidium remotum* var. *subalpinum* Borbás (1876). *Aspidium subalpinum* (Borb.) Hand.-Mazz. (1903). *Dryopteris* × *borbasii* Litard. (1910). *Lastrea dilatata* var. *boydii* Stansfield (1934). *Lastrea boydii* (Stansf.) von Tavel (1934). *Lastrea elata* Oberholzer & von Tavel in von Tavel (1934). *Lastrea nitens* Oberholzer & von Tavel in von Tavel (1934). *Dryopteris* × *subalpina* (Borbás) Domin (1942), non v. A. v. R. (1922). *Dryopteris* × *doeppii* Rothm. (1945). *Dryopteris* × *woynarii* Rothm. (1945). *Dryopteris* × *subaustriaca* Rothm. (1945). *Dryopteris boydii* (Stansf.) Manton (1950). *Dryopteris* × *lawalreei* Janchen (1963). *Dryopteris kemulariae* Mikheladze (1963). Also many bybrid combinations between the *D. dilatata* group and the *D. filix-mas* or *D. affinis* groups.

IN WILLKOMM & LANGE: Not recorded.

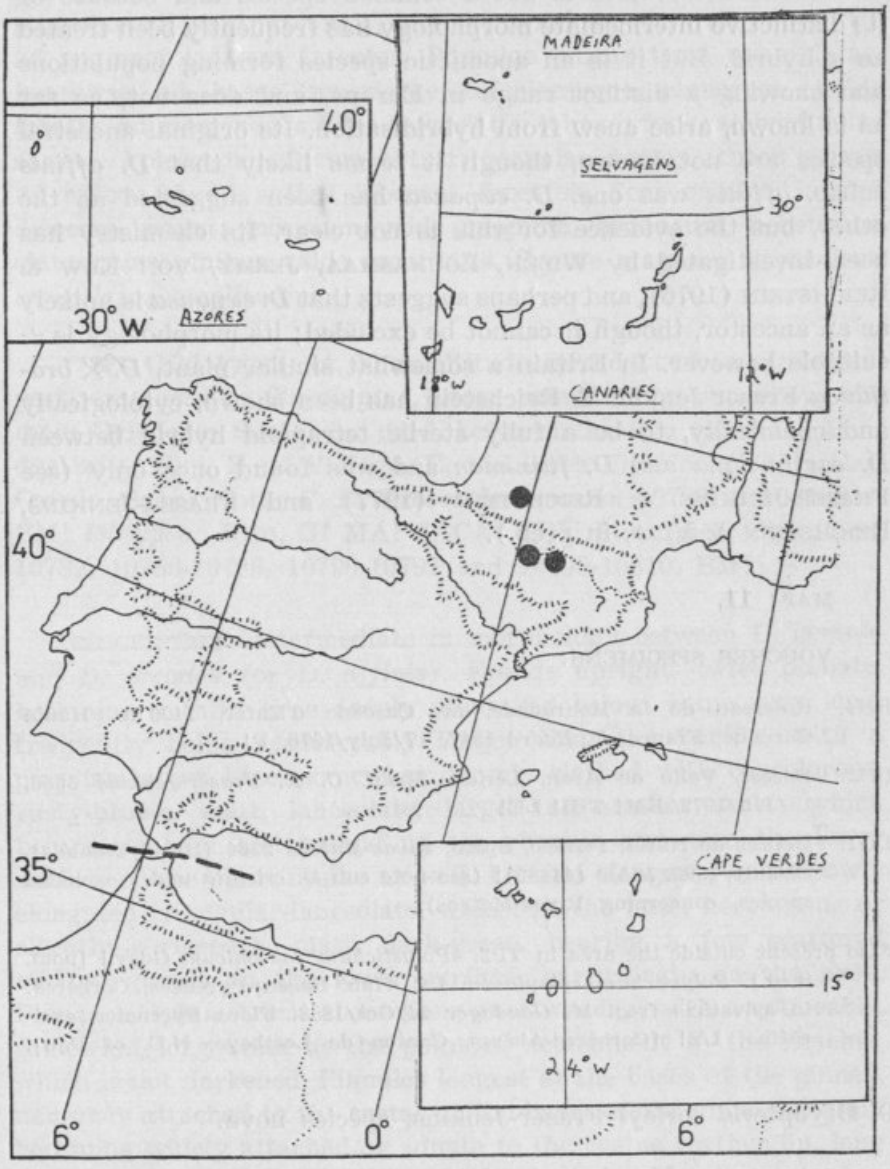
TYPE (Holotype): from West Germany, in B!

DESCRIPTION: Intermediate in morphology between *D. affinis* and *D. dilatata*. Fronds upright, twice pinnate, becoming a third time deeply pinnatifid below. Stipe long, ± densely clothed with pale lanceolate scales with dark bases which become smaller, narrower and more scattered further up and on the rhachis. Lamina narrowly elongated triangular-lanceolate, widest just above the base, herbaceous or very slightly coriaceous, slightly glossy; dark green (yellow-green when young or in an exposed place), ± eglandular. Lower pinnae have their lower basiscopic pinnules slightly developed and longer than the acroscopic ones, sometimes markedly so in the lowest pinna in more luxurious fronds; the points of attachment between the pinna-costae and rhachis are usually darkened in living plants. Pinnules fully stalked only at the base of each pinna, rapidly becoming more widely attached and then adnate to the costa further up, long, parallel-sided with the apex ranging from rounded truncate further up the frond to ± acutely pointed below, bearing triangular-acute somewhat aristate teeth at the sides (several to each lobe) and around the apex where they are largest; pinnules markedly but ± shallowly lobed at the sides with large, rectangular, crowded lobes, becoming more deeply lobed below. Indusia ± small, slightly thick, pale-brown, curved over the top of the sorus and slightly turned down at the edges, shrinking somewhat and becoming mid-brown on ripening, mostly persistent. Ripe (dark) spore-samples contain a mixture of mostly good spores with a proportion of abortive ones. Triploid apomict.

HABITAT: A subalpine species occurring near streams on the floor of luxuriant, usually coniferous forests. From. c. 900-1700 m. altitude.

RANGE IN THE AREA: Confined to the central Pyrenees in thick forest.

RANGE: Usually occurs in subalpine central Europe and the subatlantic parts of Europe, in Britain (Scotland — probably extinct) and Ireland, scattered through France, N.E. Spain, throughout Central Europe, N.W. Jugoslavia, W. Czechoslovakia and S.E. Poland, East to Soviet Moldavia, N. Turkey and the Caucasus. Reports from N.W. Italy are probably erroneous.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CANARIES
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MAP 11.

NOTES: *D. remota* is not a common species and because of its distinctive intermediate morphology has frequently been treated as a hybrid. But it is an apomictic species forming populations and showing a distinct range in Europe, and does not, as far as is known, arise anew from hybridisation. Its original ancestral species are not known, though it seems likely that *D. affinis* subsp. *affinis* was one. *D. expansa* has been suggested as the other, but the evidence for this is not clear. Its chemistry has been investigated by WIDÉN, LOUNASMAA, JERMY, VON EUW & REICHSTEIN (1976), and perhaps suggests that *D. expansa* is unikely as an ancestor, though it cannot be excluded; its morphology is ± suitable however. In Britain a somewhat similar plant, *D.* × *brathaica* Fraser-Jenkins & Reichstein has been shown, cytologically and chemically, to be a fully sterile tetraploid hybrid between *D. carthusiana* and *D. filix-mas* and was found once only (see FRASER-JENKINS & REICHSTEIN (1977) and FRASER-JENKINS, REICHSTEIN & VIDA, in prep.).

MAP: 11.

VOUCHER SPECIMENS:

BH4. Ruisseau de la Houradade, nr. Cascade d'Enfer, 1400 m., Haute Garonne, France. *F. Badré* 1547, 17/July/1975. P!

CH2. Bosost, Valle de Aran, Lerida, Spain. *C. R. Fraser-Jenkins* 3586, 15/Jan/1972. BM! TBI! LE!

DG1. Montes de Nuria, Pirineo, Spain. *Rivas-Mateos* 2264 (Herb. Trèmóls), 22/July/1892. MAF (44489)! (see note sub *D. cristata* under excluded species, concerning Rivas-Mateos).

Also present outside the area in YP2. «*Polystichum vasconicum* Gdgr.! [nom. ined.]. *Polystichum spinulosum* DC. Hab. Basses-Pyrénées, Corbères: in sylvaticis freq. *M. Gandoger* 24/Oct/1883. Flora Pyrenaica exsiccatta». LY! [Corbères-Abères, Canton de Lembeye, N.E. of Pau].

9. **Dryopteris corleyi** Fraser-Jenkins, species nova.

DIAGNOSIS: Morphologia intermedia inter *D. aemulum* et *D. oreadem*. Stipes longissimus, a base brunnea et a paleis concoloribus ferrugineis impolitis lanceolatis aliquantum dense vestitus, secus rhachim extensam. Lamina bipinnata vel tripinnatifida versus basem, elongate triangulariter lanceolata, aeruginosa, a

nervatura fuscata, leniter faeni olens si exsiccata. Pinnae a stipitibus aliquantum longis, fere symmetricae, glandulas dispersas ad paginam inferam ferentes. Pinnulae longae terni quam latae, longiorae ad bases superiorae inferioraeque pinnarum, valde lobatae ad margines, a lobis rotundatis, lobae inferiorae profundae eantae. Apices pinnularum obtusi; pinnulae dentes acutos parvos ad apices et ad apices loborum ferentes. Sori omnino lamina dispersi, magni; indusium valde magnum, brunneum, hebetatum elatum, marginibus valde recurvatis. Sporae magnae, aliquantum irregulares amplitudine.

TYPE (Holotype): «c. 50 m. altitude, mixed wood on sandstone, partly replaced by *Eucalyptus,* above ruined stone hut, above the main Oviedo to Santander road, between the two turns for Pendueles, c. 2 km. E. of Vidiago, E. of Llanes, Oviedo to Santander, Oviedo, Spain. Coll.: *C. R. Fraser-Jenkins* no. 10786, 3/10/1981». BM! *Isotypes:* ditto, G! MA! JACA! COI! *Paratypes:* ditto, nos. 10782, 10786-10788, 10790-10797 and 10799-10810. BM!

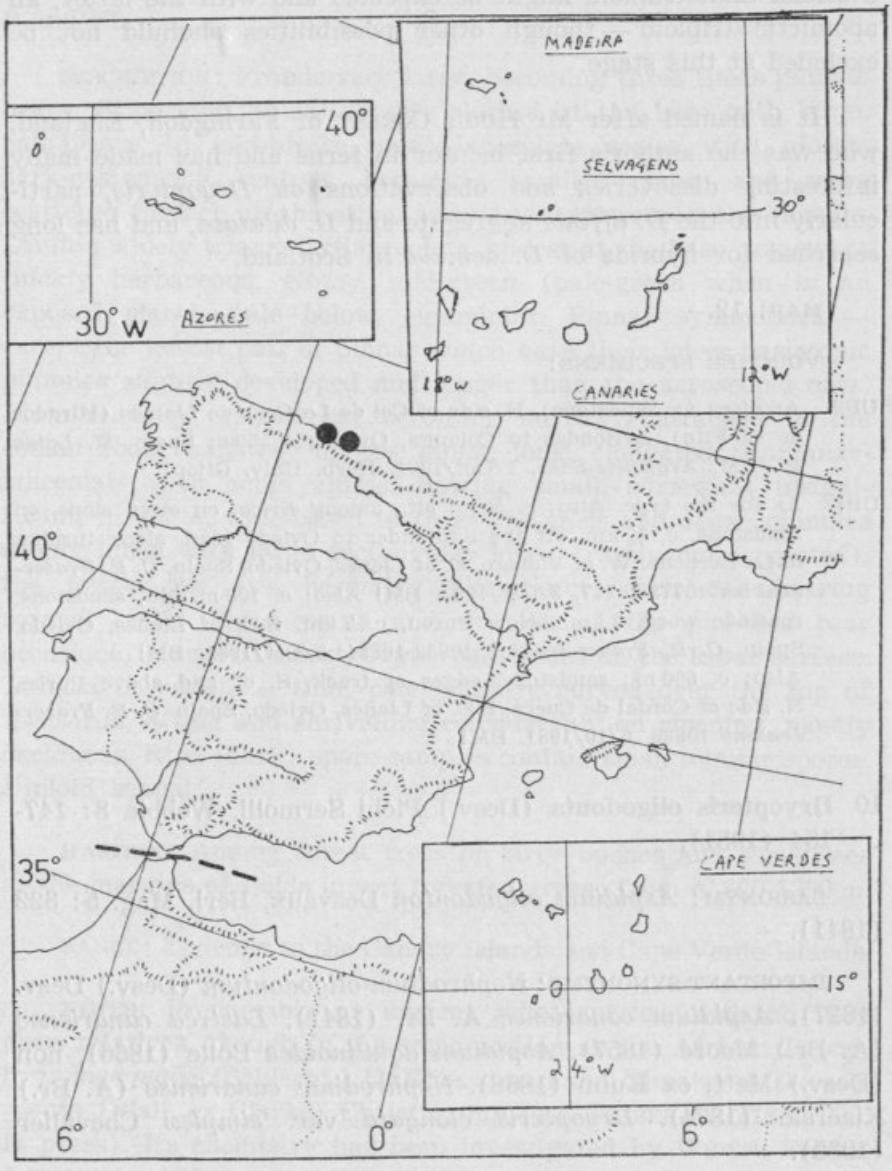
DESCRIPTION: Intermediate in morphology between *D. aemula* and *D. oreades* (or *D. affinis*). Fronds upright, twice pinnate, becoming a third time deeply pinnatifid below. Stipe very long, frequently being considerably longer than the lamina, with a purplish-brown base, somewhat densely clothed with concolorous, rusty-brown, matt, lanceolate, large and smaller scales which become smaller and extend up the rhachis and onto the lower surface of the pinna-costae as well. Lamina elongated or narrowly elongated triangular-lanceolate, widest at the base, herbaceous or slightly coriaceous, matt, dark-green, bearing a few scattered stalked glands on the lower surface, particularly on the axes. Pinnae ± symmetrical about their axes, sloping, with a noticeable, somewhat long stalk at the point of attachment to the rhachis, which is not darkened. Pinnules longest at the bases of the pinnae, narrowly attached to the costae at the bases of the pinnae, rapidly becoming widely attached or adnate to the costae further up, long (c. 3 times as long as broad), with obtuse or occasionally somewhat acute apices; bearing small, somewhat insignificant, acute teeth at the sides and around the apex; pinnules markedly lobed at the sides, with ± shallow, rounded lobes, becoming more deeply lobed below. Sori borne throughout the lamina; indusia markedly

large, tall, slightly thick, mid- or chestnut-brown, matt, and markedly curved down at the edges around the sorus, shrinking and lifting somewhat on ripening. Ripe (dark) spore-samples contain somewhat large and elongated spores with folded, ± clear perispores, bearing some roughness on the surface and showing some irregularity in size, often with a few abortive ones present. Its cytotype has now (Aug 1982) been determined and will soon be reported by GIBBY.

HABITAT: A low-level atlantic species, growing on slopes in light forest or on banks among *Erica* etc., confined to sandstone, not far from the sea. From c. 50-650 m. altitude.

RANGE: Apparently endemic to the North coast of Spain below the central part of the Cordillera Cantabrica in Oviedo province.

NOTES: Unexpectedly discovered by the author growing in four large populations in sandstone areas around Llanes in Oviedo province, North Spain. *D. corleyi* is an obviously distinct taxon behaving as a species, with a high degree of fertility (many sporeling plants were also observed). No other herbarium specimens had been seen by the author in all the herbaria visited and the discovery of this species was a considerable surprise. However the first collection, as an unidentified specimen, was made by LAÍNZ and ARGÜELLES-SAÉZ just two days before the present author's independent discovery and was shown to the author four days later, by which time it could be identified as a new species. It is surprising that it seems never to have been collected before in view of its immediately noticeable distinctness and its obviously recognisable affinity. Its morphology shows marked features of *D. aemula* (or perhaps *D. carthusiana*) combined with a narrower fronded, less dissect, and more densely scaly species in the *D. filix-mas* group or *D. affinis* group, and this «mixed morphology», combined with its large spores, virtually ensures that it is an allopolyploid. Further study using the material collected by the author will be carried out into both its cytology (see above) and its chemistry in order to investigate its origins. At present the most likely candidate for its other ancestor would seem to be *D. oreades,* though *D. affinis* subsp. *affinis* cannot be excluded (on morphological grounds). In the case of the former



MAP 12.

a sexual allotetraploid might be expected and with the latter, an apomictic triploid — though other possibilities shohuld not be excluded at this stage.

It is named after Mr HUGH CORLEY of Faringdon, England, who was the author's first mentor in ferns and has made many interesting discoveries and observations on *Dryopteris,* particularly into the *D. affinis* aggregate and *D. dilatata,* and has long searched for hybrids of *D. aemula* in Scotland.

MAP: 12.

VOUCHER SPECIMENS:

UP2. Arenisca (= sandstone), N. side of Col de La Cruz de Llames (Mirador de El Fito), Arriondas to Colunga, Oviedo, c 550 m Spain. *M. Laínz & J. M. Argüelles-Saéz,* 1/Oct/1981. Herb. Univ. Gijón!

UP4. As for the type. Also: c. 50 m. alt., among *Erica,* on steep slope, on sandstone, c. ½ km. off the Santander to Oviedo road, along turning to La Borbolla, W. of Vidiago, E. of Llanes, Oviedo, Spain. *C. R. Fraser-Jenkins* 10773-10777, 3/Oct/1981. BM! Also: c. 100 m. alt., sandstone, roadside wood, 2 km. below Puron, c. 7 km. S.E. of Llanes, Oviedo, Spain. *C. R. Fraser-Jenkins* 10833-10834, 5/Oct/1981. BM!
Also: c. 500 m., sandstone, edges of track, S. of and above Puron, N. side of Cordal de Cuera, S.E. of Llanes, Oviedo, Spain. *C. R. Fraser-Jenkins* 10839, 5/10/1981. BM!

10. **Dryopteris oligodonta** (Desv.) Pichi Sermolli, Webbia 8: 147-154 (1951).

BASIONYM: *Aspidium oligodonton* Desvaux, Berl. Mag. **5**: 322 (1811).

IMPORTANT SYNONYMS: *Nephrodium oligodontum* (Desv.) Desv. (1827). *Aspidium canariense* A. Br. (1841). *Lastrea canariense* (A. Br.) Moore (1857). *Aspidium aquilinoides* Bolle (1866), non (Desv.) Mett. ex Kuhn (1868). *Nephrodium canariense* (A. Br.) Kiaersk. (1874). *Dryopteris elongata* var. *simplex* Chevalier (1935).

MISAPPLIED NAMES: *Dryopteris oligantha* sensu C. Chr. (1934). *Aspidium elongatum* auct.

TYPE (Lectotype): From the Canaries, «Aspidium oligodontum Desv., Mus. Natur. Berol. 1811, p. 321. Hab. in Insula Teneriffae

(Canarii) Herb. A. N. Desvaux», with diagnosis. P! *Isolectotypes:* P and FI.

DESCRIPTION: Fronds very large, becoming three times pinnate below. Stipe long, thick, densely clothed at the base with large, pale-brown to mid-brown, ovate-lanceolate scales with glossy, dark-castaneous centres, becoming smaller, paler and more scattered further up the stipe, and very scattered on the rhachis. Lamina widely triangular-lanceolate, widest at the base, somewhat thickly herbaceous, glossy, mid-green (pale-green when in an exposed place), pale below, eglandular. Pinnae symmetrical — except the lowest pair of pinnae which have their lower basiscopic pinnules slightly developed and longer than the acroscopic ones. Pinnules fully stalked but becoming narrowly attached to the costae about half-way up the pinna, long, elongated triangular-lanceolate with acute apices, bearing small, somewhat insignificant, ± acute, wide-based teeth at the sides and apex; pinnules deeply lobed with large rectangular lobes (rarely more pointed), the lowest pinnules becoming pinnatisect, each one bearing several teeth. Pinna-costae and midribs of the pinnules bear occasional scattered, short, ovate, pale scales on the lower surface. Indusia ± small, ± thin, pale, slightly curved over the top of the sorus, lifting and shrivelling considerably on ripening, mostly deciduous. Ripe (dark) spore-samples contain small regular spores. Diploid sexual.

HABITAT: Among forest trees or large bushes and sometimes at the margins of fields in wet forested areas; from c. 800-1200 m.

RANGE: Endemic to the Canary Islands and Cape Verde Islands.

NOTES: Presumably an ancient relict species, with no very close relatives, though in the same section as the African *Dryopteris inaequalis* (Schlecht.) O. Ktze. group and Himalayan *D. marginata* (Wall. ex Clarke) Christ group (see FRASER-JENKINS 1983, in press). Its chemistry has been investigated by WIDÉN, FADEN, LOUNASMAA, VIDA, VON EUW & REICHSTEIN (1973).

PICHI SERMOLLI (1951) has shown that the correct name for this species is *D. oligodonta* and not *D. oligantha* (Desv.) C. Chr., as CHRISTENSEN (1905 and 1934) and others had thought. *D. oli-*

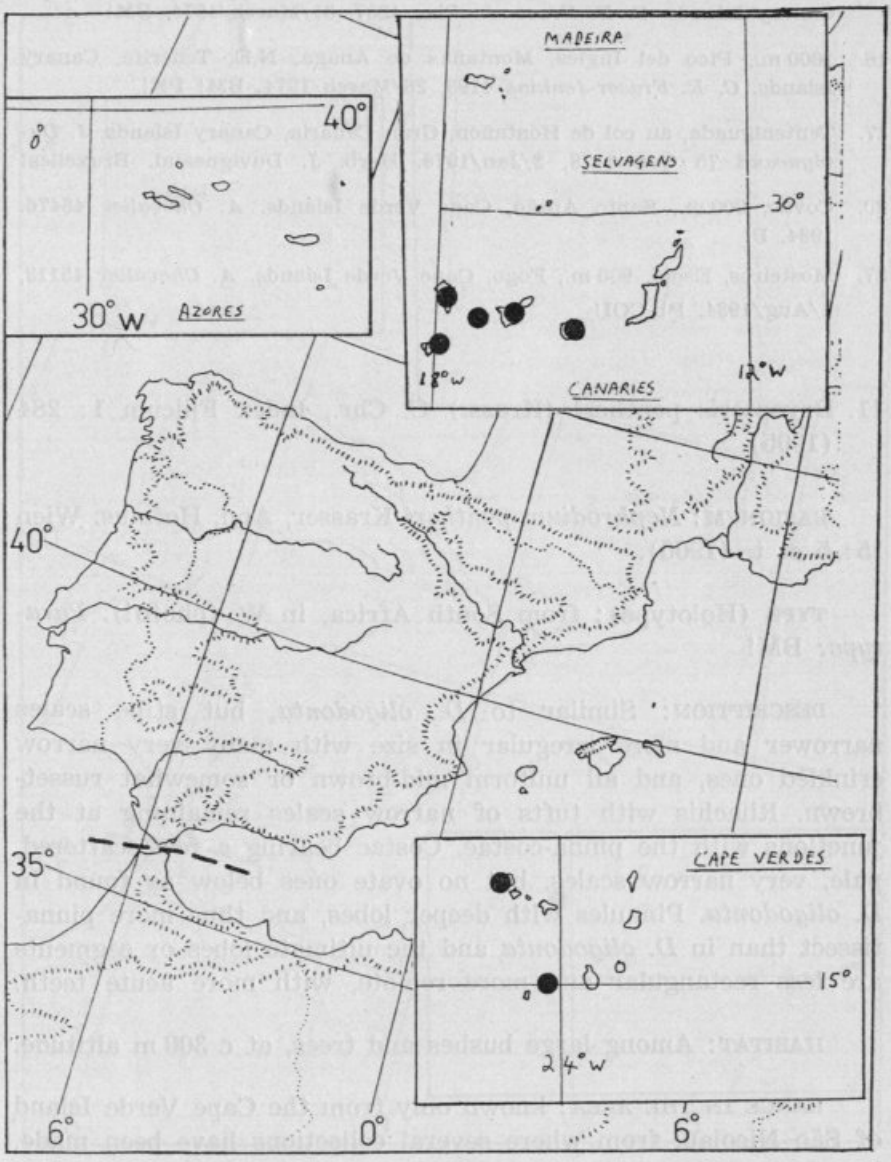
gantha is based on *Aspidium oliganthum* Desv. which by an orthographic error, latter corrected by DESVAUX, was originally spelt *A. olyganthum;* this was not a typographic error, as PICHI SERMOLLI had stated, as is shown by the spelling on the non-type sheet at Paris, mentioned below. Not only does DESVAUX's original description of a very glabrous frond with alternate pinnae and large teeth in *A. oliganthum* fit very well *Diplazium caudatum* (Cav.) Jermy [*syn.: Athyrium umbrosum* (Ait.) Presl, as mentioned by PICHI SERMOLLI] and not *Dryopteris oligodonta,* but also some years later, Desvaux himself placed his *Aspidium oliganthum* into a different genus as *Allantodia oligantha* (Desv.) Desv., while placing his *A. oligodonton* as *Nephrodium oligodontum* (Desv.) Desv., the two genera being direct synonyms of *Diplazium* and *Dryopteris* respectively. The types of *Aspidium oliganthum* and *Aspidium oligodonton,* labelled by DESVAUX with full diagnoses, and his herbarium label and the printed «type» label of Paris Museum (in P!), are clearly specimens of the two species PICHI SERMOLLI took them to be. A further specimen at Paris (!) labelled by DESVAUX, «Aspidium olyganthum Desv. Mag. Nat. Berol. 1811, p. 321. Aspidium fronde tripinnate. Teneriffe. Riedle. Herb. A. L. de Jussieu 1857, catal. no. 1202», is, surprisingly, *D. oligodonta.* But this specimen cannot be taken as the type as the more scaly fronds, subopposite pinnae and insignificant teeth clearly do not agree with DESVAUX's protologue for *Aspidium oliganthum* but agree closely with that for *A. oligodonton.* The present author thus agrees with MORTON that this must have been merely a slip of memory by DESVAUX as to which of the two very similar names should have been used; MORTON wrote on a photograph of this sheet (at BM!), «The sheet bears the name «Aspidium oliganthum Desv.», but this is probably a slip on the part of Desvaux».

MAP: 13.

VOUCHER SPECIMENS:

13 1100 m., Cumbre Nueva, S.W. of Breña Alta, La Palma, Canary Islands. *C. R. Fraser-Jenkins* 4184, 23/March/1974. BM!

14. Valverde to Frontera road, 19 km. from Valverde, Hierro, Canary Islands. *Jarvis & Murphy* 311, 12/April/1977. BM!


MADEIRA
SELVAGENS
30°
18°W
CANARIES
12°W
40°
30°W
AZORES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 13.

15. 1000 m., S. de N.S. de Guadalupe, Mña. Quemada, El Cedro, La Gomera, Canary Islands. *C. R. Fraser-Jenkins* 4207, 31/March/1974. BM!

16. 1000 m., Pico del Inglés, Montañas de Anaga, N.E. Tenerife, Canary Islands. *C. R. Fraser-Jenkins* 4193, 26/March/1974. BM! PE!

17. Tenteniguada, au col de Hontañon, Gran Canaria, Canary Islands, *J. Duvigneaud* 75 Can 1178, 2/Jan/1976. Herb. J. Duvigneaud, Bruxelles!

20. Covão, 900 m., Santo Antão, Cape Verde Islands. *A. Chevalier* 45476. 1934. P!

27. Mosteiros, Espia, 900 m., Fogo, Cape Verde Islands. *A. Chevalier* 45113, 1/Aug/1934. P! COI!

11. **Dryopteris pentheri** (Krass.) C. Chr., Index Filicum **1**: 284 (1905).

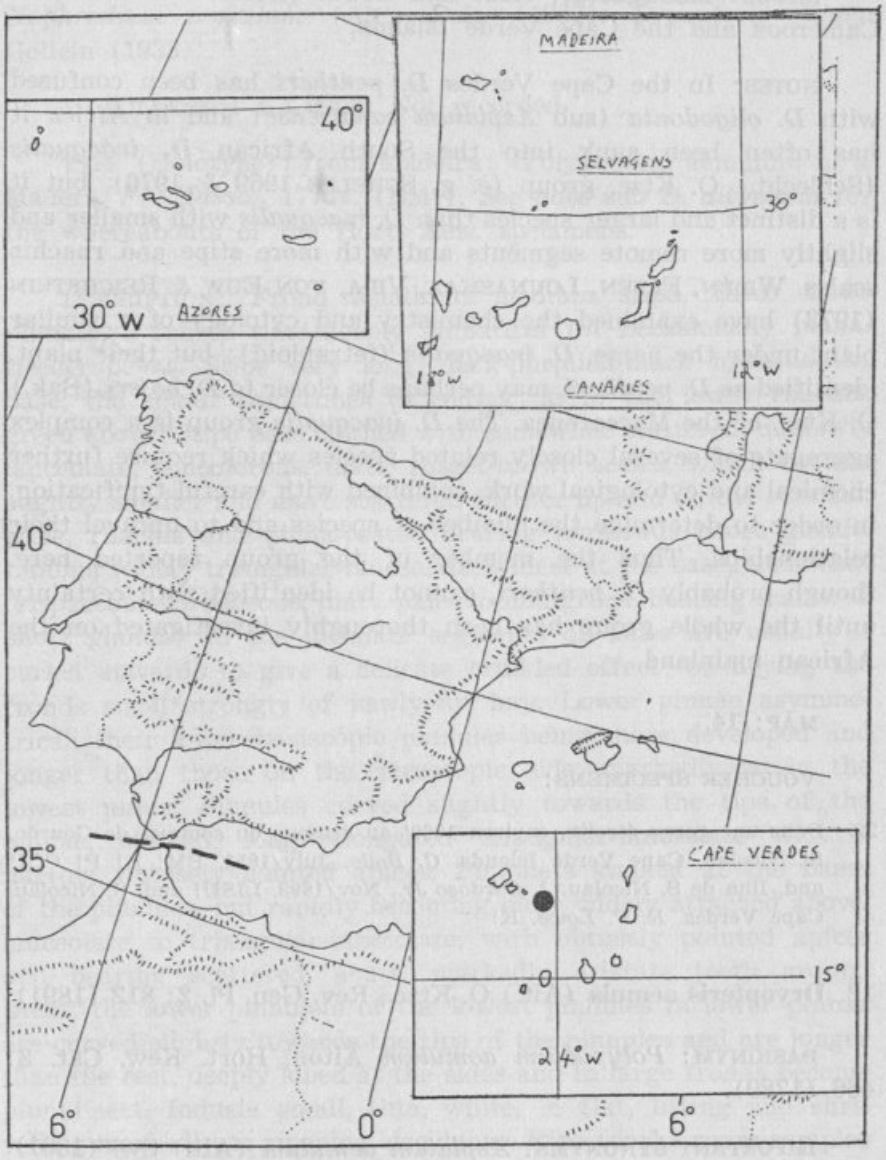
BASIONYM: *Nephrodium pentheri* Krasser, Ann. Hofmus. Wien **15**: 5 et t. (1900).

TYPE (Holotype): from South Africa, in W (photo!). *Paratype:* BM!

DESCRIPTION: Similar to *D. oligodonta,* but stipe scales narrower and more irregular in size with many very narrow crinkled ones, and all uniform mid-brown or somewhat russet-brown. Rhachis with tufts of narrow scales remaining at the junctions with the pinna-costae. Costae bearing a few scattered, pale, very narrow scales, but no ovate ones below as found in *D. oligodonta.* Pinnules with deeper lobes, and thus more pinnatisect than in *D. oligodonta* and the ultimate lobes or segments are less rectangular and more remote, with more acute teeth.

HABITAT: Among large bushes and trees, at c 300 m altitude.

RANGE IN THE AREA: known only from the Cape Verde Island of São Nicolau, from where several collections have been made, but *Dryopteris* species have not been found there recently and may now be extinct due to the drying up of the climate (LOBIN, pers. comm., 1980). Reported here from the Cape Verdes, albeit provisionally, for the first time following examination of herbarium material by the author.


MADEIRA
SELVAGENS
30°
18°W
CANARIES
40°
30°W
AZORES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 14.

RANGE: Madagascar, East and South Africa, Fernando Po, Cameroon and the Cape Verde Islands.

NOTES: In the Cape Verdes *D. pentheri* has been confused with *D. oligodonta* (sub *Aspidium canariense*) and in Africa it has often been sunk into the South African *D. inaequalis* (Schlecht.) O. Ktze. group (e. g. SCHELPE 1969 & 1970), but it is a distinct and larger species than *D. inaequalis* with smaller and slightly more remote segments and with more stipe and rhachis scales. WIDÉN, FADEN, LOUNASMAA, VIDA, VON EUW & REICHSTEIN (1973) have examined the chemistry and cytology of a similar plant under the name, *D. inaequalis* (tetraploid); but their plant, identified as *D. pentheri,* may perhaps be closer to *D. bojeri* (Bak.) O. Ktze. of the Mascarenes. The *D. inaequalis* group is a complex aggregate of several closely related species which require further chemical and cytological work, combined with careful typification, in order to determine the number of species and to unravel their relationships. Thus the member of the group reported here, though probably *D. pentheri,* cannot be identified with certainty until the whole group has been thoroughly investigated on the African mainland.

MAP: 14.

VOUCHER SPECIMENS:

22. Dans une gorge étroite, environ 1000′ au dessous du sommet de Gourdo, St Nicolau, Cape Verde Islands. *C. Bolle,* July/1851. BM! B! P! COI! and, Ilha de S. Nicolau. *J. Cardoso Jr.,* Nov/1893. LISU! and, S. Nicolau, Cape Verdes. *R. T. Lowe.* K!

12. **Dryopteris aemula** (Ait.) O. Ktze., Rev. Gen. Pl. 2: 812 (1891).

BASIONYM: *Polypodium aemulum* Aiton, Hort. Kew. Cat. 3: 466 (1789).

IMPORTANT SYNONYMS: *Aspidium aemulum* (Ait.) Sw. (1801). *Nephrodium foenisecii* Lowe (1830). *Aspidium dilatatum* var. *recurvum* Bree (1831). *Aspidium foenisecii* (Lowe) Lowe (1834). *Aspidium recurvum* (Bree) Bree (1843). *Lastrea recurva* (Bree) Newman (1844). *Lastrea foenisecii* (Lowe) Watson (1846). *Lophodium foenisecii* (Lowe) Newm. (1851). *Lophodium recurvum*

(Bree) Newm. (1851). *Lastrea aemula* (Ait.) Brack. (1854). *Nephrodium aemulum* (Ait.) Bak. (1867). *Dryopteris liliana* Golicin (1933).

IN WILLKOMM & LANGE: Not recorded.

TYPE (Holotype): from Madeira: «Polypodium aemulum m/s. Madera. *Fr. Masson* 1776». (BM!). See note sub *D. aitoniana* for the whereabouts of the Hort. Kew. specimens.

DESCRIPTION: Frond small to medium sized, three times pinnate, a fourth time deeply pinnatifid (or occasionally pinnatisect) below. Stipe very long, dark-purplish-black towards the base, the colour sometimes extending up to the lower rhachis, green above; stipe base clothed with somewhat scattered, narrowly lanceolate, concolorous, matt, russet-brown scales, which become slightly smaller and more scattered further up and on the rhachis; stipe, rhachis and pinna-costae bearing numerous short glands. Lamina widely triangular-lanceolate, widest at the base, somewhat crispaceous-herbaceous, matt, pale- to mid-green, bearing scattered short glands; all the ultimate segments or lobes are usually ± curled upwards to give a delicate crinkled effect; on drying the fronds smell strongly of newly-cut hay. Lower pinnae asymmetrical, their lower basiscopic pinnules being more developed and longer than those on the acroscopic side, markedly so in the lowest pinna. Pinnules curved slightly towards the tips of the pinnae, stalked, long, elongated triangular-lanceolate with ± narrow, obtusely pointed apices. Pinnulets stalked at the bases of the pinnules, but rapidly becoming more widely attached above, lanceolate to triangular-lanceolate, with obtusely pointed apices and bearing scattered, acute, markedly aristate teeth around them; the lower pinnulets of the lowest pinnules in lower pinnae are curved slightly towards the tips of the pinnules and are longer than the rest, deeply lobed at the sides and in large fronds become pinnatisect. Indusia small, thin, white, ± flat, lifting and shrivelling markedly on ripening, deciduous. Ripe (dark) spore-samples contain small, regular, rugose but non-spinulose spores. Diploid sexual.

HABITAT: A markedly Atlantic species occurring in high rainfall areas on slopes in light, deciduous (often *Quercus*) forest,

or on damp banks, or the edges of tracks among *Erica* etc.; apparently confined to non-calcareous rocks. From c 100-500 m altitude.

RANGE IN THE AREA: Markedly Atlantic in its distribution, occurring only near the coastal region of the West Pyrenees and in scattered localities across the highly Atlantic North coast and North West coast of Spain, but not extending Southwards into Portugal. Widespread in the Azores and Madeira and present on one island in the Canaries (La Gomera).

RANGE: Atlantic refugia in Britain and Ireland, N.W. and S.W. France, Spain and Macaronesia, N.E. Turkey and S.W. Transcaucasia.

NOTES: *D. aemula* is less common in the area than *D. guanchica* and usually occurs only near the coast at lower levels. It has been somewhat over-recorded in error for *D. guanchica,* or sometimes *D. dilatata* (especially by RUIZ DE AZÚA (1928), specimens in MA!) or even *D. carthusiana,* in Spain. It has also been reported by NEWMAN (1954) from the Cape Verdes in error [see also JERMY (1968)]. The first correctly based report of *D. aemula* from the Canaries was that of FRASER-JENKINS (1975), specimens from that collection also being cytologically verified by GIBBY in 1975 (GIBBY, pers. comm. 1981). TARDIEU-BLOT (1946) stated that it does not occur in the Canary Islands and must have placed a plus sign in her list in error (see GIBBY, JERMY, RASBACH, RASBACH, REICHSTEIN & VIDA 1977). PAGE (in litt., Ph. D. thesis, 1968) did not distinguish between *D. dilatata* and *D. aemula* when he reported plants of that complex from La Gomera and most of his collections were of what was subsequently discovered to be the new species *D. guanchica.* The report of JERMY (1968) was erroneous and was not, as was stated later in GIBBY, JERMY, RASBACH, RASBACH, REICHSTEIN & VIDA (1977), based on plants of *D. aemula* in PAGE's collection, which had not been identified at the time (GIBBY & JERMY, pers. comm., 1980). However PAGE had indeed made the first collection of *D. aemula* from La Gomera, which was not discovered until the present author examined the collection in 1975. A further collection was made and identified by the present author in 1974 before its presence in PAGE's collec-

tions had been noticed. The confusion as to its presence in the Canaries was thus cleared up.

D. aemula does not occur elsewhere in the world apart from the region mentioned above, but two other species, *D. chinensis* (Bak.) Koidz. and *D. gymnophylla* (Bak.) C. Chr., both from Eastern Asia, appear to be distantly related and have recently been placed in the same section, *Aemulae* Fraser-Jenkins (1983, in press). VIDA (1969) was the first worker to draw attention to the fact that *D. aemula* differs from the *D. dilatata* aggregate in several important respects (segment shape, scales, non-spinulose spores etc.) and is probably nearer to the *D. pallida* group despite its superficial resemblance in frond shape to *D. dilatata.*

There is some variation in the species due to its geographical isolation from area to area, the Madeiran plants are more finely dissect, the Azores plants are more densely glandular and less finely dissect, the British plants are similar to the Transcaucasian/Turkish populations but more glandular and the segments are more curled up and the Transcaucasian/Turkish populations have flatter and less glandular fronds. The variation is not constant however and hardly of taxonomic significance, though LOWE (1851) has distinguished a var. *alatum* and var. *productum* and a sub-var. *rude* from Madeira.

The chemistry and cytology of *D. aemula* has been investigated by WIDÉN, LOUNASMAA, VIDA and REICHSTEIN (1975) from various areas and further information is given by GIBBY, JERMY, RASBACH, RASBACH, REICHSTEIN & VIDA (1977).

It appears that LÜDI probably did not make a herbarium specimen for his record of *D. aemula* from square PH1 (below) as there is no such specimen at BERN (R. SUTTER, pers. comm. 1981), nor at ZT, where his herbarium was deposited. The record could refer to *D. aemula* or *D. guanchica* (or other species), and requires confirmation.

MAP: 15.

VOUCHER SPECIMENS:

NJ4. Caaveiro (Capela, La Coruña), locis nemorosis apricis, 50 m., Spain. *Laínz,* 17/Sept/1976. Herb. Gijón! (with *D. guanchica*).

PJ2. Jalas & Suominen (1972); the report in Merino (1909), from Galdo referred to *D. guanchica,* specimen in P!

PJ4. [Oberhalb Luarca, Sierra de Adrades], Quercion roboris, Luarca-Lugo, ca. 200 m., Spain. *Oberdorfer,* 10/July/1953. KR! and: wood between Vega do Ouria and Sta. Columba, 20 km. E. of Vegadeo on Boal road, Sierra de La Bobia, S.E. of Castropol, Oviedo, Spain. *C. R. Fraser-Jenkins* 10668-10669, 27/Sept/1981. BM!

UP2. c 550 m, below and N.E. of «Mirador de El Fito», N. side of Col de La Cruz de Llames, Arriondas to Colunga, E. of Gijón, Oviedo, Spain. *C. R. Fraser-Jenkins* 10827, 4/Oct/1981. BM!

UP4. c 500 m, S. of and above Puron, N. side of Cordal de Cuera, S.E. of Llanes, Gijón to Santander, Oviedo, Spain. *C. R. Fraser-Jenkins* 10836-10838, 5/Oct/1981. BM!

VP2. Jalas & Suominen (1972).

VP4. W. side of Col de La Granja, between Castro Urdiales and Gouriezo, S.W. of Castro Urdiales, c 300 m., Spain. *C. R. Fraser-Jenkins* 10569, 17/Sept/1981. BM!

WP4. c 150 m., Mt. Jaizquibel, between San Sebastian & Hendaye, Spain. *J. Vivant, H. & K. Rasbach* and *H. L. & T. Reichstein* 3615, 23/Sept/1973. Herb. T. Reichstein, Basel!

NH1. Jalas & Suominen (1972).

PH1. Eichenwald in der Sierra de Meira, zwischen Ribadeo und Lugo, 450 m., Spain. *W. Lüdi,* 10/July/1953. Lüdi (1954) and Lawalrée (1956).

UN1. Valle de Raicedo, Espinaredo, Termino de Pilona, Asturias, 5-600 m., Spain. *J. M. Argüelles-Saéz,* 13/Oct/1973. Herb. Gijón!

VN1. Somahoz [S. of Los Corrales], prov. Santander, Spain. *Pereda.* Herb. Gijón!

WN1. Barranco, Galdacano, Viscaya, Spain. *Ruiz de Azúa,* 24/Dec/1924. MA (332)!

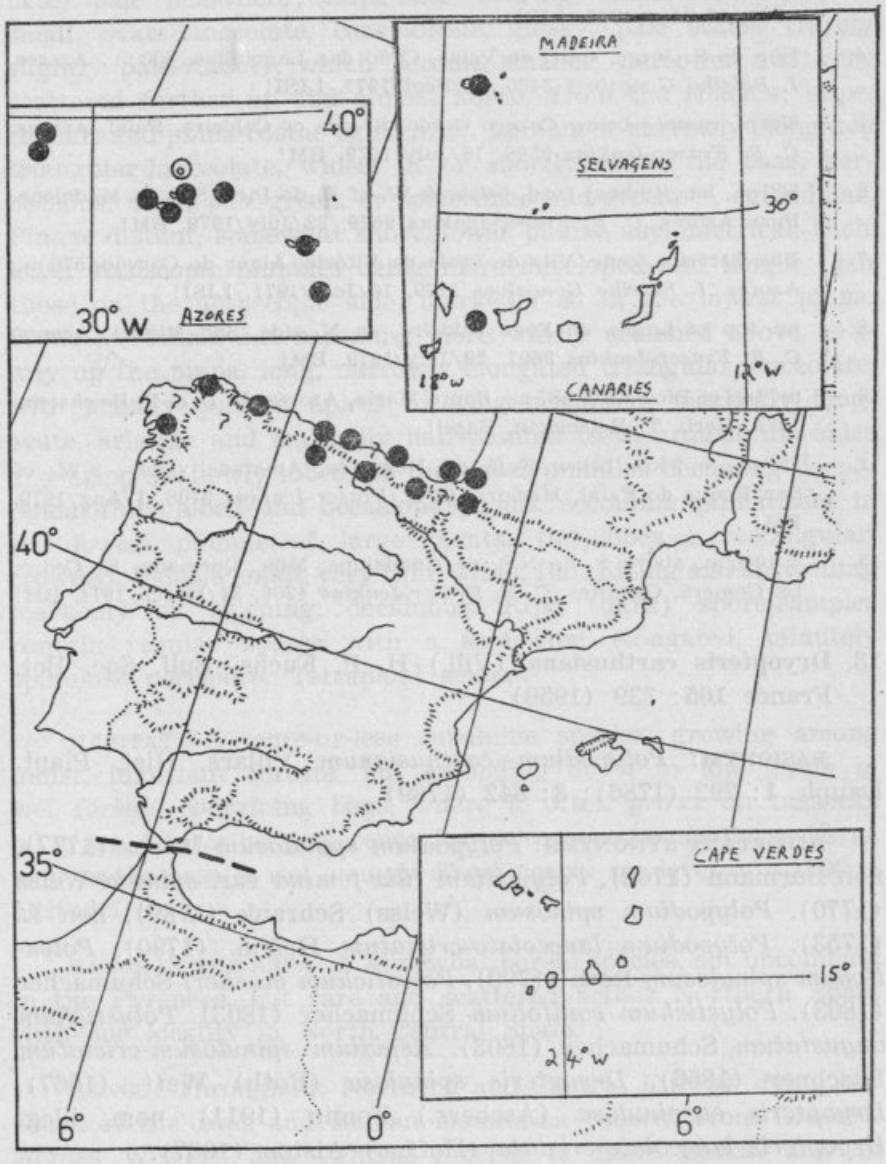
WN3. Jalas & Suominen (1972).

XN1. Moulin d'Enfer, près Bidarray, Basses Pyrénées, France. *L. de Vergnes,* 14/Oct/1916. P! Also: Basses Pyrénées, Itxassou, ravin de Laxia, France. *J. Vivant, H. & K. Rasbach* and *H. L. & T. Reichstein* 3602, 22/Sept/1973. Herb. T. Reichstein, Basel! Also: ravine humide de La Rhûne, près de St Jean de Luz, Basses Pyrénées, France. *E. Walter* 26/July/1934. MPU! Also: ravin d'Ascain, Basses Pyrénées, France. *G. Hibon* 4730, 7/Aug/1936. P!

NH2. La Coruña, Portosin, Montes Barbanza, Spain. *M. Pastrana* AB 429, 30/Dec/1977 MA! BM! (with *D. affinis* ssp. *affinis*). Also: Noya (Coruña), Spain. *F. Bellot,* 21/Aug/1967. Herb. Fac. Cienc. Biol., Univ. Complutense, Madrid (no. 4808)!

NG1. Teis [Vigo], Spain. *J. Ruiz de Azúa.* Ruiz de Azúa (1930).

1. Ilha de Corvo, 450 m., Azores. *I. Botelho Gonçalves* 1593, 12/June/1964. LISI!



MAP 15.

Correction: Remove the open circle for the island of Graciosa in the Azores.

2. Ribeira da Cruz, Ilha das Flores, 150 m., Azores. *I. Botelho Gonçalves* 1892, 17/May/1965. LISI!

4. Ilha de S. Jorge, conc. de Velas, Chão das Lagoinhas, 800 m., Azores. *I. Botelho Gonçalves* 3495, 15/Sept/1971. LISI!

5. 800 m, ravines below Cabeço Gordo, S. side of Caldeira, Faial, Azores. *C. R. Fraser-Jenkins* 9598, 18/July/1979. BM!

6. 550 m., longitudinal road, below & W. of P. do Pico, S.E. of Madalena, Pico, Azores. *C. R. Fraser-Jenkins* 9629, 22/July/1979. BM!

7. Ilha Terceira, conc. Vila de Praia da Vitória, Algar do Carvão, 570 m., Azores. *I. Botelho Gonçalves* 3179, 10/July/1971. LISI!

8. nr. top of Lagoa do Fogo caldeira, on N. side, São Miguel, Azores. *C. R. Fraser-Jenkins* 9691, 29/July/1979. BM!

9. nr. top of Pico Alto, 587 m., Santa Maria, Azores. *H. L. & T. Reichstein*, 1973. Herb. T. Reichstein, Basel!

11. 850 m., c 2 km below Fajã da Nogueira, Ametade valley, S.W. of San Roque do Faial, Madeira. *C. R. Fraser-Jenkins* 9708, 1/Aug/1979. BM!

15. c 1000 m, above S. de N.S. de Guadalupe, Mña. Quemada, El Cedro, La Gomera, Canaries. *C. R. Fraser-Jenkins* 4208, 31/March/1974. BM!

13. **Dryopteris carthusiana** (Vill.) H. P. Fuchs, Bull. Soc. Bot. France **105**: 339 (1959).

BASIONYM: *Polypodium carthusianum* Villars, Hist. Plant. Dauph. **1**: 292 (1786); **3**: 842 (1789).

IMPORTANT SYNONYMS: *Polypodium spinulosum* Müller (1777), non Burmann (1768). *Polypodium filix-femina* var. *spinosa* Weiss (1770). *Polypodium spinosum* (Weiss) Schrank (1789), non L. (1753). *Polypodium lanceolato-cristatum* Hoffm. (1790). *Polystichum spinulosum* Roth (1799). *Polystichum muelleri* Schumacher (1803). *Polystichum conifolium* Schumacher (1803). *Polystichum angustatum* Schumacher (1803). *Aspidium spinulosum-cristatum* Laschner (1856). *Dryopteris spinulosa* (Roth) Watt. (1867). *Dryopteris euspinulosa* (Aschers.) Fomin (1911), nom. illeg. *Dryopteris lanceolato-cristata* (Hoffm.) Alston (1957).

TYPE (neotype, *Fraser-Jenkins* 1980b): from France, in BM!

DESCRIPTION: Fronds twice pinnate, becoming a third time deeply pinnatifid below and in large plants just becoming a third time pinnatisect. Stipe very long, dark brown at the very

base, pale elsewhere; stipe-base bearing scattered, somewhat small, ovate-lanceolate, concolorous, glossy, pale scales (rarely slightly pale-russet), which become smaller, narrower and very scattered further up and almost absent from the rhachis; stipe, rhachis and pinna-costae eglandular. Lamina ± narrowly elongated triangular-lanceolate, widest at or shortly above the base, herbaceous, matt, pale-green, or sometimes mid-green, ± eglandular. Pinnae distant, somewhat short, lower pinnae asymmetrical, their lower basiscopic pinnules being more developed and longer than those on the acroscopic side, markedly so in the lowest pinna. Pinnules stalked but becoming more widely attached above halfway up the pinna, long, narrowly elongated triangular-lanceolate, with acutely pointed apices, bearing scattered, markedly long-acute, aristate and markedly hair-pointed teeth around the sides and apex, shallowly lobed, or the lower pinnules becoming deeply pinnatifidly lobed and occasionally just becoming pinnatisect in the lowest pinnule of large plants, the lobes ± rectangular, crowded. Indusia small, very thin, white, flat, lifting and shrivelling markedly on ripening, deciduous. Ripe (dark) spore-samples contain regular spores with a somewhat elongated, minutely spinulose perispore. Tetraploid sexual.

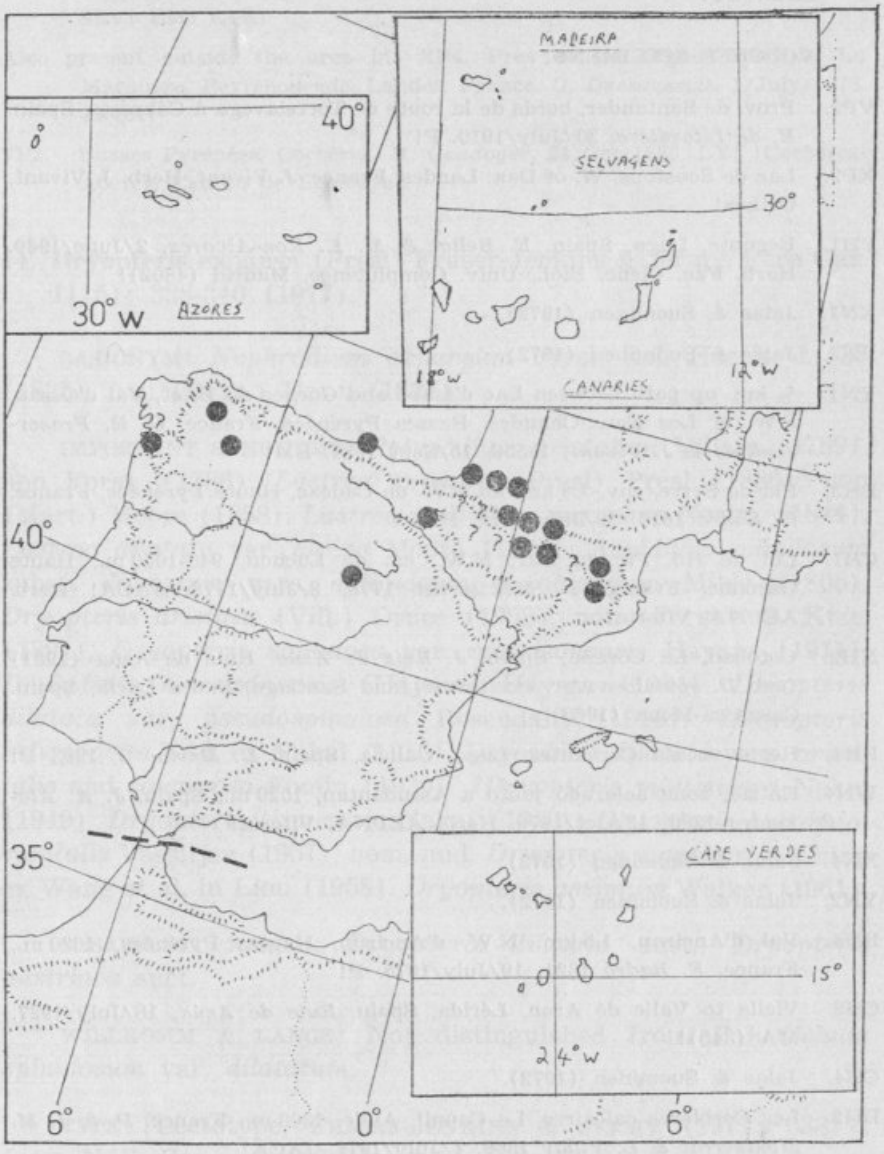
HABITAT: A more-or-less subalpine species, growing among moist, luxuriant forests, but extending down to low levels in wet forests containing bogs, where it often grows on tussocks of grass. Shows no preference for calcareous or acidic rocks as long as the area is wet enough. From nearly sea-level to c 1700 m altitude.

RANGE IN THE AREA: A somewhat boreal species, not uncommon in the Pyrenees, but rare and scattered across Northern Spain with one locality in North Central Spain.

RANGE: Throughout Northern and Central Europe, dying out south of the Alps and Balkan mountains (absent from Greece). Across Western and Central Siberia to Lake Baikal also in N. Turkey, the Caucasus, Transcaucasia and the Tien Shan (just reaching N.W. China). North America.

NOTES: This species has been widely over-recorded in error for *Athyrium filix-femina, Dryopteris dilatata* [e. g. LAWALRÉE

(1953), specimens in BR!, LAÍNZ (1973*b*)], *D. expansa* (LAÍNZ 1973*a*), specimens in Herb. Gijón!, *D. guanchica, D. submontana* and *D. aemula* in Spain and Portugal, but is considerably less common there than previously thought, indeed LAÍNZ (1973*b*) cast doubt on its occurrence, though it does occur in scattered localities throughout North Spain. However it has been necessary not to accept any literature records apart from those in the Pyrenees and one of RUIZ DE AZÚA (1931) where he mentions the correct «variety», thus distinguishing it from *D. dilatata*. WALKER (1955 & 1961) and GIBBY & WALKER (1977) have shown that *D. carthusiana* is an allotetraploid species derived partly from *D. intermedia* (Mühl.) Gray, which represents the same genome as *D. azorica,* but the other parent is not known except that it is also part-ancestral to *D. cristata* (see also WAGNER, WAGNER & HAGENAH 1969); it would seem that a species such as *D. villarii* might be generally similar in morphology to the missing parental species. WIDÉN, SARVELA & AHTI (1967) have also examined the chemistry of *D. carthusiana*. Nomenclatural information is given by FRASER-JENKINS (1980*b*). Though reported from Cadiz Province, South Spain, by ALLORGE (1934) and ALLORGE & ALLORGE (1945), this was undoubtedly in error, probably for immature *Athyrium filix-femina* (L.) Roth which occurs in the area, though MOLESWORTH-ALLEN & GALIANO (1970) and MOLESWORTH-ALLEN (1971) suggest it could have been *Diplazium caudatum* and GALIANO & SILVESTRE (1974) suggest either that or *Polystichum setiferum* (Forssk.) Woynar; a further possibility is opened up by the present discovery of *D. guanchica* in the area (see that species). A search by the present author of the relevant box in Paris (P) containing the material from ALLORGE's excursion has revealed that he did not collect a specimen, as was often the case, so that this record is unverifiable and, being very unlikely, is rejected. A report by ESTÁCIO DA VEIGA (1869) and COLMEIRO Y PENIDO (1889) of this species from the Serra de Monchique, S. Portugal, almost certainly refers to *Athyrium filix-femina,* which does occur there, though *D. guanchica* and *D. affinis* subsp. *affinis* cannot at present be completely excluded (see note sub *D. guanchica*).


MADEIRA
SELVAGENS
30°
18°W
CANARIES
12°W
40°
30°W
AZORES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 16.

MAP. 16:

VOUCHER SPECIMENS:

VP2. Prov. de Santander, bords de la route de Torrelavega à Cóbreces, Spain. *R. de Litardière*, 30/July/1910. P!

XP2. Lac de Soustons, W. of Dax, Landes, France. *J. Vivant*. Herb. J. Vivant, Orthez!

PH1. Begonte, Lugo, Spain. *F. Bellot & M. E. Ron-Alvarez*, 2/June/1969. Herb. Fac. Cienc. Biol., Univ. Complutense, Madrid (4802)!

XN1. Jalas & Suominen (1972).

XN3. Jalas & Suominen (1972).

YN1. ½ km. up path between Lac d'Isabe and Gorges du Bitet, Val d'Ossau, S.W. of Les Eaux-Chaudes, Basses Pyrénées, France. *C. R. Fraser-Jenkins & J. Vivant*, 10556, 15/Sept/1981. BM!

BH3. Pla de Serre, env. 1.5 km. au S.W. de Cadeac, Haute Pyrénées, France. *F. Badré* 1615, 19/July/1975. P!

CH1. Col de Hô, Pic du Gar, N.W., ca. de Luchon, 940-1050 m., Haute Garonne, France. *P. Montserrat* 1778, 8/July/1978. JACA! Herb. AEPNA, Vitoria!

NH2. Cotobad, La Coruña, Spain. *J. Ruiz de Azúa*. Ruiz de Azúa (1931) (sub *D. spinulosa* var. *exaltatum*) and Santiago, Santa Lucia, Spain. Casaseca-Mena (1960).

PH4. Regio vocata Cervantes, Lugo, Galicia, Spain. *B. Merino* 3, 1903 P!

WN4. Entzia, zona aclarado junto a Assudantan, 1020 m., Spain. *J. A. Alejandre* 1280, 13/Oct/1979. Herb. AEPNA, Vitoria!

XN4. Jalas & Suominen (1972).

YN2. Jalas & Suominen (1972).

BH4. Val d'Ancizan, 1.5 km. N.W. d'Ancizan, Hautes Pyrénées, 1620 m., France. *F. Badré* 1621, 19/July/1975. P!

CH2. Viella to Valle de Aran, Lérida, Spain. *Ruiz de Azúa*, 18/July/1927. MA (345)!

CH4. Jalas & Suominen (1972).

DH2. Les Corbières calcaires, Le Caunil, Aude, 1300 m., France. *P. & J. M. Montserrat & L. Villar* 1566, 4/July/1978. JACA!

NG1. Pontevedra, Vilaboa, S. Adrian, 2 m. alt., Spain. *E. Valdes-Bermejo & S. Castroviejo* 20/76, 1976. MA! BM (Fraser-Jenkins no. 10142)!

CG3. Jalas & Suominen (1972).

DG1. Vall de Ribas, Bosc de Ribas, bai 1500 m., Spain. *J. Vigo*, Aug/1962. BC (no. 596459)!

VL3. Guadalajara, Aldeanueva de Atienza, Spain. *S. Silvestre*, 4/Sept/1965. SEV! BM! LTR!

Also present outside the area in: XP4. Près de La Digne, Pont de La Marquèze, Peyrehourade, Landes, France. *G. Dussaussois*, 1/July/1978. JACA!

YP2. Basses Pyrénées, Corbères. *M. Gandoger*, 24/Oct/1883. LY! [Corbères-Abères, Canton de Lembeye].

14. **Dryopteris expansa** (Presl) Fraser-Jenkins & Jermy, Fern Gaz. 11(5): 338-340 (1977).

BASIONYM: *Nephrodium expansum* Presl, Rel. Haenk. 1: 38 (1825), non (Desv.) Desv. (1827).

IMPORTANT SYNONYMS: *Polypodium aristatum* Villars (1789), non Forst. (1786). *Lastrea expansa* (Presl) Presl (1836), non (Mart.) Moore (1858). *Lastrea multiflora* var. *nana* Newm. (1844). *Lastrea dilatata* var. *alpina* Moore (1855). *Aspidium spinulosum* subsp. *dilatatum* vars. *deltoideum* et *oblongum* Milde (1865). *Dryopteris aristata* (Vill.) Druce (1908), non (Forst.) O. Ktze. (1891). *Dryopteris spinulosa* var. *morrisonensis* Hayata (1911). *Dryopteris morrisonensis* (Hayata) Hayata (1911). *Dryopteris dilatata* var. *pseudospinulosa* Rosendahl (1916). *?Dryopteris subopposita* Kod. ex Nakai (1918). *Dryopteris dilatata* vars. *orientalis* and *squarrosa* Fomin (1930). *?Dryopteris minimisora* Nakai (1949). *Dryopteris siranensis* Nakai (1953). *Dryopteris extremiorientalis* Vassiljev (1957), nom. nud. *Dryopteris manshurica* Ching ex Wang et al. in Liou (1958). *Dryopteris assimilis* Walker (1961).

MISAPPLIED NAMES: *Dryopteris dilatata* auct., *Dryopteris austriaca* auct.

WILLKOMM & LANGE: Not distinguished from *Polystichum spinulosum* var. *dilatatum*.

TYPE [Lectotype, FRASER-JENKINS & JERMY (1977: 338)]: from N.W. Canada, in PR!

DESCRIPTION: Fronds not persistent in winter, three times pinnate. Stipe very long, pale; the base bearing ± dense, large, ovate-lanceolate, glossy, pale or pale-brown scales with somewhat vaguely defined, darker-brown central and basal areas, becoming

smaller, narrower and scattered further up and very scattered on the rhachis; stipe, rhachis and pinna-costae ± eglandular, or glandular. Lamina widely triangular-lanceolate, widest at or shortly above the base, thinly herbaceous, ± matt, somewhat yellowish-green, pale-green, or sometimes mid-green, ± eglandular, or glandular. Pinnae crowded and often slightly overlapping, long, asymmetrical, their lower basiscopic pinnules being more developed and longer than those on the acroscopic side, very markedly so in the lowest pinna which has a markedly long lowest pinnule. Pinnules stalked, long, narrowly elongated triangular-lanceolate, with acutely pointed apices. Pinnulets sloping, ± rectangular in the upper part of the frond with rounded-truncate apices, but in the lower pinnules of the lowest few pairs of pinnae becoming lanceolate and somewhat falcate with markedly decurrent bases (especially in the lowest pinnule) and acutely pointed apices, becoming somewhat large and well separated from each other towards the base of the frond, bearing scattered, long-acute, aristate and hair-pointed teeth around their sides and apex, the lowest ones bearing teeth at the tips of shallow, acute side-lobes, teeth not exserted. Indusia small, very thin, white, flat, lifting and shrivelling markedly on ripening, deciduous. Ripe (dark) spore-samples contain regular spores with a somewhat wide, pale or russet, minutely spinulose perispore, the spinules being ± scattered. Diploid sexual.

HABITAT: In Southern Europe an alpine species, growing in high mountain ranges in crevices among rocks, in damp screes, or in damp forests, frequently on non-calcareous rock. From c. 1000-2200 m., or more.

RANGE IN THE AREA: Confined to the Pyrenees, the Picos de Europa, and scattered through parts of the Cordillera Central and the mountains between them and the West Pyrenees, in Spain and in a single, slightly disjunct locality, the highest part of the Serra da Estrela, in Portugal. Absent from Macaronesia.

RANGE: A circumboreal species across Northern Europe (absent from Ireland, Belgium and Holland) and extending southwards into all the high ranges of South Central Europe, Corsica, North East Turkey, and the Caucasus. Across Siberia to the Far East (though scattered near Irkutsk), N. Manchuria,

Japan, Korea, Taiwan and the Aleutian Isles. Across N. America to Greenland and from Alaska to California.

NOTES: *D. expansa* was first recognised to be cytologically distinct from *D. dilatata,* to which it is part ancestral, by MANTON (1950) and WALKER (1955), the latter redescribing it as a species under the name *D. assimilis* which became widely used in European literature. Though at first thought to be genomically the same as *D. intermedia* (and *D. azorica*), its considerably different morphology led to re-investigation by GIBBY & WALKER (1977) who showed that *D. intermedia* and *D. expansa* are genomically different. In most herbaria and much of the literature it is much confused with *D. dilatata,* the reports of which, from the higher parts of the Cordillera Central were almost certainly based on *D. expansa* (see under *D. dilatata*). RIVAS-MARTÍNEZ, COSTA, IZCO & SÁENZ (1981) have recently published the author's determinations to this efect made in MAF in 1980 without acknowledgement of the origin of this new information, and state that *D. dilatata* could also occur in the Sierra de Guadarrama though that no evidence for this exists apart from their previous reports made without voucher specimens and without taxonomic knowledge of the species concerned. *D. expansa* has been chemically investigated by WIDÉN, SORSA & SARVELA (1970) and WIDÉN & BRITTON (1971).

MAP: 17.

VOUCHER SPECIMENS:

UN1. Cercanías del Lago Ubales, [S. of] Termino de Caso, 1690 m., Spain. *J. M. Argüelles-Saéz,* 31/Oct/1971. Herb. Gijón! (with *D. oreades*).

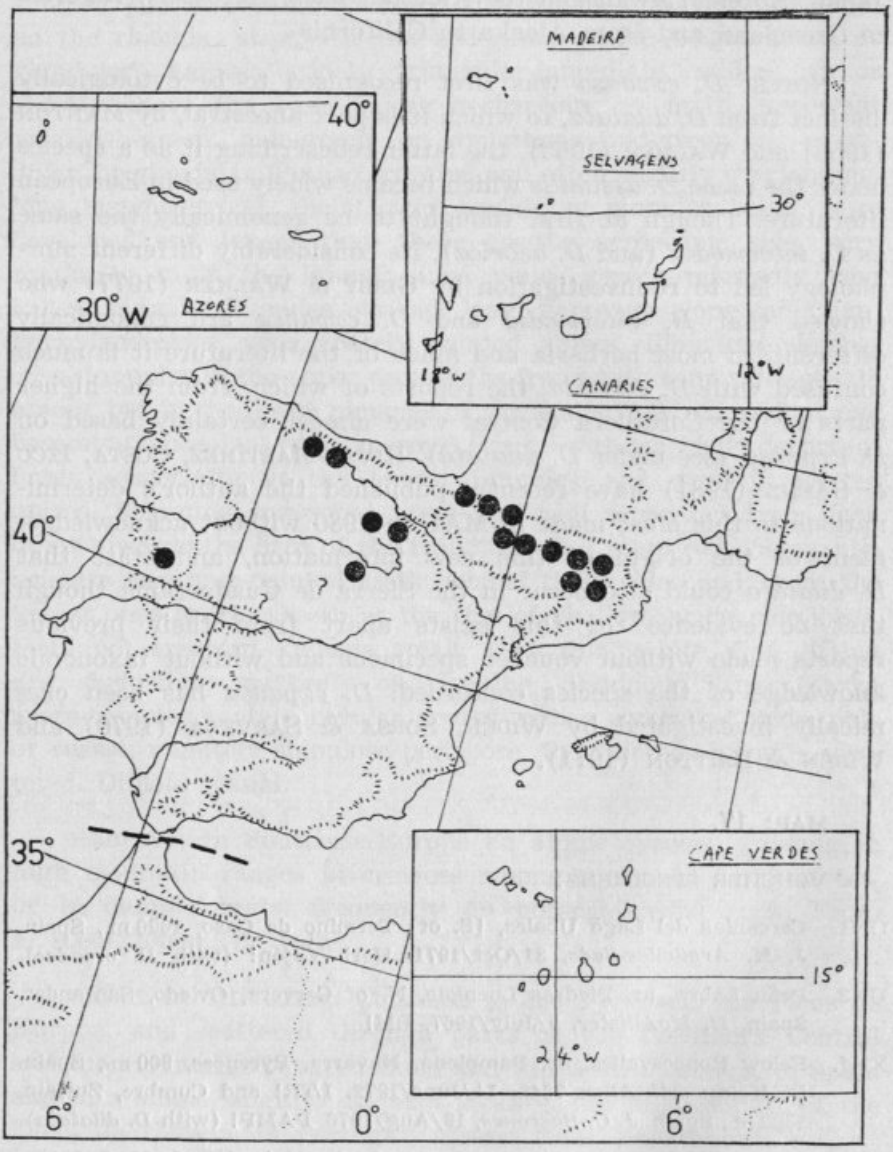
UN3. Peña Labra, nr. Piedras Luengas, N. of Cervera, Oviedo, Santander, Spain. *H. McAllister,* 5/July/1967. BM!

XN1. Below Roncesvalles, nr. Pamplona, Navarra, Pyrenees, 900 m., Spain. *B. Molesworth-Allen* 7648, 14/June/1972. LTR! and Cumbre, Zuriain, 1300 m., Spain. *J. C. Bascones,* 19/Aug/1976. PAMP! (with *D. dilatata*).

XN3. Larra, Rio Belagua, 1400 m., Spain. *J. A. Alejandre, J. M. Lekuona & Ramon* 2426, 12/Aug/1980. Herb. AEPNA, Vitoria!

YN1. Lac d'Isabe, Gorges de Bitet, vallée d'Ossau, 1000 m., France. *P. Montserrat* 5223, 3/Aug/1972. JACA!

BH3. Lac d'Escoubas, Barèges, Hautes Pyrénées, France. *C. Rey-Pailhade,* 16/Aug/1913. MPU!


MADEIRA
SELVAGENS
40°
30°
30° W
AZORES
18° W
12° W
CANARIES
40°
35°
CAPE VERDES
15°
24° W
6°
0°
6°

MAP 17.

YN2. Refugio Calcilarruego, Ordesa, Huesca, 1850-1900 m., Spain. *P. Montserrat* 5763, 8/Aug/1974. JACA!

BH4. Superbagnères de Luchon, c 1200 m, Haute Garonne, France. *E. K. Horwood,* 27/July/1961. LTR!

CH2. Prov. de Lérida, Pyrénées Central., Espot, Ribera de S. Maurice, 1600 m, Spain. *W. Rothmaler,* 12/July/1934. JE! BCF (no. 309)!

CH4. Andorre. *C. Bange* 79,133, 1979. LY!

DH2. Pyrénées Orient., Lac de Pradeilles (Les Bouillouses), N. de Mont-Louis, 1950 m., France. *P. Berthet* 527, 7/Aug/1975. LY!

VM3. Burgos, in montibus «Sierra de Neila», 1850 m., Spain. *J. F. Muñoz-Garmendia* (360), *Segura* et al., 17/Sept/1977. MA!

WM1. Logroño, in montibus «Sierra de Urbion», pr. locum dictum «Laguna Negra de Viniegra de abajo», ad 2000 m., Spain. *J. F. Muñoz-Garmendia* (no. 266), *Segura* et al., 17/Sept/1977. MA!

CG3. Vall de Judas & Vall del Riu, 2000-2300 m, Spain. *M. Losa & M. Montserrat,* 1948. BCF (4931)!

DG1. Valle del Puigmal, Nuria, Ribas de Freser, 2,200-2,800 m., Gerona, Spain. *L. Villar* 5308, 3/Aug/1974. JACA!

VL3. Puerto de la Quesara, Sierra de Ayllón, Spain. *A. Barra, B. Blanco, Temperano & R. Morales* AB679, 19/Oct/1978. MAF! BM (*Fraser-Jenkins* 10144)! and *S. Rivas-Martinez* et al., 11/6/1979. MAF!

VL2. Pedriza Posterior, Sierra de Guadarrama, Risco Moreno, 1700 m., Spain. *S. Rivas-Martinez.* Rivas-Martinez & Costa (1975), sub *D. dilatata.*

PE1. Serra da Estrêla, Covão da Metade, Portugal, *M. Ferreira* 1305, June/1894. G! Z! WU! MPU! COI!

UK1. 2300 m., Circo de la Laguna Grande de Gredos, al pie de Risco Moreno, Spain. Rivas-Martinez & Saenz de Rivas (1971), sub *D. dilatata.*

15. **Dryopteris dilatata** (Hoffm.) Gray, Man. Bot. North. U. S.: 631 (1848).

BASIONYM: *Polypodium dilatatum* Hoffman, Deutsch. Flora Bot. Taschenb. 2: 7 (1796).

IMPORTANT SYNONYMS: *Polypodium tanacetifolium* Hoffm. (1796). *Polypodium multiflorum* Roth (1797). *Aspidium dilatatum* (Hoffm.) J. E. Smith (1804). *Polystichum dilatatum* (Hoffm.) Schumacher (1803). *Nephrodium dilatatum* (Hoffm.) Desv. (1827). *Aspidium dumetorum* J. E. Smith (1828). *Lastrea dilatata* (Hoffm.) Presl (1836). *Lastrea collina* Newm. (1844). *Lastrea maculata*

Deakin (1848). *Polystichum corbieri* Foucaud (1896). *Dryopteris spinulosa* subsp. *dilatata* (Hoffm.) C. Chr. (1905). *Dryopteris alexeenkoana* Fomin (1911).

MISAPPLIED NAME: *Dryopteris austriaca* (Jacq.) Woynar, sensu Woynar, Jermy etc., non *Polypodium austriacum* Jacquin [= *Pteridium aquilinum* (L.) Kuhn].

IN WILLKOMM & LANGE: *Polystichum spinulosum* var. *vulgare* (misidentification) and var. *dilatatum*.

TYPE (Lectotype, FRASER-JENKINS 1980*b*: 608) from Denmark, illustration in Müller, Fl. Fridrichsdal: 193-194, t. 2, fig. 4 (1767).

DESCRIPTION: Intermediate in morphology between *D. expansa* and *D. azorica;* similar to *D. expansa,* but fronds persistent at least for the first part of winter, scales usually slightly narrower with a more distinct darker central aera, though they may be almost entirely pale in juvenile specimens. Frond eglandular. Lamina widest shortly above the base, more thickly herbaceous than *D. expansa,* slightly glossy, dark-green or sometimes mid-green, the lowest basiscopic pinnule in the lowest pinna the same size as or slightly shorter than the next, but more foliose and well developed fronds frequently have the lowest pinnule slightly the longest. Pinnulets sloping, rectangular in the upper part of the frond and the lowest pinnulets less lanceolate than in *D. expansa* and with rounded or obtusely pointed apices, not falcate, only slightly decurrent if at all at their bases, and more crowded than in *D. expansa.* Teeth usually with somewhat wider bases, not markedly exserted. Small plants or plants growing in exposed places may have their pinnulets somewhat curved down. Ripe (dark) spore-samples contain regular spores with less wide and darker perispores, the spinules being mostly joined together and more dense than in *D. expansa.* Tetraploid sexual.

HABITAT: A widespread and common species in damp places. On slopes in forests or woods, among rocks and screes, or on banks, showing no particular preference as to rock type. From sea-level to c 2000 m altitude.

RANGE IN THE AREA: Common throughout North and West Spain and Northern Portugal and also present in the Sierra

Carbonera (Cáceres), W. Central Spain. Apparently absent from the Cordillera Central and reported from there in error for *D. expansa*. Introduced in one locality in S. Spain (Algeciras) and now probably extinct there. It has also been discovered recently by BOTELHO GONÇALVES followed by SJÖGREN on Pico Island in the Azores [see FRANCO (1971) and FRANCO in SJÖGREN (1973)] from where other records all referred to *D. azorica, D. aemula* or *D. crispifolia*. Absent from elsewhere in Macaronesia.

RANGE: A European (sensu lato) species, absent from Iceland (where it has been reported in error for *D. expansa),* present throughout Western and Central Europe, reaching as far North as the Faroes, S. Norway, S. Sweden and S.W. Finland. Becoming rare in South Mediterranean Europe, extending eastwards to N. Turkey, the Crimea, the Caucasus and the Caspian coast of Iran (rare). Often reported in error for *D. expansa* from further East. Also present in the West Falkland Islands (specimens in K!), where it would presumably be introduced from Britain, though the Falkland locality needs further investigation, if it still survives there. In North America it is replaced by *D. campyloptera* (Kunze) Clarkson which is genomically identical but sufficiently distinct to be a separate species (see GIBBY 1977). Reports from Africa, Madagascar and the Mascarenes refer to *D. antarctica* (see under *D. guanchica*).

NOTES: Details of the nomenclature of this species are given by FRASER-JENKINS (1980*b*). The two names, *Polystichum pilidens* Touill. and *Polystichum thujaeforme* Pourret, given by COLMEIRO Y PENIDO (1899) and RUIZ DE AZÚA (1928) in synonymy for this species were manuscript names preserved in the Institute of Botany, Madrid (MA). Reports from the Cordillera Central appear to refer to *D. expansa,* though the reports from the Sierra de Gredos [RIVAS-MARTINEZ & SAENZ DE RIVAS (1971)] and Sierra de Guadarrama [RIVAS-MARTINEZ & COSTA (1975)] were made without extant voucher specimens (RIVAS-MARTINEZ, pers. comm., 1981) and need confirmation (see under *D. expansa).* The record from Cepeda, Peña de Francia, Salamanca [FERNÁNDEZ-DIEZ (1975)] was in error for *Athyrium filix-femina* [FERNÁNDEZ-DIEZ (1980) and pers. comm., 1981]. It has been reported from the Azores (discovered by BOTELHO GONÇALVES, who informed SJÖGREN, who collected it shortly afterwards) by FRANCO (1971),

who was the first person to determine BOTELHO GONÇALVES' collection (in 1969, confirmed by J. SARVELA in 1971). This determination was overlooked by GIBBY, JERMY, RASBACH, RASBACH, REICHSTEIN & VIDA (1977), though tentatively reported by SJÖGREN (1973), as it was thought that it could refer to the then undescribed *D. crispifolia*. FRASER-JENKINS (1982) was also unfortunately unaware that FRANCO's report was based on this correct specimen, and reported it anew, based on SJÖGREN's specimen and report, which did rot come to this notice until 1979. The Azores population consists of plants with rather narrow fronds and less foliose pinnae than in most of the mainland populations and is unusual in apparently being restricted to only a few craters in one locality on the North side of the island, in contrast to its commonness on the mainland; however its cytotype has now (July 1982) been investigated by GIBBY and will soon be reported. It has been shown (MANTON 1950, MANTON & WALKER 1955, and GIBBY & WALKER 1977) that *D. dilatata* is an allopolyploid species derived from *D. expansa* and either *D. intermedia* or, more likely (on morphological grounds), *D. azorica*. The chemistry of *D. dilatata* has been investigated by WIDÉN, SORSA & SARVELA (1970).

MAP: 18.

VOUCHER SPECIMENS:

NJ4. La Coruña, Puentedeume, Caaveiro, Rio del Eume, 75 m., Spain. *E. Valdes-Bermejo & S. Castroviejo* 69/76, 1976. MA!

PJ2. Orol, Lugo, Spain. *I. Barrera,* 17/July/1977. Herb. Fac. Cienc. Biol., Univ. Complutense. Madrid (4759)!

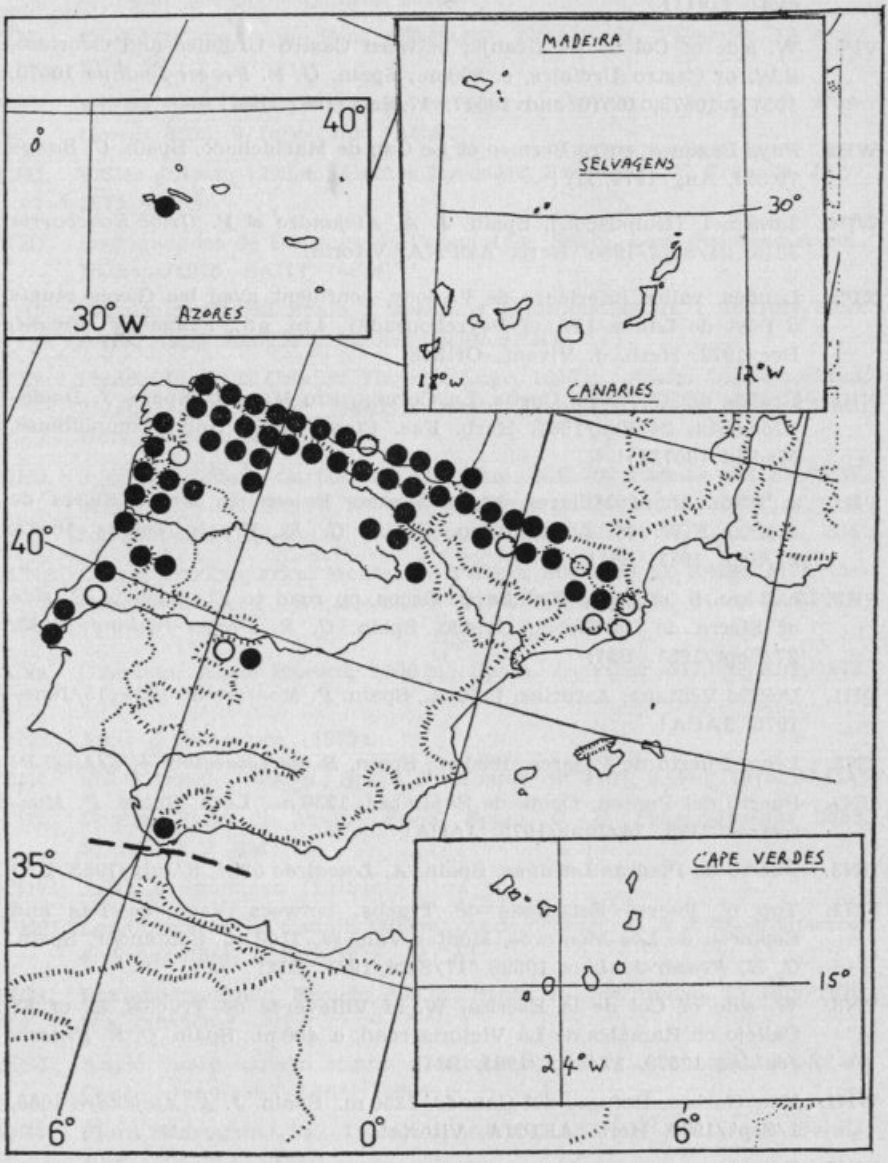
PJ4. Wood between Vega do Ouria and Sta. Columba, 20 km. E. of Vegadeo on Boal road, Sierra de La Bobia, S.E. of Castropol, Oviedo, Spain. *C. R. Fraser-Jenkins* 10670-10672, 27/Sept/1981. BM!

QJ2. La Cabruñana [Grado to Cornellana], Spain. *R. M. Simó,* 15/Oct/1970. FCO (no. 00191)!

TP4. Ad fluminem España in ditione gegionensi, loco nemoroso. *Laínz & Sanchez-Ferrero,* 2/May/1975. Herb. Gijón!

UP2. Monte Sueve, Asturias, El Fito, 550 m., Spain. *M. Laínz,* 19/Nov/1972. G (177/1)! JACA!

UP4. La Franca [Riba de Deva], Asturias, non longe a mare, Spain. *M. Laínz,* 19/Nov/1972. Herb. Gijón! (with *D. guanchica*).



MAP 18.

Correction: The open circle at the North tip of Portugal (NG3) is now a full spot.

VP2. Santander, Cóbreces, bois, Spain. *R. Litardière,* 30/July/1910. *Litardière* (1911).

VP4. W. side of Col de La Granja, between Castro Urdiales and Gouriezo, S.W. of Castro Urdiales, c. 300 m., Spain. *C. R. Fraser-Jenkins* 10570, 10571, 10573, 10576 and 10577, 17/Sept/1981. BM!

WP2. Pays Basques, entre Bermeo et Le Cap de Machichaco, Spain. *C. Bange* 79,304, Aug/1979, LY!

WP4. Jaizkibel, [Guipúzcoa], Spain. *J. A. Alejandre & P. Uribe-Echebarria* 3015, 21/Sept/1980. Herb. AEPNA. Vitoria!

XP2. Landes, vallée inferieure de l'Adour, confluent avec les Gaves réunis a Port de Lanne [W. of Peyrehourade], 4 m. alt., France. *J. Vivant,* Dec/1972. Herb. J. Vivant, Orthez!

NH3. Brañas del Cruceiro, Curtis, La Coruña, Rio Mandeo, Spain. *J. Dalda-González,* 24/Feb/1967. Herb. Fac. Cienc. Biol., Univ. Complutense, Madrid (00724)!

PH1. c. 2 km. N. of Millares, N. of Fontao, Baleira to Meira, Sierra de Meira, N.W. of Lugo, Lugo, Spain. *C. R. Fraser-Jenkins* 10687, 27/Sept/1981. BM!

PH3. c. 3 km. S. of Santa Eulalia de Oscos, on road to Fonsagrada, S. side of Sierra de La Bobia, Oviedo, Spain. *C. R. Fraser-Jenkins* 10683, 27/Sept/1981. BM!

QH1. Puerto Ventana, Asturias, 1150 m., Spain. *P. Montserrat* 1824, 15/June/1975. JACA!

TN3. Léon, Puerto de Pajares, 1990 m., Spain. *R. de Litardière* 4, 8/Aug. P!

UN1. Puerto del Ponton, Oseja de Sajambre, 1230 m., Léon, Spain. *P. Montserrat* 2138, 16/June/1975. JACA!

UN3. Puerto de Piedras Luengas, Spain. *A. Lawalrée* 5304, 5/July/1953. BR!

VN1. Top of Puerto Estacasas de Trueba, between Vega de Pas and Espinosa de Los Monteros, Montes Valnera, 1160 m., Santander, Spain. *C. R. Fraser-Jenkins* 10598, 17/Sept/1981. BM!

VN3. W. side of Col de la Escrita, W. of Villaverde de Trucios, E. of El Callejo on Ramales de La Victoria road, c. 400 m., Spain. *C. R. Fraser-Jenkins* 10579, 17/Sept/1981. BM!

WN1. Mte. Gorbea, Refugio del Ganado, 1350 m., Spain. *J. A. Alejandre* 1086, 1/Sept/1979. Herb. AEPNA, Vitoria!

WN3. Guipuzcoa, pr. oppidulum Oyarzun, in montibus «Peñas de Aya», 800 m., Spain. *Muñoz-Garmendia* 356, 357, 365 and 366, 21/Aug/1978. MA!

XN1. Roncesvalles, 900 m., Navarra, Spain. *B. Molesworth-Allen* 5942, 14/June/1972. MGC!

XN3. Txamantxoia, Belagua, Alto Roncal, Navarra, 1350-1500 m., Spain. *L. Villar* 458, 27/Aug/1973. JACA!

YN1. Cauterets, route du Pont d'Espagne, France. *H. Vilmorin*, 12/Aug/1974. P!

BH3. Mt. du Bedal, sobre Bagnères de Bigorre, 680-700 m., France. *P. Montserrat* 3226, 6/July/1975. JACA!

CH1. Vallée d'Aran, 1200 m., Hautes Pyrénées, France. *D. F. Trèmóls*, July/1873. MPU!

NH2. Proximidades de Santiago de Compostela, Spain. *Losa-Quintana* & col., 15/Sept/1975. SANT (08247)!

PH2. Folgoso de Caurel, Spain. *J. Amigo & J. Euilian* 800716/1, 16/July/1980. SANT! and 800722/3, 22/July/1980. SANT!

PH4. Piedrafita de El Cebrero, Hayedo, Lugo, 1000 m., Spain. *Losa-Quintana*, 21/June/1975. MAF (93603)! Herb. Fernández-Casas, Fac. Cienc., Univ. Auton., Madrid!

QH2. 3 ½ km. N.E. of Carbon del Sil, 5 km. N.E. of Paramo del Sil, S.W. of Palacios del Sil, N. W. side of Sierra de Jistredo, N.N.E. of Ponferrada, León, Spain. *C. R. Fraser-Jenkins* 10751, 30/Sept/1981. BM!

WN2. Okina, La Txuparka, Montes de Vitoria, 800-1000 m., Spain. *P. Uribe-Echebarria & J. A. Alejandre* 1175, 6/June/1980. Herb. AEPNA, Vitoria!

XN4. Gamueta, Anso, Huesca, 1400 m., Spain. *L. Villar* 537, 31/Aug/1973. JACA!

YN2. Jalas & Suominen (1972).

BH4. Val d'Anisclo, 1400 m., Spain. *P. Montserrat* 4407, 2/Aug/1975. JACA!

CH2. Bosost, Valle de Aran, Lérida, Spain. *C. R. Fraser-Jenkins* 3588, 15/Jan/1972. BM!

CH4. Jalas & Suominen (1972).

DH2. Les Corbières, Le Caunil, 1300 m., Aude, France. *P. & J. M. Montserrat & Villar* 1567, 4/July/1978. JACA!

NG1. Pontevedra, Bueu, Ermelo, 400 m., Spain. *S. Castroviejo*, 15/July/1970. MA (198360)!

NG3. Anjão, marg. do rio Minho (Valladares), Minho, Portugal. *A. R. da Cunha*, June/1886. LISU (2206)!

QG1. Flora Maragata, Sa. Teleno, Abedubol, 1500 m., Spain. *F. Bernis*, July/1946. MA (329)!

VM3. San Millán, Sierra de la Demanda, Burgos, Spain. *A. E. Salvo-Tierra* 5708, 23/June/1979, MGC!

WM1. Picos de Urbion, Vinuesa, Spain. *S. Rivas-Martinez* & col., 15/July/1975. MAF (93198)!

CG3. Vall de Riu, 2000-2200 m., Spain. *M. Losa & P. Montserrat,* 1948. BCF (4932)!

DG1. Vall de Ribas, Baga de Siat, 1800 m., Spain. *J. Vigo & A. Anglada,* 14/July/1968. BC (605333)!

DG3. Jalas & Suominen (1972).

NG2. Pass below Extremo, S. of Monção, N. of Braga, Minho, Portugal. *C. R. Fraser-Jenkins* 4909, 6/June/1976. BM!

NG4. E. side of Picos de Fonte Fria, N. of Pitões [das Júnias] (Portugal), S. of Muiños (Spain), Trás-os-Montes e Alto Douro, Portugal. *C. R. Fraser-Jenkins* 10698, 29/Sept/1981. BM!

PG2. Larouco, 1300 m., Portugal. *A. M. Hernandez,* 25/July/1976. JACA!

WM4. Moncayo, Spain. *B. Lazáro* 2265, July/1878. MAF (4461)! & July/1880. MAF (44552 & 66674)!

DG2. Jalas & Suominen (1972).

DG4. Jalas & Suominen (1972).

NF1. Valongo, Portugal. *C. Bange* 79,205, 1979, LY!

NF3. W. side of pass between Amarante e & Vila Real, E. of Porto, Douro, Portugal. *C. R. Fraser-Jenkins* 4911, 6/June/1976. BM!

NF2. Vermoim, prox. Oliveira de Azeméis, Portugal. *J. Matos* 7587, 28/June/1960. COI! MA (195087)!

NE3. E. side of Serra do Caramulo, Caramulinho peak, S.E. of S. João do Monte, Portugal. *C. R. Fraser-Jenkins* 10132, 5/Aug/1980. BM!

PE1. Cântaros in Sa. da Estrella, Portugal. *Welwitsch,* Aug/1848. LISU!

NE2. Marinha Grande, Mata do Engenho, Portugal. *G. de Barros Sá Nogueira,* March/1945. LISI!

ND1. Jalas & Suominen (1972).

TJ3. Jalas & Suominen (1972).

UJ1. Arroyo de La Pedriza, Loreras, finca del Hospital del Obispo, Sierra (Palomera) Carbonera, Navatrasierra, Cáceres, Spain. *M. Ladero-Alvarez.* 13/Aug/1966. MAF (80575)! and 8/April/1971. FCO (no. 00188)! GDA!

MD4. Serra de Montejunto, Portugal. [Welwitsch] P-2198. LISU!

MC3. Serra de Cintra, entre Guincho et Colares, Portugal. *C. Bange* 79,246, 1979. LY! (see comments under *D. guanchica*).

TF4. «D'un herbier de Cadiz par Bedeau en 1828, comme exotique, sans indication de l'habitat». P! [introduced].

6. Mistério de St Luzia, Bocas de Fogo, in crater 1000 m., N.W. side of P. do Pico, Pico, Azores. *E. Sjögren* 680705-28a, b & c., 15/July/1968. UPS! and *I. B. Gonçalves* 2250, 5/July/1968. LISI! MGC! and, following

Sjögren, collections from the same locality by *Fraser-Jenkins*, July/1980 (nos. 10,080-10,082, 10,084, 10,086-10,087, 10,091-10,092, 10,095, 10,097-10,097-10,098, 10,100-10,101, 10,105-10,106, 10,109, 10,111, 10,117, 10,123 and 10,125-10,127). BM!

16. **Dryopteris intermedia** (Mühl. ex Willd.) Gray, Man. Bot. North. U. S.: 630 (1848).

BASIONYM: *Aspidium intermedium* Mühl. ex Willd., Spec. Plant. 5: 262 (1810), non Sadl. (1820), nec al.

IMPORTANT SYNONYMS: *Nephrodium intermedium* (Mühl. ex Willd.) Presl (1825). *Lastrea intermedia* (Mühl. ex Willd.) Presl (1836).

TYPE: from N. America (Pennsylvania), in B.

This species only occurs in the European flora (sens. lat.) as subspecies *maderensis* of which full details are given after subsp. *intermedia*.

1) Subsp. **intermedia.**

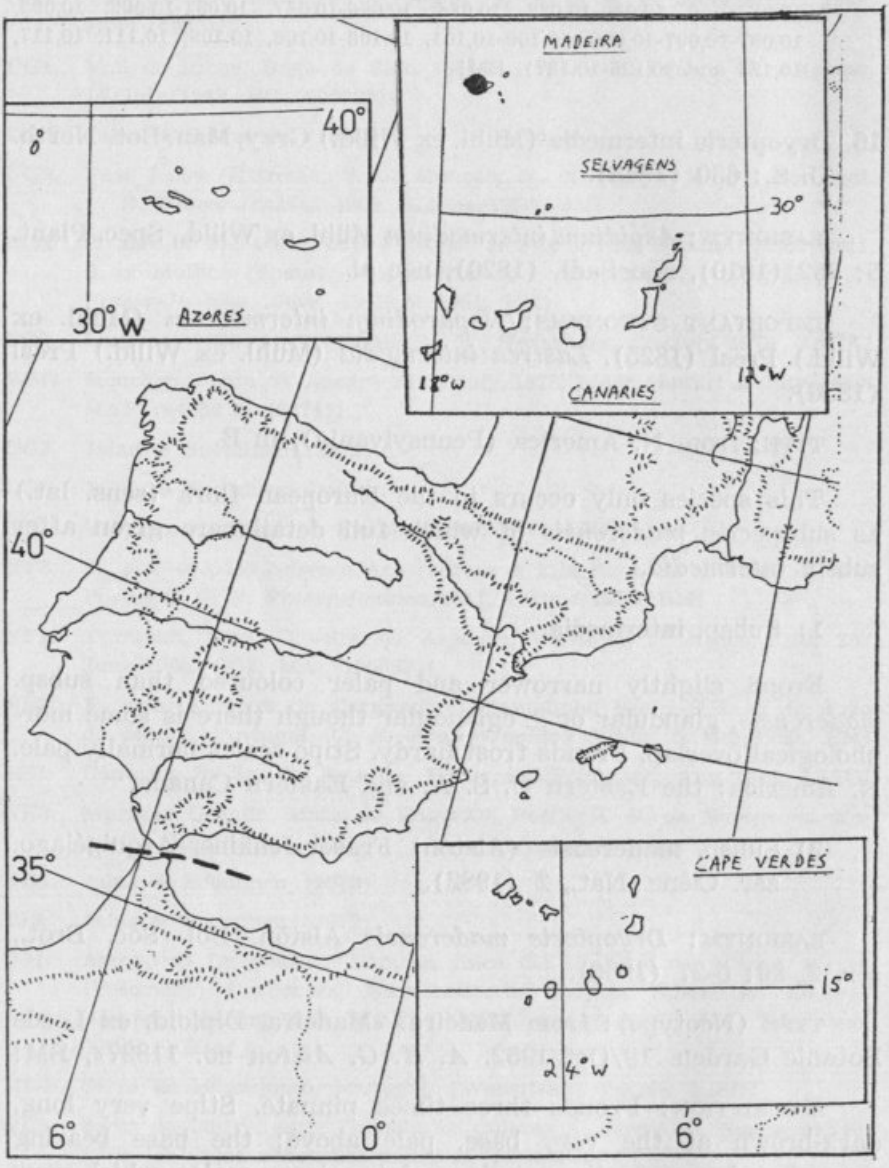
Frond slightly narrower and paler coloured than subsp. *maderensis*, glandular or ± eglandular though there is some morphological overlap. Fronds frost hardy. Stipe scales normally pale. N. America: the Eastern U. S. A. and Eastern Canada.

2) Subsp. **maderensis** (Alston) Fraser-Jenkins, Arquipélago, sér. Ciênc. Nat., 2 (1982).

BASIONYM: *Dryopteris maderensis* Alston, Bol. Soc. Brot., ser. 2, 30: 5-27 (1956).

TYPE (Neotype): from Madeira. «Madeira. Diploid. ex Leeds Botanic Garden. 19/Oct/1952. *A. H. G. Alston* no. 11827», BM!

DESCRIPTION: Fronds three times pinnate. Stipe very long, dark-brown at the very base, pale above; the base bearing somewhat dense, small, ovate-lanceolate, glossy scales, which vary in colour from mostly pale to, more normally, dark with pale edges, and become small, narrower and considerably more scattered further up, and ± absent from the top half of the stipe; stipe, rhachis and pinna-costae eglandular. Lamina narrowly elongated


MADEIRA
SELVAGENS
30°
40°
30°W
AZORES
18°W
12°W
CANARIES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 19.

triangular-lanceolate, widest shortly above the base, slightly crispaceous, herbaceous, glossy mid- to dark-green, or pale-green when in an exposed place, pale below, eglandular. Pinnae not crowded, narrow, the lowest ones asymmetrical, their lower basiscopic pinnules being more developed and longer than those on the acroscopic side, markedly so in the lowest pinna, which has its lowest basiscopic pinnule considerably shorter than the next. Pinnules stalked, ± long, narrowly elongated triangular-lanceolate, with acutely pointed apices. Pinnulets small, not, or only slightly sloping, rectangular in the upper part of the frond with truncate apices, but in the lower pinnules of the lowest few pairs of pinnae rectangular with pointed apices and borne ± at right angles to the pinnule costa, well separated from each other, bearing scattered, wide-based long-acute, aristate, hair-pointed teeth, exserted around their sides and apex. Plants growing in exposed places may have the pinnulets markedly turned down. Indusia small, very thin, white, flat, with minutely toothed edges, lifting and shrivelling markedly on ripening, deciduous. Ripe (dark) spore-samples contain small regular spores with dark, minutely spinulose perispores. Diploid sexual.

HABITAT: Among tall bushes and in woods; from c. 300-900 m. altitude, or more.

RANGE: Confined to Madeira, as an endemic.

NOTES: WALKER (1955 & 1961) and GIBBY & WALKER (1977) have shown that *D. intermedia* subsp. *maderensis, D. intermedia* subsp. *intermedia* and *D. azorica* all represent the same genome; on morphological and geographical grounds, it seems likely that *D. azorica* should be considered an ancestor of *D. dilatata* and *D. intermedia* subsp. *intermedia* an ancestor of *D. campyloptera* and *D. carthusiana*. WALKER (1961) considered *D. intermedia* and *D. maderensis* to be conspecific and FRASER-JENKINS (1982) reduced *D. maderensis* to a subspecies of *D. intermedia* because they are so close morphologically; however *D. azorica* is retained as a species as it is considerably more distinct. The same genome is also part-ancestral to *D. guanchica* and *D. crispifolia*. WIDÉN, SORSA & SARVELA (1970) and WIDÉN, LOUNASMAA, VIDA & REICHSTEIN (1975) have shown that the chemistry of all three diploids (*intermedia, maderensis* and *azorica*) is closely similar.

MAP: 19.

VOUCHER SPECIMENS:

11 500 m., 2 km. S.W. of Portela, S. of Porto da Cruz, Madeira. *C. R. Fraser-Jenkins* 9760, 1/Aug/1979. BM!

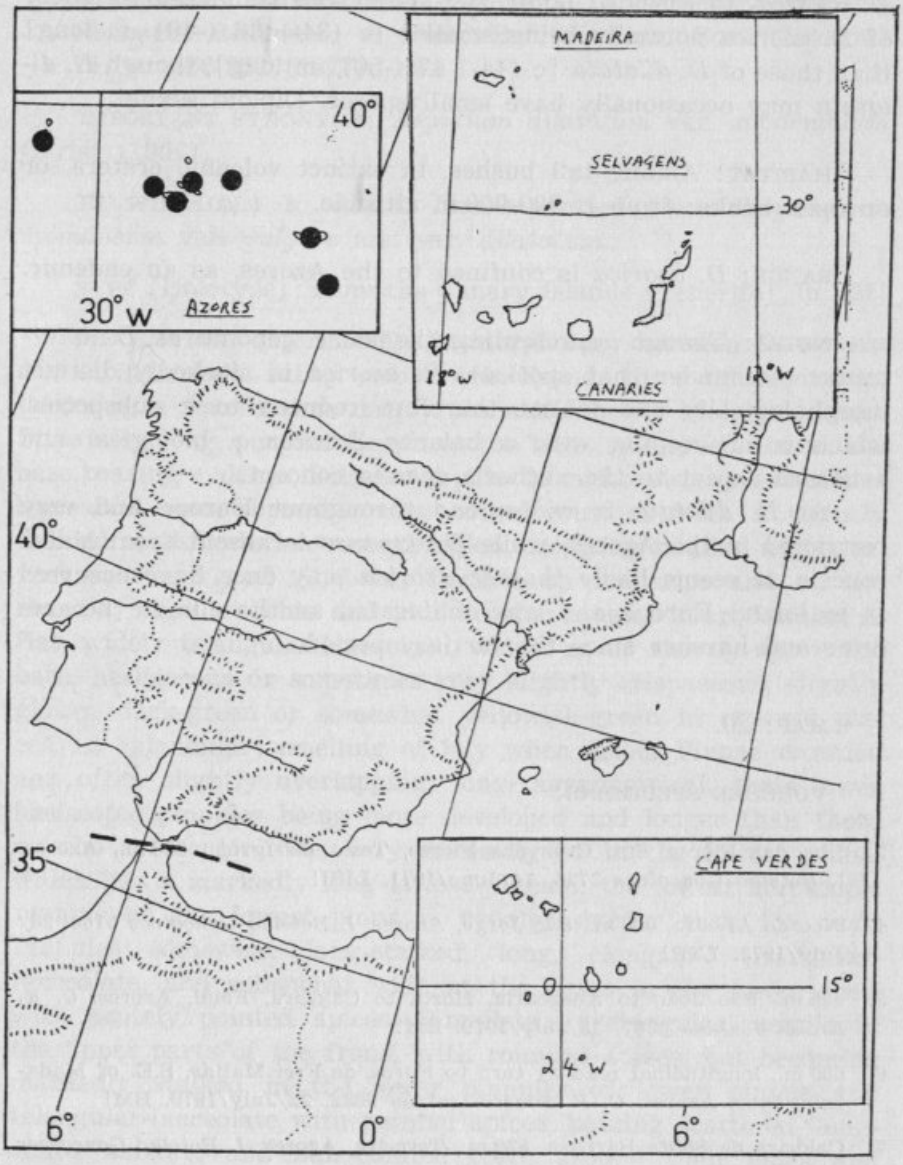
17. **Dryopteris azorica** (Christ) Alston, Bol. Soc. Broteriana, sér. 2, **30**: 14 (1956).

BASIONYM: *Aspidium dilatatum* var. *azoricum* Christ, Bull. Acad. Int. Géogr. Bot. (Mans) **17**: 157 (1907).

IMPORTANT SYNONYMS: *Dryopteris dilatata* subsp. *azorica* (Christ) A. R. & Q. Pinto da Silva (1974).

TYPE (Holotype): from the Azores (S. Miguel), in COI (teste R. FERNANDES, 1981).

DESCRIPTION: Intermediate in morphology between *D. intermedia* subsp. *maderensis* and *D. dilatata*. Differs from *D. intermedia* in having a much larger frond, the stipe is more densely scaly and the scales are larger and lanceolate with a marked dark stripe in the centre. The lamina is less crispaceous with wider, more foliose, somewhat crowded pinnae and the pinnulets are larger and more crowded; the costae on the underside of the pinnules bear small, somewhat prominent, scattered, ovate-lanceolate, pale-brown scales. As is often the case when comparing an allotetraploid with one of its diploid ancestral species, due to variation in the allotetraploid between one extreme and the other, *D. azorica* can sometimes be difficult to distinguish from *D. dilatata*, particularly when the plants are not full-sized (except in the Azores where *D. dilatata* is less foliose than on the mainland) but the pinnulets in *D. azorica* are inserted to the pinnule-costae more nearly, at 90° and therefore more nearly in a straight line from one pinnulet to the one opposite it; they are also slightly more narrowly attached than in *D. dilatata*. The scales on the underside of the pinnules are larger and more prominent than in *D. dilatata* and the segment teeth are more exserted, sticking out from the pinnulets at the sides and apex. The lowest basiscopic pinnule of the lowest pinna is normally shorter in *D. azorica* than in *D. dilatata* and the lamina is slightly more crispaceous in


MADEIRA
SELVAGENS
40°
30°
30° W
AZORES
18° W
CANARIES
12° W
40°
35°
CAPE VERDES
15°
24° W
6°
0°
6°

MAP 20.

D. azorica. In cases of doubt the spores can be measured, those of *D. azorica* normally being smaller [c (34-) 36 (-40) μm long] than those of *D. dilatata* [c (44-) 47 (-50) μm long], though *D. dilatata* may occasionally have small spores. Diploid sexual.

HABITAT: Among tall bushes, in extinct volcanic craters, or on open banks; from c. 300-900 m altitude.

RANGE: *D. azorica* is confined to the Azores, as an endemic.

NOTES: Though representing the same genome as *D. intermedia* (see under that species), *D. azorica* is markedly distinct morphologically and is not therefore reduced to a subspecies, which is in keeping with a balance between a biological and artificial aspect to the author's species concept.

As *D. dilatata* is widespread throughout Europe and very restricted in the Azores, while *D. expansa* is absent from Macaronesia, it seems likely that *D. azorica* may once have occurred in mainland Europe and was obliterated as the climate became drier and harsher since the tertiary period.

MAP: 20.

VOUCHER SPECIMENS:

2. Ilha das Flores, Sta. Cruz das Flores, Testa da Igreja, 500 m., Azores. *I. Botelho Gonçalves* 2726, 14/June/1971. LISI!

4. Pico do Areeiro, 900 m., São Jorge, Azores. *I. Botelho Gonçalves* 5156, 28/July/1973. LTR!

5. 425 m., São João to Abegoaria, Horta to Caldeira, Faial, Azores. *C. R. Fraser-Jenkins* 9587, 18/July/1979. BM!

6. 650 m., longitudinal road by turn to Furna de Frei Matias, S.E. of Madalena, Pico, Azores. *C. R. Fraser-Jenkins* 9632, 22/July/1979. BM!

7 Caldeira de Santa Bárbara, 830 m., Terceira, Azores. *I. Botelho Gonçalves* 5233, 8/Aug/1973. LTR!

8. nr. top of Lagoa do Fogo caldeira, on N. side, São Miguel, Azores. *C. R. Fraser-Jenkins* 9693, 29/July/1979. BM!

9. Ilha da Santa Maria, Vila do Porto, baldio, Azores. *I. Botelho Gonçalves 2101*, 23/Jan/1968. LISI!

18. **Dryopteris guanchica** Gibby & Jermy in Gibby, Jermy, Rasbach, Rasbach, Reichstein & Vida, Bot. J. Linn. Soc. (London) **74**(3): 256-262 (1977).

IMPORTANT SYNONYMS: *Aspidium dilatatum* var. *subaemulum* Christ (1904).

IN WILLKOMM & LANGE: Not separated from *Polystichum spinulosum* var. *vulgare* and var. *dilatatum*.

TYPE (Holotype): from the Canary Islands (Tenerife), in BM!

DESCRIPTION: Intermediate in morphology between *D. aemula* and *D. intermedia* subsp. *maderensis*. Fronds three times pinnate, becoming a fourth time deeply pinnatifid below in large plants. Stipe very long, purplish-brown at the base, pale-green above; the base bearing ± dense, lanceolate, pale- to mid-brown, or sometimes somewhat russet-brown scales, concolorous, or with a vaguely defined, slightly darker central region, becoming smaller, narrower, very scattered and ± absent further up the stipe and on the rhachis; stipe, rhachis and pinna-costae ± eglandular. Lamina ± flat, widely triangular-lanceolate, widest at or shortly above the base, herbaceous or sometimes very slightly crispaceous, slightly glossy, dark-green or somewhat yellowish-green in exposed places, ± eglandular; smelling of hay when dried. Pinnae crowded and often slightly overlapping, long, asymmetrical, their lower basiscopic pinnules being more developed and longer than those on the acroscopic side, very markedly so in the lowest pinna, which has a markedly long lowest pinnule, the lowest acroscopic pinnule on the lowest pinna is usually shorter than the next. Pinnules somewhat long-stalked, long, elongated triangular-lanceolate, and somewhat wide at the bases in the lower ones, with acutely pointed apices. Pinnulets ± rectangular, sessile in the upper parts of the frond, with rounded apices, but becoming markedly stalked in the lower pinnules of lower pinnae and triangular-lanceolate with pointed apices, bearing scattered, long-acute, aristate and hair-pointed teeth around their sides and particularly at their apices, the lowest ones becoming deeply pinnatifidly lobed. Indusia small, very thin, white, flat, glandular, lifting and shrivelling markedly on ripening, deciduous. Ripe (dark) spore-samples contain regular, rugose and minutely spinulose spores. Tetraploid sexual.

HABITAT: A markedly Atlantic species, usually growing on rocky banks or at the bases of walls, or (mainly in the Canary Islands) in forest. Confined to non-calcareous rock. From sea-level to c 1000 m altitude.

RANGE: Confined to North-West Spain and one place (Algeciras) in the South; North-West Portugal, Sintra, and perhaps once in S.W. Portugal: the Canary Islands; not occurring elsewhere in Europe. Apparently not extending further East along the North Spanish coast than c 4° W. longitude, though further search is required to establish this fully.

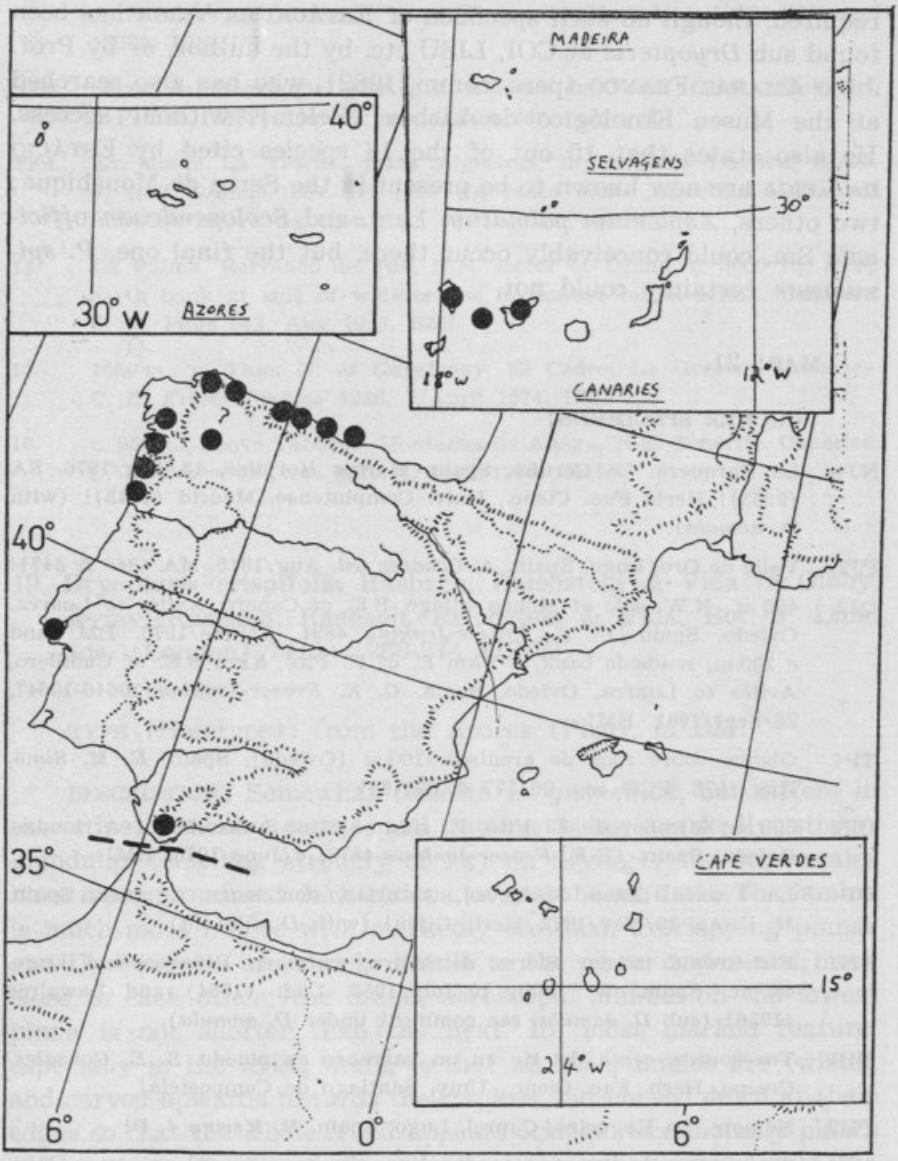
NOTES: CHRIST (1904) first recorded this species, as his *Aspidium dilatatum* var. *subaemulum*, with the observation that it was a curious form intermediate between *D. dilatata* and *D. aemula*, but this taxon was largely ignored. More recently, it was independently recognised as a species in the Canary Islands by GIBBY, JERMY, RASBACH, RASBACH, REICHSTEIN & VIDA (1977), GIBBY & JERMY, naming it *D. guanchica* and giving full and very clear details of it, thus accounting for observations by numerous authors concerning the occurrence of the *D. dilatata* group in the Canaries, where *D. dilatata* is absent. In particular PAGE (in lit., Ph. D. thesis, 1968) had mentioned specimens in the «*D. dilatata/aemula*» complex intermediate between the two species, having observed the salient features of *D. guanchica*, which was at that time a quite unknown species, and BENL & SVENTENIUS (1970) suggested the presence of hybrids, though the spores were not abortive. At first *D. guanchica* was thought to be a Canary Islands endemic, but a specimen from Portugal was then noticed and identified by Dr M. GIBBY at the British Museum (Natural History), London. The specimen was labelled in the writing of WELWITSCH as from the Serra da Cintra [= Sintra], collected in 1839, shortly after his arrival at Lisbon (on 13/July/1839, R. FERNANDES, pers. comm., 1981), and other WELWITSCH collections in various herbaria, labelled «Junto a Pena» or «In Serrae de Cintra editissimis petr. speluncis rarius. Welwitsch no. 293», from the same locality, show that the first specimen was also a WELWITSCH collection. In order to confirm its presence on the European mainland, GIBBY, JERMY & DYCE visited the area in 1976, as reported by DYCE (1976)

[and see a notice of DYCE's reported by GILBERT (1977)]. The Serra de Sintra contains the most southerly records in Portugal of *D. affinis, D. dilatata, D. guanchica* and *D. filix-mas* and the area is now mostly managed as a national park, called the Parque da Pena, converted in 1838 and thereafter from the original «cerca», or garden of the Convento da Pena, which had been bought on Nov. 8, 1838 by King D. Fernando II [AZEVEDO GOMES (1960: 216]. Just to the West of the highest peak in the park is a fern garden, and the valley contains several species which were obviously introduced from Macaronesia [JERMY, pers. comm., 1980 and see REZENDE-PINTO (1941 and 1943) and FRANCO (1971 and 1974)]. *Trichomanes speciosum* and *Pteris palustris* Poir. (=*P. serrulata* auct.) are introduced there. It also seems very likely that *D. filix-mas* was introduced there as it is a long way from its nearest station and does not normally grow so near the sea on lower altitude mountains (529 m alt. at the summit) in Portugal; the specimen cited under that species is also the only extant specimen in any of the herbaria seen. The status of *D. dilatata, D. affinis* and *D. guanchica* at Sintra could therefore be open to doubt and indeed GIBBY, JERMY & DYCE discovered a few plants of *D. dilatata* in the wilder areas of the park, though this species also occurs not too far away in the Serra de Montejunto. But from its presence also among the rocks near the summit, and the fact that it occurs at several localities in the Serra da Sintra, it is almost certainly of natural occurrence there, which is not an unlikely extension of its range. *D. guanchica* has not at present been found in Southern or Central Portugal, apart from at Sintra, despite examination of almost all of the *Dryopteris* material in Portuguese and other herbaria, though there exists a possible report, sub *Polystichum spinulosum,* from the Serra de Monchique. But the above-mentioned authors discovered twelve plants of it on the ridge above the park at Sintra growing below rocks in natural forest, with a few plants just below the rocks beside the path. Again this species appears almost certain to be native to the area. There are few mountains close to the sea to the North until those of Central Portugal, which would help to explain the disjunction of the Sintra population, and in addition, the habitat is typical of those occupied by this species further North. There were no plants of *D. guanchica* in the fern garden below. Further search in Portugal and South-West Spain is

obviously desirable to help cast light on this, and indeed a further specimen was collected last century from S.W. Spain, as reported below. Later in 1976 GIBBY discovered further specimens, collected by DURIEU & MERINO in N.W. Spain, in the BM and in June 1976 the present author also discovered *D. guanchica* in several localities along the North coast of Spain. At present it is known from a number of localities in N.W. Spain and N.W. Portugal, with scattered occurrences further South, so that there can be no doubt whatever as to its status as a native species on the European mainland.

D. guanchica has been shown by GIBBY, WIDÉN & WIDÉN (1978) and GIBBY (1979) to be an allotetraploid species derived from the two diploid sexual species, *D. aemula* and *D. intermedia* subsp. *maderensis*. This is also supported by the detailed chemical study carried out by WIDÉN, LOUNASMAA, VIDA & REICHSTEIN (1975) and GIBBY, WIDÉN & WIDÉN (1978), who produced evidence for the suppression of certain compounds (see also GIBBY & WIDÉN, in press). As mentioned in the introduction it is impossible to extrapolate where *D. guanchica* originated, though it is perhaps unikely to have done so in Macaronesia; however the presence of a somewhat similar species, *D. antarctica* (Bak.) C. Chr. (=*D. callolepis* C. Chr.), in East and South Africa, the Mascarene Islands, Madagascar and Amsterdam Island suggests ancient tertiary African connections. Chemical and cytological evidence produced by WIDÉN, FADEN, LOUNASMAA, VIDA, VON EUW & REICHSTEIN (1973) shows that the two species are very similar.

It is reported from La Palma in the Canary Islands in this paper on the basis of a collection of PAGE's, which was previously reported as either *D. guanchica* or some other species by GIBBY (1979: 349); a report by PAGE (pers. comm., 1980) that this plant could have been diploid, from a count made on progeny grown from spores, is presumed to be an error due to contamination. The record of *Polystichum spinulosum* var. *vulgare* from the Serra de Monchique given by ESTÁCIO DA VEIGA (1869) and repeated by COLMEIRO Y PENIDO (1889) could well refer to *Athyrium filix-femina*, but there is also a possibility that it could have been *D. affinis* subsp. *affinis*, or even the present species. However A. R. PINTO OA SILVA and C. SÉRGIO (pers. comm., 1981) state that the indications in ESTÁCIO DA VEIGA's herbarium are sometimes not reliable and it is certain only that *D. carthusiana* is excluded


MADEIRA
SELVAGENS
30°
18°W
CANARIES
12°W
40°
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AZORES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 21.

from the locality. Further investigation into this problem is required, though no such specimen of ESTÁCIO DA VEIGA has been found sub *Dryopteris* at COI, LISU etc. by the author, or by Prof. J. DO AMARAL FRANCO (pers. comm. 1982), who has also searched at the Museu Etnológico de Lisboa (Belém), without success. He also states that 15 out of the 18 species cited by ESTÁCIO DA VEIGA are now known to be present in the Serra de Monchique; two others, *Asplenium palmatum* Lam. and *Scolopendrium officinale* Sm. could conceivably occur there, but the final one, *P. spinulosum* certainly could not.

MAP: 21.

VOUCHER SPECIMENS:

NJ4. La Barquera, La Coruña, Spain. *Marina Horjales*, 13/Aug/1976. SA (9263)! Herb. Fac. Cienc., Univ. Complutense, Madrid (4343)! (with *D. aemula*).

PJ2. Valle de Oro, Lugo, Spain. *A. Casares Gil*, Aug/1915. MA (346 & 347)!

QJ2. 400 m., N.W. side of Mones village, S.E. of Canero, Avilés to Luarca, Oviedo, Spain. *C. R. Fraser-Jenkins* 4894, 5/June/1976. BM! and c 200 m, roadside bank, c 1 km E. of El Pito, 5 km S.E. of Cudillero, Avilés to Luarca, Oviedo, Spain. *C. R. Fraser-Jenkins* 10646-10647, 26/Sept/1981. BM!

TP4. Obaya, sobre roca de arenisca, 100 m [Oviedo], Spain. *R. M. Simó*, Aug/1973. FCO (no. 001177 & 00178)!

UP2. 500 m., Mirador de El Fito, E. side of Mte. Sueve, N. of Arriondas, Oviedo, Spain. *C. R. Fraser-Jenkins* 4878, 4/June/1976. BM!

UP4. La Franca [Riba de Deva], Asturias, non longe a mare, Spain. *M. Laínz*, 19/Nov/1972. Herb. Gijón! (with *D. dilatata*).

PH1. Eichenwald in der Sierra de Meira, zwischen Ribadeo und Lugo, 450 m., Spain. *W. Lüdi*, 10/July/1953. Lüdi (1954) and Lawalrée (1956) (sub *D. aemula*, see comment under *D. aemula*).

NH2. Toxosoutos, cerca del rio en un barranco en pinedo. *S. E. González-Crespo*, Herb. Fac. Cienc., Univ. Santiago de Compostela!

PH2. Nemore, La Rogueira, Caurel, Lugo, Spain. *B. Merino* 4. P!

NG1. 650 m., Ermita des Angels, Gondomar to Porriño, Tuy to Vigo, Pontevedra, Spain. *C. R. Fraser-Jenkins* 4907, 6/June/1976. BM!

NG2. Serra d'Arga, Cabreiro, Portugal. *G. Sampaio* 122, PO!

NF1. Valongo, Santa Justa, ravin dernière la chapelle, Portugal. *C. Bange* 79,208, 1979. LY!

MC3. Serra de Sintra, N. facing side, 450 m., S. of Pena Palace, Portugal. *J. W. Dyce, M. Gibby & A. C. Jermy* 12374, 5/May/1976. BM! and 12576. LISU!

NB2. Serra de Monchique, Portugal. *Estácio da Veiga* (1868). Colmeiro y Penido (1889) (sub *P. spinulosum* var. *vulgare*).

TF4. Ex Monte La Trocha, juxta Algeciras, in Hispania Baetica, Spain. *J. Ball,* 9/June/1851. B! [the old route from Algeciras westwards into the Sierra de Ojén].

13. La Palma, Barranco del Rio, N.E. sector of Island, c. 3000 ft., steep earth bank at side of watercourse in mature laurel forest, Canaries. *C. N. Page* 543, Aug/1963. BM!

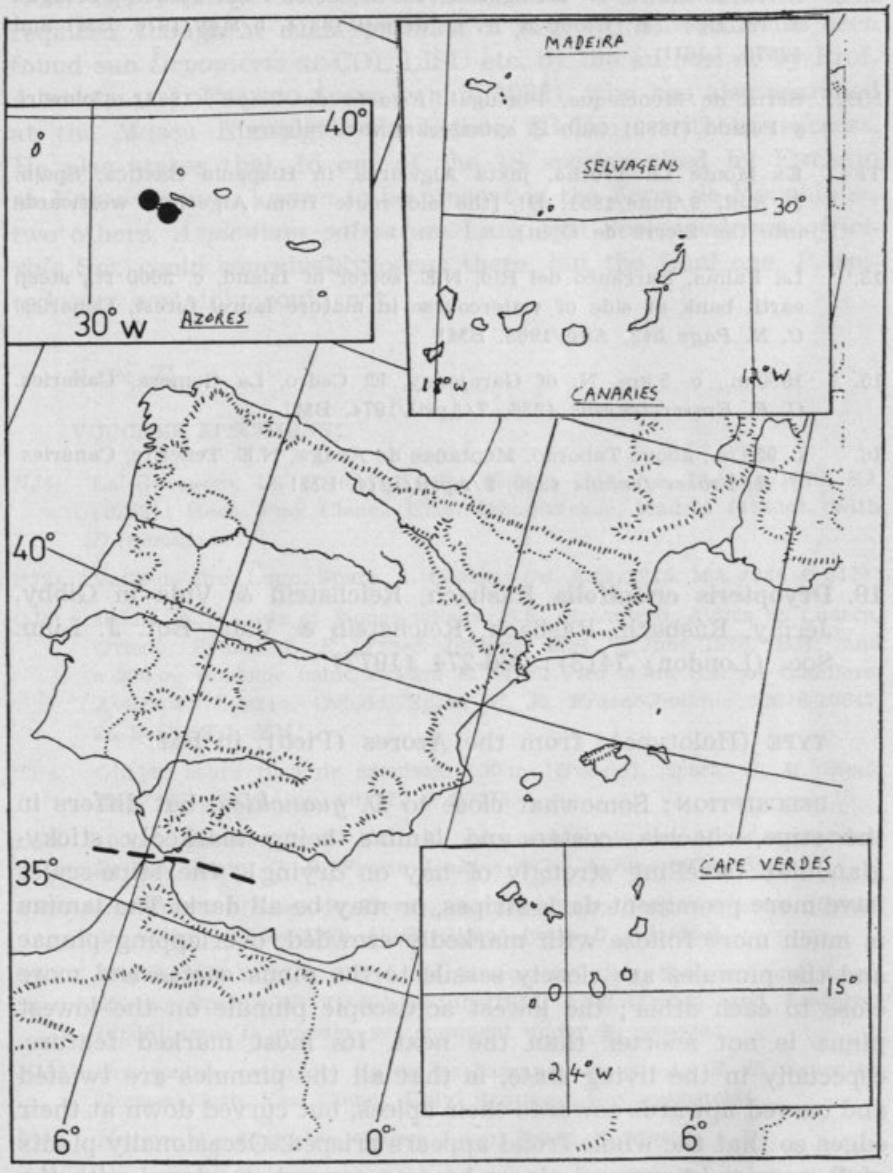
15. 1050 m., c. 5 km. N. of Garajonay, El Cedro, La Gomera, Canaries. *C. R. Fraser-Jenkins* 4236, 7/April/1974. BM!

16. c. 950 m., above Taborno, Montañas de Anaga, N.E. Tenerife, Canaries. *C. R. Fraser-Jenkins* 4220, 2/April/1974. BM!

19. **Dryopteris crispifolia** Rasbach, Reichstein & Vida in Gibby, Jermy, Rasbach, Rasbach, Reichstein & Vida, Bot. J. Linn. Soc. (London) **74**(3): 266-274 (1977).

TYPE (Holotype): from the Azores (Pico), in BM!

DESCRIPTION: Somewhat close to *D. guanchica,* but differs in the stipe, rhachis, costae and lamina being markedly sticky-glandular (smelling strongly of hay on drying); the stipe-scales have more prominent dark stripes, or may be all dark. The lamina is much more foliose with markedly crowded, overlapping pinnae and the pinnules are closely sessile to the pinna costae and more close to each other; the lowest acroscopic pinnule on the lowest pinna is not shorter than the next. Its most marked feature, especially in the living state, is that all the pinnules are twisted and curved upwards towards their apices, but curved down at their edges so that the whole frond appears crisped. Occasionally plants of *D. azorica* in exposed places become somewhat crisped with the edges of their pinnules turned downwards only, but their segments are not so crowded and the lowest pinnulets are not so deeply lobed. Ripe (dark) spore-samples contain regular, minutely-spinulose spores. Tetraploid sexual.


MADEIRA
SELVAGENS
40°
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AZORES
18°W
12°W
CANARIES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 22.

HABITAT: On banks or among low bushes (*Erica* etc.). From c 400-900 m altitude.

RANGE: endemic to the Azores (Pico and Faial).

NOTES: The discovery by the authors mentioned above of this new species in the Azores accounted for many previous reports of *D. dilatata,* as opposed to *D. azorica,* from there, excluding the first collection of true *D. dilatata* on Pico Island by BOTELHO GONÇALVES and SJÖGREN in 1968. The reports by GIBBY, WIDÉN & WIDÉN (1978) and GIBBY (1979) of the occurrence of *D. crispifolia* on São Miguel were in error for a somewhat crispaceous specimen of *D. azorica* (*Dansereau, Pinto da Silva & Rainha* no. 872, in LISE!).

D. crispifolia is an allotetraploid species derived most probably from *D. azorica* and *D. aemula* and is thus genomically identical to *D. guanchica* [see GIBBY, WIDÉN & WIDÉN (1978) and GIBBY (1979)]. It seems likely that the morphological differences between the two reflect the differences between *D. azorica* and *D. intermedia* subsp. *maderensis,* the two presumed part ancestral species of *D. crispifolia* and *D. guanchica* respectively. Unlike *D. guanchica, D. crispifolia* was almost certainly formed *in situ* on the Azores and is the only species, of all the allotetraploids in this group, which occurs sympatrically with both its parents today. Its chemistry [see WIDÉN, LOUNASMAA, VIDA & REICHSTEIN (1975) and GIBBY, WIDÉN & WIDÉN (1978)] also supports this origin, provided that certain compounds are suppressed when combined with other genomes, for which suppression the authors concerned provide evidence.

On Faial along with normal plants, some interesting plants of *D. crispifolia* occur which have flat fronds in the living state and less crowded segments. Though looking somewhat similar to *D.* × *martinsiae* (= *D. aemula* × *D. crispifolia),* they are not hybrids and have good spores. They are somewhat intermediate between *D. guanchica* and *D. crispifolia,* though still clearly referable to the latter.

MAP: 22.

VOUCHER SPECIMENS:

5 800 m., ravines below Cabeço Gordo, S. side of Caldeira, Faial, Azores. *C. R. Fraser-Jenkins* 9597, 18/July/1979. BM!

6. 700 m., 1 km. W. from Cabeço do Rondo, Pico, Azores. *H. & K. Rasbach* (T. Reichstein no. 3530), 8/May/1973. BM! G!

Excluded species

1. **Dryopteris cristata** (L.) Gray

This species has been recorded by several authors from Spain [e. g. LAGASCA, GARCIA & ROXAS-CLEMENTE (1802), WILLKOMM in WILLKOMM & LANGE (1861), COLMEIRO Y PENIDO (1889), ARIZAGA (1914), RUIZ DE AZÚA (1928), JALAS & SUOMINEN (1972) and MAYOR, DIAZ, NAVARRO & SIMÓ (1977), the latter in error for *D. aristata* (= *D. expansa*) given by STEPHENSON (1927)]. However the description given by LAGASCA, GARCIA & ROXAS-CLEMENTE (1802) almost certainly applies to *D. filix-mas*, and the other localities mentioned seem highly unlikely for *D. cristata* which is a species that occurs considerably further North in Europe. The name *D. cristata* has often been erroneously applied in various parts of Europe to *D. carthusiana* and *D. dilatata* and this has probably happened to a certain extent in Spain, but it has usually been applied there to *D. filix-mas*. No specimens of *D. cristata* from Iberia exist in the many herbaria examined by the present author except for the following: — «Polystichum cristatum. [Puerto de Tosas'] Montes de Planes ['Gerona], Cataluña. [*Vayreda*] Herb. Hisp. *M. Rivas Mateos* 2265. Junio». MAF (44462)! (square DG1).

This specimen is unequivocal *D. cristata*, but seems most unlikely to have come from Spain. The author is most grateful to Prof. P. MONTSERRAT of Jaca for pointing out (pers. comm. 1980) further details of this specimen, not written on the label and warning that RIVAS MATEOS is known to have muddled labels on specimens and to have recorded specimens as from Spain that actually came from elsewhere in Europe, information that he had heard from FONT-I-QUER.

Therefore *D. cristata* is rejected as a Spanish species. LAÍNZ (1973*b*) also opined that *D. cristata* has been recorded from

Iberia in error and RUIZ DE AZÚA (1928) mentioned that such records might refer to juvenile plants.

2. **Dryopteris patula** (Sw.) Underw.

A specimen at Kew which appears to be this Central American species is presumed to have a transposed label; no other such collections have been seen. The specimen is labelled: «Nephrodium denticulatum (Sw.), Fonte da Chupadeira, Monte Queimada. Cape Vertes. Feb. 13th, 66. Cape Vertes. *R. T. Lowe*».

Hybrids

A number of hybrids between species have been found in the area, particularly in the Azores. Hybrids are defined here as being the F_1 offspring of an act of gamete fusion (hybridisation) between two species. Because of the presence of such hybrids it is important when identifying collections to check for them before placing the specimens into species; this can only be reliably done from examination of spore-samples (dry or mounted) with a stage-microscope at c. 100 × magnification or more. It is therefore important that collections are made of specimens with ripe, black or dark-brown, sori in the act of dehiscing or shortly afterwards, but not when young (white), nor when so old that the (red-brown) sori have lost all their spores.

Hybrids occur spontaneously in low numbers in the population and can be recognised initially (in the field) by their intermediate appearance and confirmed from their abortive mis-shapen spores. A few hybrids which have involved an apomictic parent, such as *D.* × *tavelii* (= *D. affinis* × *D. filix-mas*), have partially good spores, but the majority are still abortive. *D.* × *tavelii*, though capable in ideal conditions of reproducing itself, does not appear to do so on any large scale, and remains in low numbers in any one population of ferns, like any other hybrid. It appears that hybrids between parents that have a genome in common [e. g. *D.* × *madalenae* (= *D. azorica* × *D. crispifolia*)] are more easily formed and considerably more common than those between unrelated parents [e. g. *D.* × *cedroensis* (= *D. guanchica* × *D. oligodonta*)]. It is from hybrids, particularly diploid sexual ones, that allopolyploid species have formed in the past; the lower ploidy

apomictic hybrids may also give rise directly to new subspecies or species if they are sufficiently fertile.

So far twelve *Dryopteris* hybrids have been discovered in the area, though a few more might be expected. Hybrids in this genus can apparently only form between two sexually reproducing species, or a sexual reproducing species and an apomictic species, but not between two apomictic species.

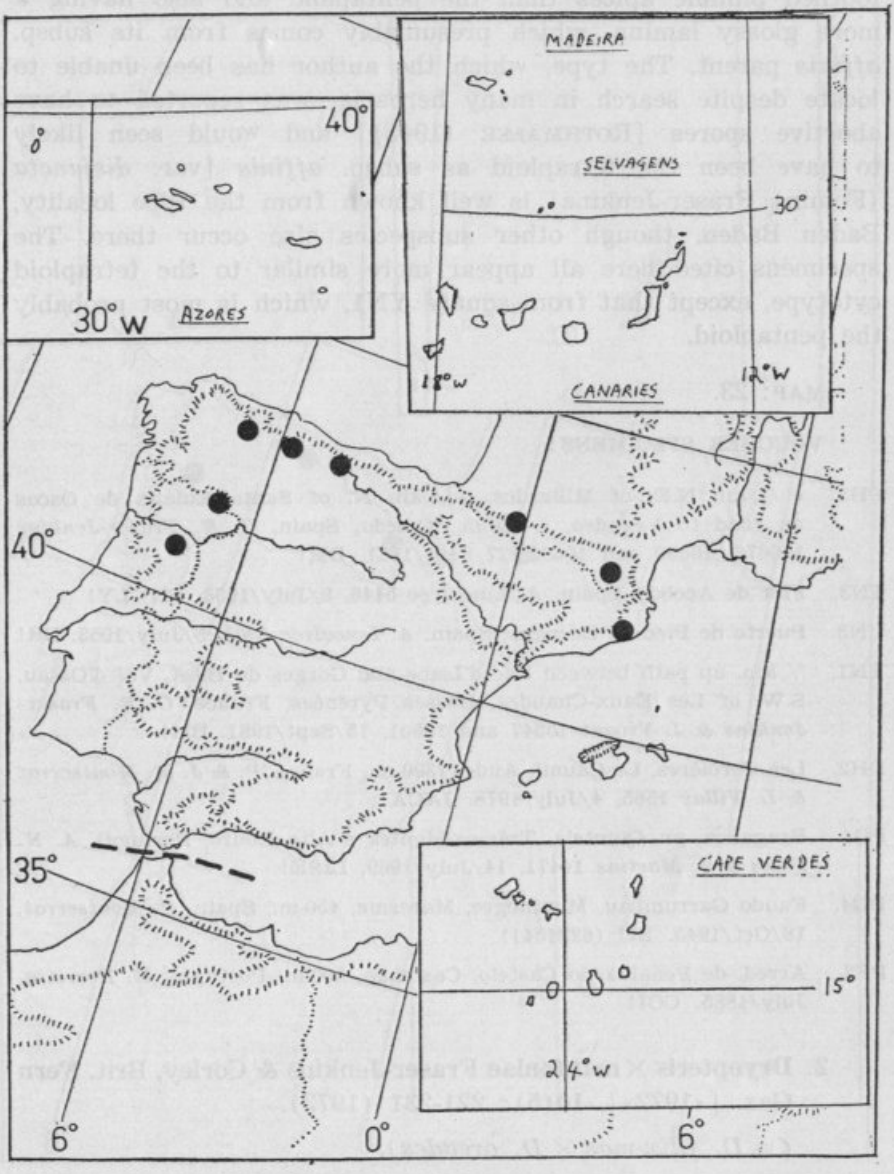
The hybrids are as follows; it has not been considered necessary to describe them all as all have intermediate morphology between the parents.

1. **Dryopteris × tavelii** Rothmaler, Candollea **10**: 92-93 (1945). (= *D. affinis* × *D. filix-mas*)

TYPE: from S.W. Germany (Baden Baden. Coll. *O. Swartz*), not located.

RANGE: Scattered throughout Europe where *D. affinis* and *D. filix-mas* occur together; also S.W. France, Spain and Portugal.

NOTES: Widely over-reported in the area [e. g. LAWALRÉE (1956) and REICHLING (1963)] and elsewhere, such reports often mentioning populations of the hybrid, due to confusion with *D. affinis,* particularly with subsp. *borreri* [including var. *robusta* (see under subsp. *borreri*)]. This hybrid shows more features of *D. filix-mas,* especially in its thinner indusium (which therefore lifts and shrivels more in the later stages, though beginning well curved down at the sides) and often more acute pinnule teeth, than do the subspecies of *D. affinis*, and does not occur as large populations, but as isolated plants. It cannot be reliably identified without examination of its spores when ripe, but not mostly shed, which are mostly abortive, with scattered, very large, good spores, whereas *D. affinis* normally has a clear majority of good spores, the good ones being smaller than those in the hybrid. The hybrid occurs as a tetraploid apomict derived partly from subsp. *affinis,* which is more common in Western Europe, and also as a pentaploid apomict derived partly from subsp. *borreri,* which is more common in Central Europe [see DÖPP (1939) and (1955), MANTON (1950), SCHNELLER (1974) and FRASER-JENKINS (1980*a*)]. The two cytotypes are slightly distinct morphologically, the tetraploid having more rounded and less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SELVAGENS
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AZORES
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CANARIES
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CAPE VERDES
15°
24°w
6°
0°
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MAP 23.

toothed pinnule apices than the pentaploid and also having a more glossy lamina, which presumably comes from its subsp. *affinis* parent. The type, which the author has been unable to locate despite search in many herbaria, was reported to have abortive spores [ROTHMALER (1945)] and would seen likely to have been the tetraploid as subsp. *affinis* [var. *disjuncta* (Fomin) Fraser-Jenkins] is well known from the type locality, Baden Baden, though other subspecies also occur there. The specimens cited here all appear more similar to the tetraploid cytotype, except that from square YN1, which is most probably the pentaploid.

MAP: 23.

VOUCHER SPECIMENS:

PH3. c ½ km N.E. of Millardos, 1½ km N. of Santa Eulalia de Oscos on road to Vegadeo, c 650 m., Oviedo, Spain. *C. R. Fraser-Jenkins* 106676, 10680 and 10682, 27/Sept/1981. BM!

TN3. Flor de Acebos, Spain. *A. Lawalrée* 5446, 9/July/1953. BR! LY!

UN3. Puerto de Piedras Luengas, Spain. *A. Lawalrée* 5301, 5/July/1953. BR!

YN1. ½ km. up path between Lac d'Isabe and Gorges du Bitet, Val d'Ossau, S.W. of Les Eaux-Chaudes, Basses Pyrénées, France. *C. R. Fraser-Jenkins & J. Vivant* 10547 and 10561, 15/Sept/1981. BM!

DH2. Les Corbières, Le Caunil, Aude, 1300 m., France. *P. & J. M. Montserrat & L. Villar* 1565, 4/July/1978. JACA!

PG4. Bragança, pr. Quintela, Trás-os-Montes e Alto Douro, Portugal. *A. N. Teles & J. Martins* 14471, 14/July/1969. LISE!

DG4. Faudo Garrumbau, Montnegre, Maresme, 450 m., Spain. *P. Montserrat*, 18/Oct/1945. BC (622154)!

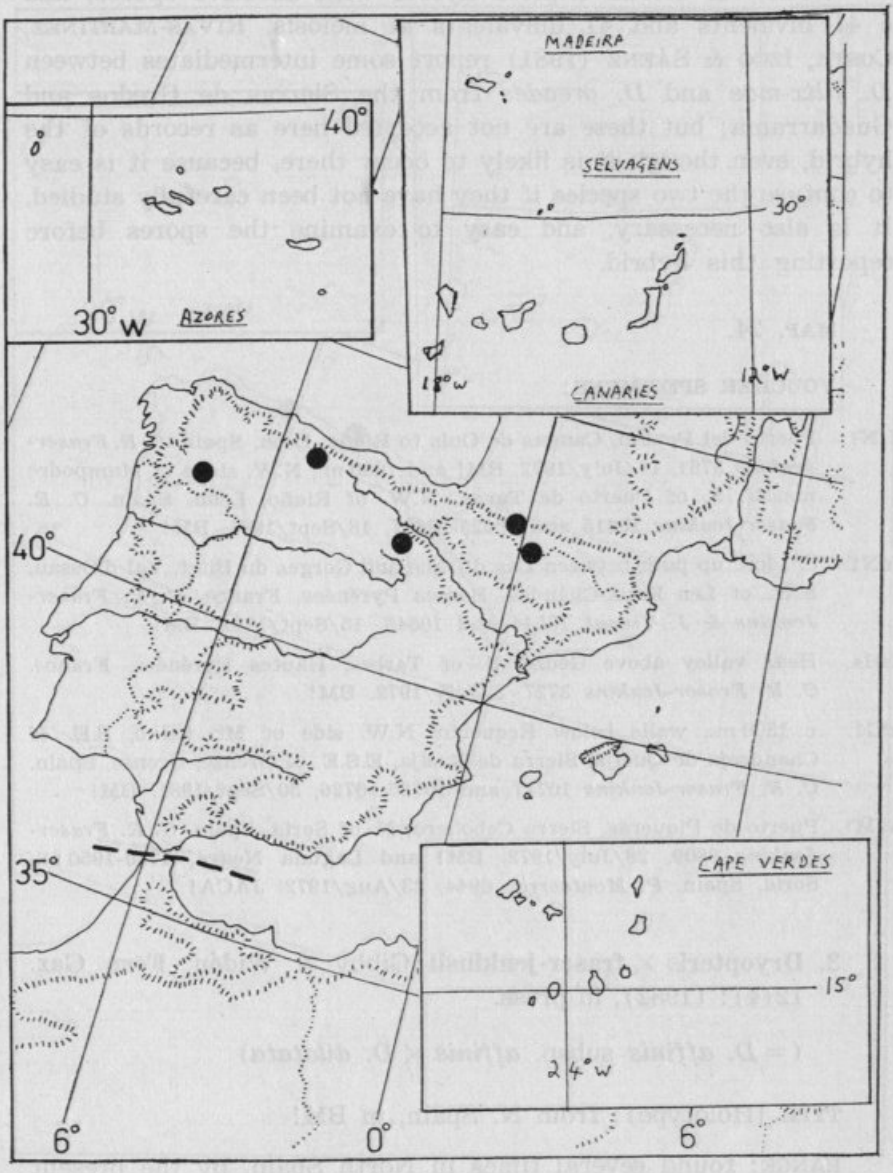
PF2. Arred. de Penalva do Castelo, Castendo, 500 m, Portugal. *M. Ferreira*, July/1885. COI!

2. **Dryopteris × mantoniae** Fraser-Jenkins & Corley, Brit. Fern Gaz. [«1972»], **10**(5): 221-231 (1973).

(= D. filix-mas × D. oreades).

TYPE (Holotype): from Britain (Wales), in BM!

RANGE: Scattered throughout West Europe, Turkey and the Caucasus where the parents occur together; also Spain [FRASER-JENKINS (1976)].



MAP 24.

NOTES: A sterile triploid hybrid with abortive spores, and c 41 bivalents and 41 univalents at meiosis. RIVAS-MARTÍNEZ, COSTA, IZCO & SÁENZ (1981) report some intermediates between *D. filix-mas* and *D. oreades* from the Sierras de Gredos and Guadarrama; but these are not accepted here as records of the hybrid, even though it is likely to occur there, because it is easy to confuse the two species if they have not been carefully studied. It is also necessary, and easy to examine the spores before reporting this hybrid.

MAP. 24.

VOUCHER SPECIMENS:

UN1. Puerto del Ponton, Cangas de Onis to Riaño, León, Spain. *C. R. Fraser-Jenkins* 3761, 14/July/1972. BM! and 1650 m., N.W. slope of Mampodre massif, S. of Puerto de Tarna, N.W. of Riaño, León, Spain. *C. R. Fraser-Jenkins* 10615 and 10625-10627, 18/Sept/1981. BM!

YN1. c. 1 km. up path between Lac d'Isabe and Gorges du Bitet, Val d'Ossau, S.W. of Les Eaux-Chaudes, Basses Pyrénées, France. *C. R. Fraser-Jenkins & J. Vivant* 10544 and 10545, 15/Sept/1981. BM!

BH4. Heas valley above Gèdre, S. of Tarbes, Hautes Pyrénées, France. *C. R. Fraser-Jenkins* 3727, 8/July/1972. BM!

PG1. c 1300 m., walls below Requeixo, N.W. side of Mt. Seixo, S.E. of Chandreja de Queija, Sierra de Queija, E.S.E. of Orense, Orense, Spain. *C. R. Fraser-Jenkins* 10717 and 10725-10726, 30/Sept/1981. BM!

WM1. Puerto de Piqueras, Sierra Cebollera, N. of Soria, Spain. *C. R. Fraser-Jenkins* 3809, 28/July/1972. BM! and Laguna Negra, 1750-1950 m., Soria, Spain. *P. Montserrat* 6944, 23/Aug/1972. JACA!

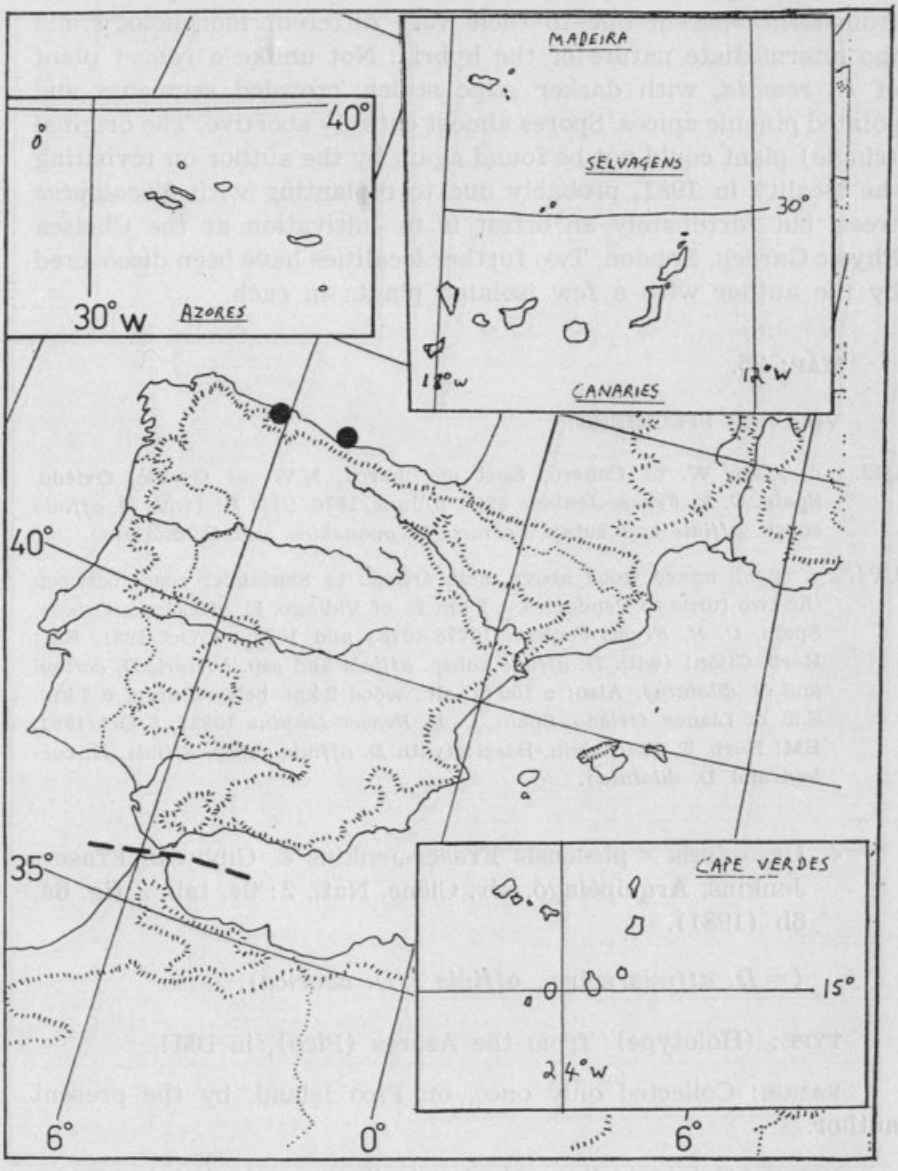
3. **Dryopteris × fraser-jenkinsii** Gibby & Widén, Fern Gaz. 12(4): (1982), in press.

(= *D. affinis* subsp. *affinis* × *D. dilatata*)

TYPE (Holotype): from N. Spain, in BM!

RANGE: found several times in North Spain, by the present author.

NOTES: A tetraploid hybrid which has been investigated by GIBBY & WIDÉN (in press). The identity of its second parent as *D. dilatata*, as opposed to other members of the *D. dilatata* group


MADEIRA
SELVAGENS
30°
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40°
30°W
AZORES
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35°
CAPE VERDES
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24°W
6°
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MAP 25.

(such as *D. guanchica*) requires confirmation. Markedly different from either parent due to their very different morphology and the intermediate nature of the hybrid. Not unlike a robust plant of *D. remota,* with darker stipe scales, crowded segments and pointed pinnule apices. Spores almost entirely abortive. The original (single) plant could not be found again by the author on revisiting the locality in 1981, probably due to replanting with *Eucalyptus* trees, but fortunately an offset is in cultivation at the Chelsea Physic Garden, London. Two further localities have been discovered by the author with a few isolated plants in each.

MAP: 25.

VOUCHER SPECIMENS:

QJ2. c ½ km W. of Canero, East of Luarca, N.W. of Oviedo, Oviedo. Spain. *C. R. Fraser-Jenkins* 4899, 5/June/1976. BM! P! (with *D. affinis* subsp. *affinis* and subsp. *borreri, D. guanchica* and *D. dilatata*).

UP4. c. 50 m., mixed wood above main Oviedo to Santander road, between the two turns to Pendueles, c 2 km E. of Vidiago, E. of Llanes, Oviedo, Spain. *C. R. Fraser-Jenkins* 10778-10781 and 10798, 3/Oct/1981. BM! Herb. Gijón! (with *D. affinis* subsp. *affinis* and ssp. *borreri, D. corleyi* and *D. dilatata).* Also: c 100 m. alt., wood 2 km. below Puron, c 7 km. S.E. of Llanes, Oviedo, Spain. *C. R. Fraser-Jenkins* 10835, 5/Oct/1981. BM! Herb. T. Reichstein, Basel! (with *D. affinis* subsp. *affinis, D. corleyi* and *D. dilatata*).

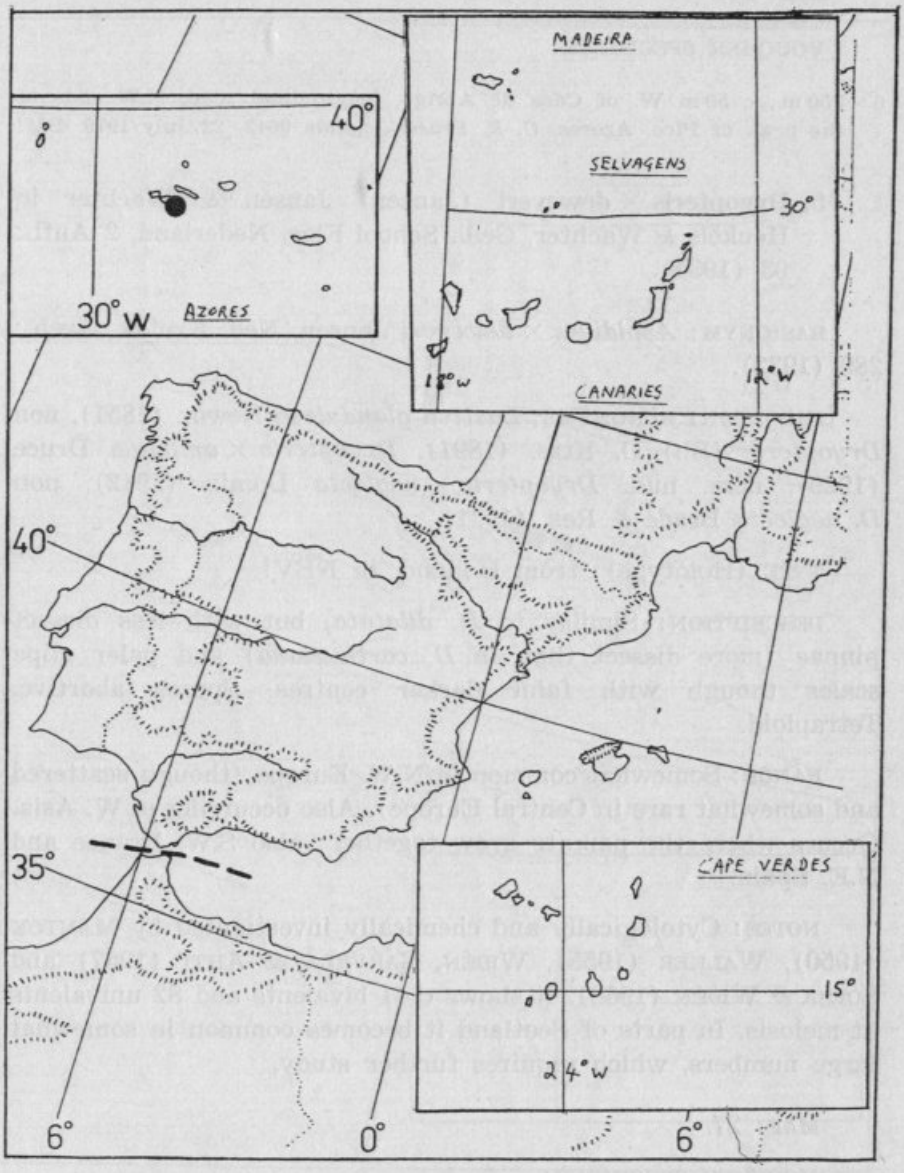
4. **Dryopteris × picoensis** Fraser-Jenkins & Gibby in Fraser-Jenkins, Arquipélago, sér. Ciênc. Nat., **2**: 94, tab. 3 fig. **6a, 6b** (1981).

(= *D. affinis* subsp. *affinis* × *D. azorica*).

TYPE: (Holotype): from the Azores (Pico), in BM!

RANGE: Collected only once, on Pico Island, by the present author.

NOTES: Cytologically and chemically investigated by GIBBY & WIDÉN (in press) and found to be a triploid hybrid. Spores mostly abortive. Similar in morphology to *D. remota,* but with more crispaceous, narrower and less dissect fronds than *D.×fraser-jenkinsii.*


MADEIRA
SELVAGENS
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CANARIES
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AZORES
40°
35°
CAPE VERDES
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24°w
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MAP 26.

MAP. 26.

VOUCHER SPECIMENS:

6. 850 m., c 50 m W. of Casa de Abrigo, longitudinal road, N.W. side of the peak of Pico, Azores. *C. R. Fraser-Jenkins* 9642, 22/July/1979. BM!

5. **Dryopteris × deweveri** (Jansen) Jansen & Wachter in Heukels & Wachter, Geill. School Flor. Nederland, 2 Aufl.: 93 (1934).

BASIONYM: *Aspidium × deweveri* Jansen, Ned. Kruidk. Arch.: 289 (1932).

IMPORTANT SYNONYMS: *Lastrea glandulosa* Newm. (1851), non *Dryopteris* (Bl.) O. Ktze. (1891). *Dryopteris × ambigua* Druce (1929), nom. nud. *Dryopteris × neglecta* Domin (1942), non *D. neglecta* Brade & Res. (1931).

TYPE (Holotype): from Holland, in NBV!

DESCRIPTION: Similar to *D. dilatata,* but with less dissect pinnae (more dissect than in *D. carthusiana*) and paler stipe scales though with faint darker centres. Spores abortive. Tetraploid.

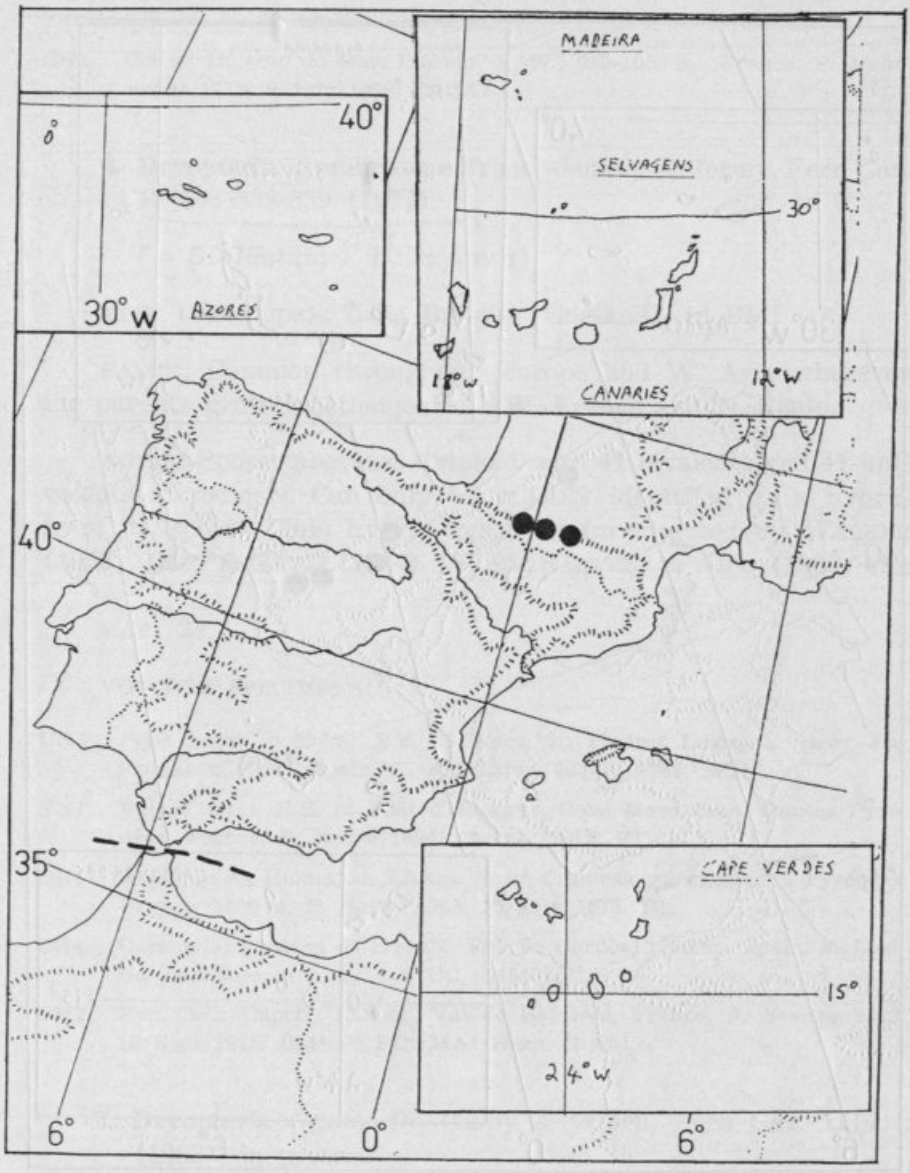
RANGE: Somewhat common in N.W. Europe (though scattered and somewhat rare in Central Europe). Also occurring in W. Asia. Occurs where the parents grow together; also S.W. France and N.E. Spain.

NOTES: Cytologically and chemically investigated by MANTON (1950), WALKER (1955), WIDÉN, SARVELA & AHTI (1967) and SORSA & WIDÉN (1968). It shows c 41 bivalents and 82 univalents at meiosis. In parts of Scotland it becomes common in somewhat large numbers, which requires further study.

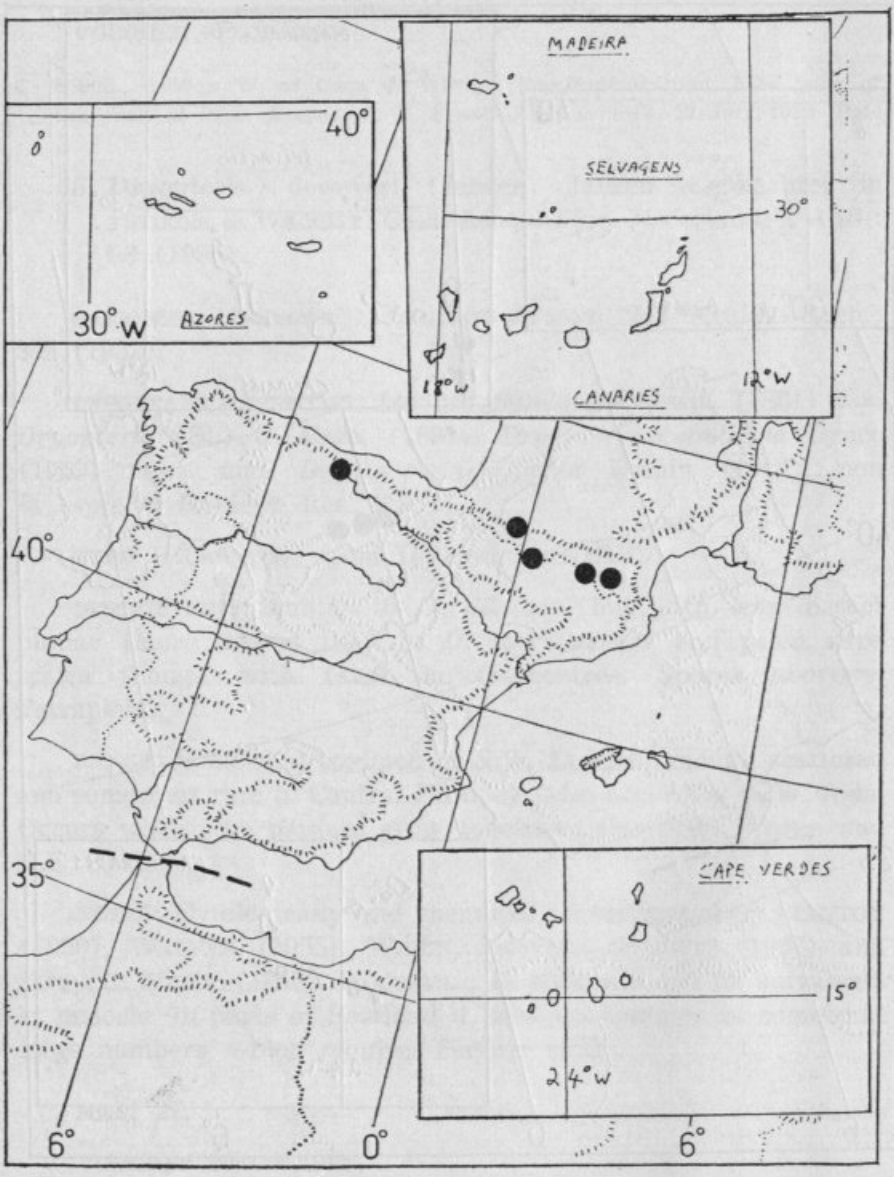
MAP: 27.

VOUCHER SPECIMENS:

YN1. c ½ km. up path between Lac d'Isabe and Gorges du Bitet, Val d'Ossau, S.W. of Les Eaux-Chaudes, Basses Pyrénées, France. *C. R. Fraser-Jenkins & J. Vivant* 10553, 15/Sept/1981. BM! Herb. J. Vivant, Orthez!


MADEIRA
SELVAGENS
30°
18°W
CANARIES
12°W
40°
30°W
AZORES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 27.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SELVAGENS
40°
30°
30° W
AZORES
18° W
12° W
CANARIES
40°
35°
CAPE VERDES
15°
24° W
6°
0°
6°

MAP 28.

BH3. Pla de Serre, 1.5 km au S.W. de Cadéac, 1200 m., Hautes Pyrénées, France. *F. Badré* 1612, 19/July/1975. P!

CH1. Col de Hô, Pic du Gar, Luchon, N.-W., 940-1050 m., France. *P. Montserrat* 1779, 8/July/1978. JACA!

6. **Dryopteris × ambroseae** Fraser-Jenkins & Jermy, Fern Gaz. 11(5): 338-339 (1977).

(= D. dilatata × D. expansa)

TYPE (Holotype): from Britain (England), in BM!

RANGE: Common throughout Europe and W. Asia wherever the parents grow together; also S.W. France and N. Spain.

NOTES: Spores abortive. Triploid with 41 bivalents and 41 univalents at meiosis. Can only be reliably identified as a hybrid from its spores. This hybrid has been investigated by WALKER (1955), DÖPP & GÄTZI (1964), WIDÉN, SARVELA & AHTI (1967) etc.

MAP: 28.

VOUCHER SPECIMENS:

UN3. Peña Labra, c 30 km. S.E. of Potes, nr. Piedras Luengas, [prov. Palencia], c 7000', Spain. *H. McAlister*, 8/July/1967, MB!

YN1. Val de Jéret, N.E. of Pont d'Espagne, Gave Marcadeau, Hautes Pyrénées, France. *F. Badré* 1690, 23/July/1975. P!

BH4. Ruisseau du Riomajou, 7.5 km. S. of Tramezaygues, Hautes Pyrénées, France, 1400 m. *F. Badré* 1503, 15/July/1975. P!

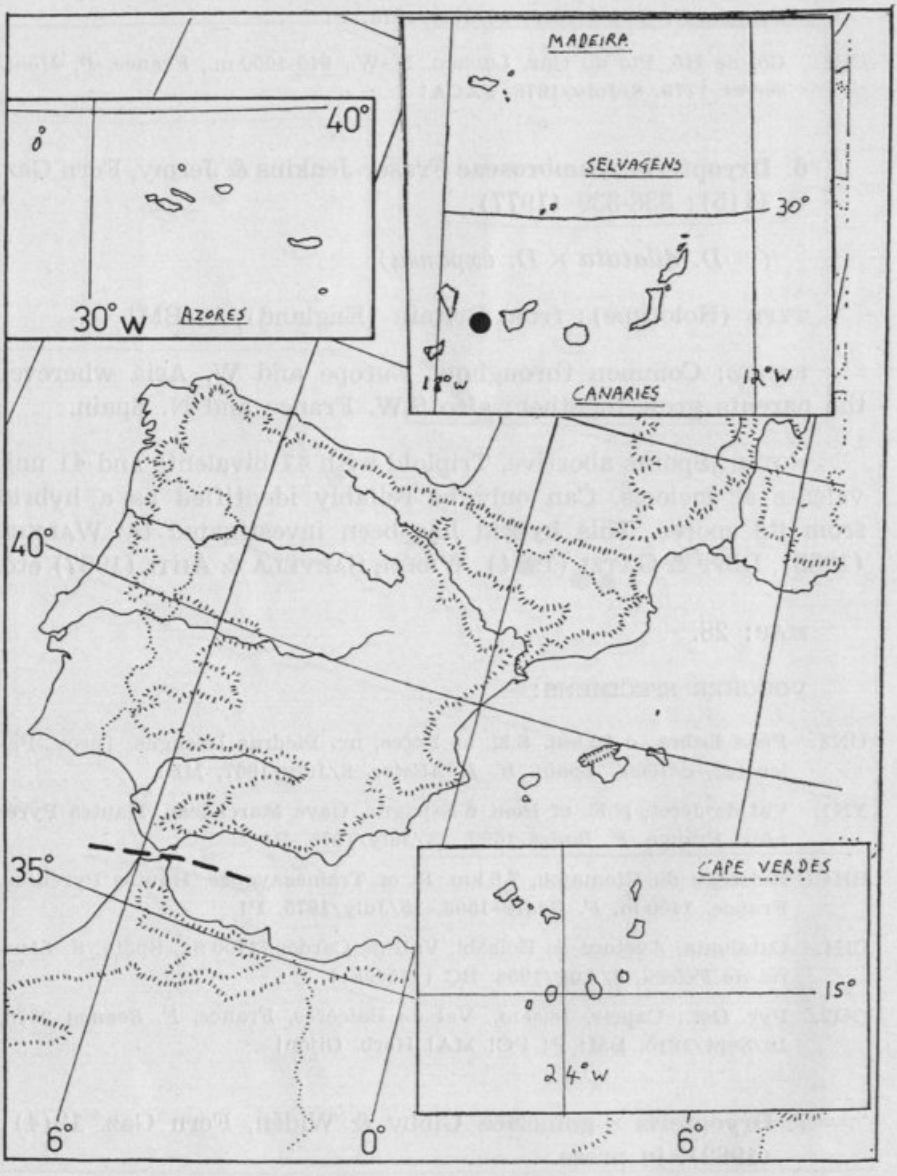
CH4. Catalunia, Avetora de Bolsabi, Vall de Cardós, 1700 m., Spain. *S. Lleuria de Felceu*, 8/Aug/1956. BC (145408)!

DH2. Pyr. Ost.: Capcir, 1800 m., Val de Balcères, France. *F. Sennen* 2373, 10/Sept/1915. BM! P! PC! MA! Herb. Gijón!

7. **Dryopteris × gomerica** Gibby & Widén, Fern Gaz. 12(4): (1982), in press.

(= D. aemula × D. guanchica)

TYPE (Holotype): from the Canary Islands (La Gomera), in BM!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SELVAGENS
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40°
30°W
AZORES
18°W
12°W
CANARIES
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 29.

RANGE: Known only from a single plant found on La Gomera by the present author, though it may be expected to occur more frequently.

NOTES: Spores abortive. Triploid with 41 bivalents and 41 univalents at meiosis. This hybrid has been investigated cytologically and chemically by GIBBY; WIDÉN & WIDÉN (1978) and GIBBY (1979).

MAP: 29.

VOUCHER SPECIMENS:

15. c 1000 m, top of Mña. Quemada, nr. junction with side road to Agulo, El Cedro, La Gomera, Canaries. *C. R. Fraser-Jenkins* 4211, 31/March/1974. BM! PE!

8. **Dryopteris × martinsiae** Fraser-Jenkins, Arquipélago, sér. Ciênc. Nat., 2: 95, tab. 3 fig. 7 (1981).

(= D. aemula × D. crispifolia)

TYPE (Holotype): from the Azores (Pico), in BM!

RANGE: Known from a few plants found by the present author and also by Prof. E. SJÖGREN on Pico.

NOTES: Spores abortive. Cytotype unknown though presumed to be triploid; plants are being investigated by Dr. M. GIBBY of the British Museum (Natural History), London.

MAP: 30.

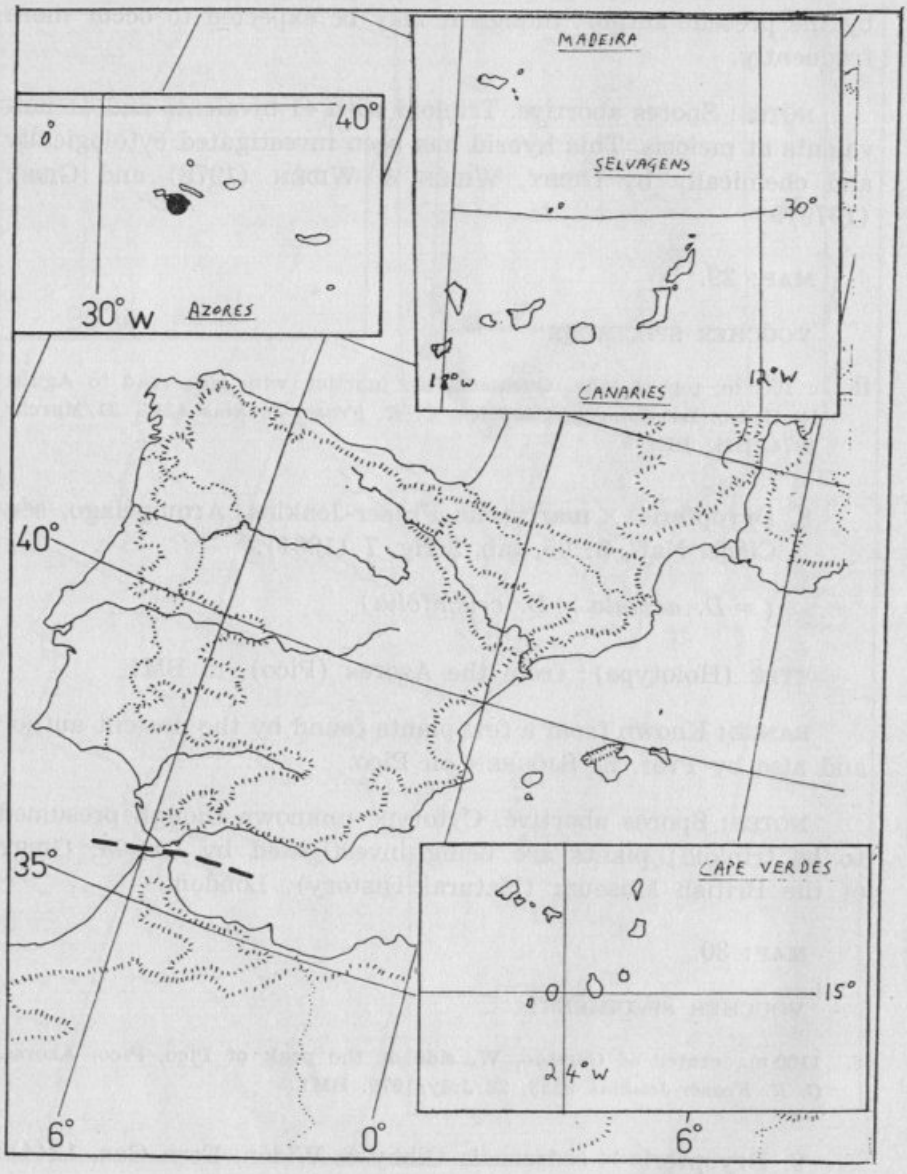
VOUCHER SPECIMENS:

e. 1100 m., crater of Capitão, W. side of the peak of Pico, Pico, Azores. *C. R. Fraser-Jenkins* 9653, 22/July/1979. BM!

9. **Dryopteris × cedroensis** Gibby & Widén, Fern Gaz. 12(4): (1982), in press.

(= D. guanchica × D. oligodonta).

TYPE (Holotype): from the Canaries (La Gomera), in BM!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SELVAGENS
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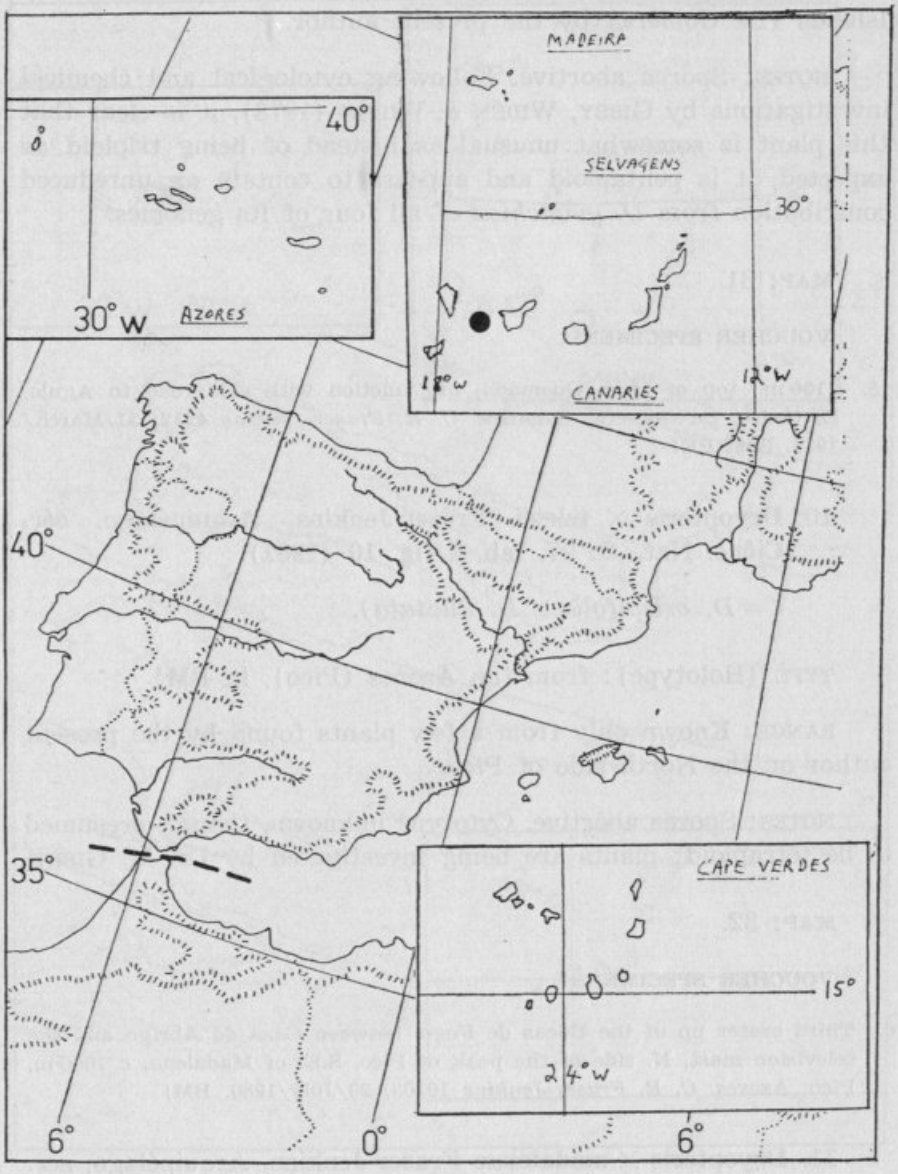
30° W
AZORES
18° W
CANARIES
12° W
40°
35°
CAPE VERDES
15°
24° W
6°
0°
6°

MAP 30.


MADEIRA
SELVAGENS
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AZORES
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CANARIES
12° W
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CAPE VERDES
15°
24° W
6°
0°
6°

MAP 31.

RANGE: Known only from a single plant found in the Canary Islands (La Gomera) by the present author.

NOTES: Spores abortive. Following cytological and chemical investigations by GIBBY, WIDÉN & WIDÉN (1978), it is clear that this plant is somewhat unusual as instead of being triploid as expected, it is pentaploid and appears to contain an unreduced contribution from *D. guanchica* of all four of its genomes.

MAP: 31.

VOUCHER SPECIMENS:

15. 1100 m., top of Mña. Quemada, nr. junction with side road to Agulo, El Cedro, La Gomera, Canaries. *C. R. Fraser-Jenkins* 4212, 31/March/1974. BM! PE!

10. **Dryopteris × telesii** Fraser-Jenkins, Arquipélago, sér. Ciênc. Nat., 2: 97, tab. 4 fig. 10 (1981).

(= D. crispifolia × D. dilatata).

TYPE (Holotype): from the Azores (Pico), in BM!

RANGE: Known only from a few plants found by the present author on the North side of Pico.

NOTES: Spores abortive. Cytotype unknown, though presumed to be tetraploid; plants are being investigated by Dr. M. GIBBY.

MAP: 32.

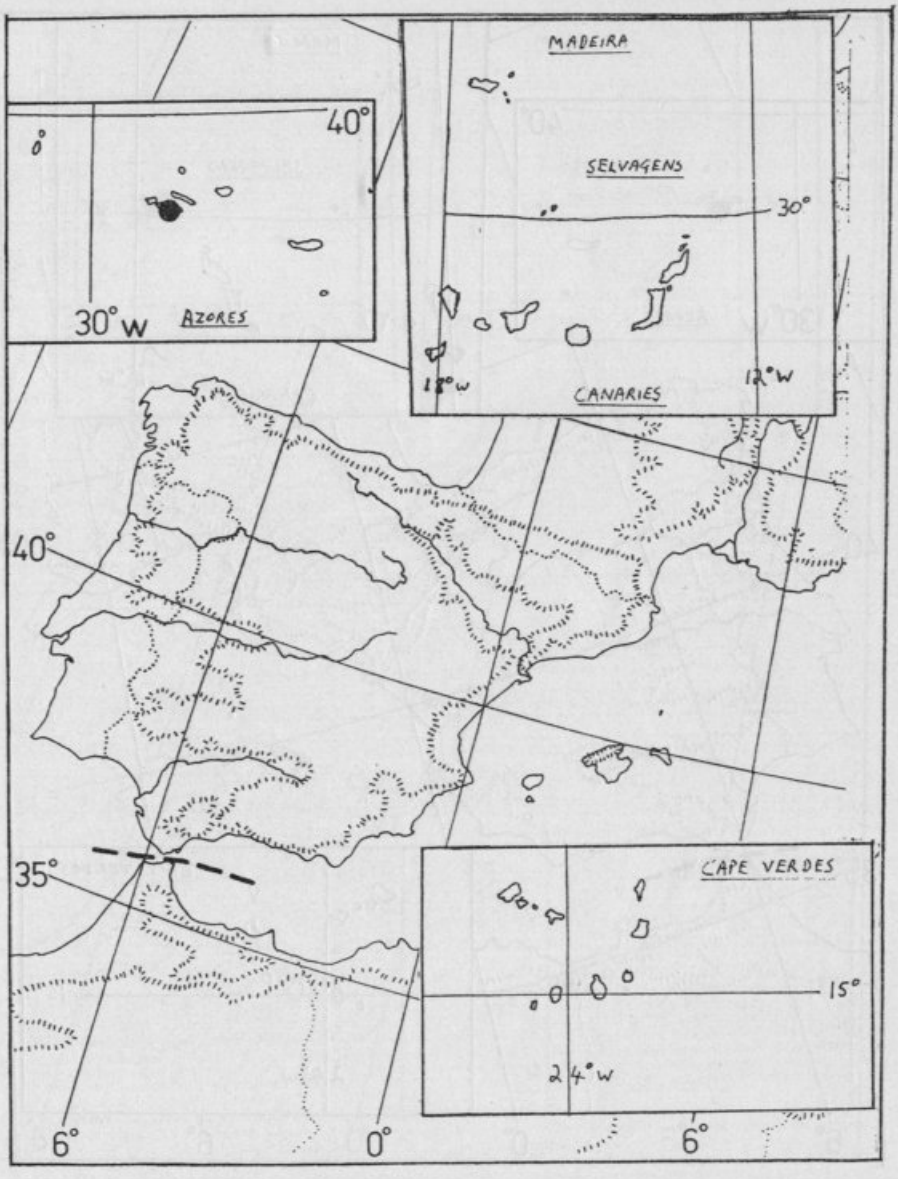
VOUCHER SPECIMENS:

6. Third crater up of the Bocas de Fogo, between Casa de Abrigo and the television mast, N. side of the peak of Pico, S.E. of Madalena, c 1000 m, Pico, Azores. *C. R. Fraser-Jenkins* 10103, 20/July/1980. BM!

11. **Dryopteris × madalenae** Fraser-Jenkins, Arquipélago, sér. Ciênc. Nat., 2: 96, tab. 3 fig. 9 (1981).

(= D. azorica × D. crispifolia)

TYPE (Holotype): from the Azores (Pico), in BM!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40°
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AZORES
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CANARIES
12° W
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CAPE VERDES
15°
24° W
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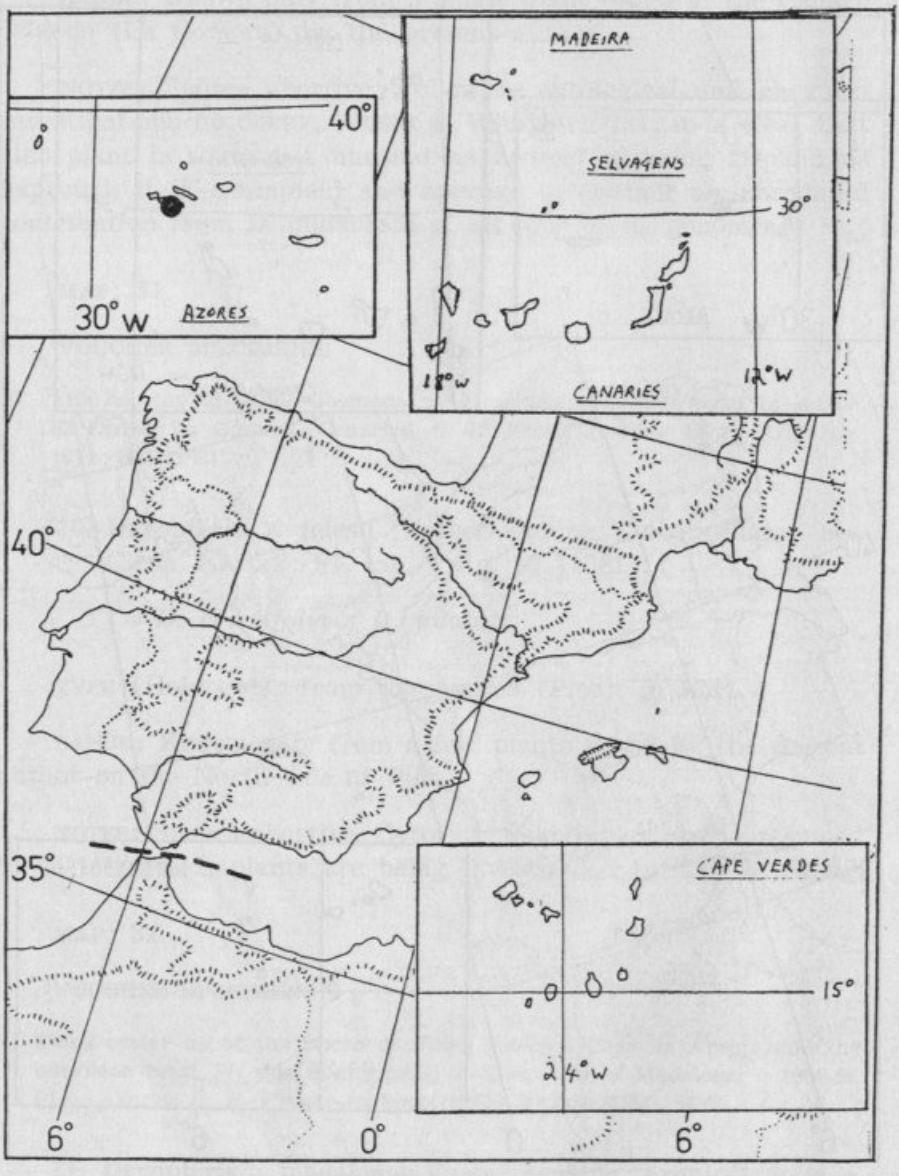
0°
6°

MAP 32.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SELVAGENS
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30°
30° W
AZORES
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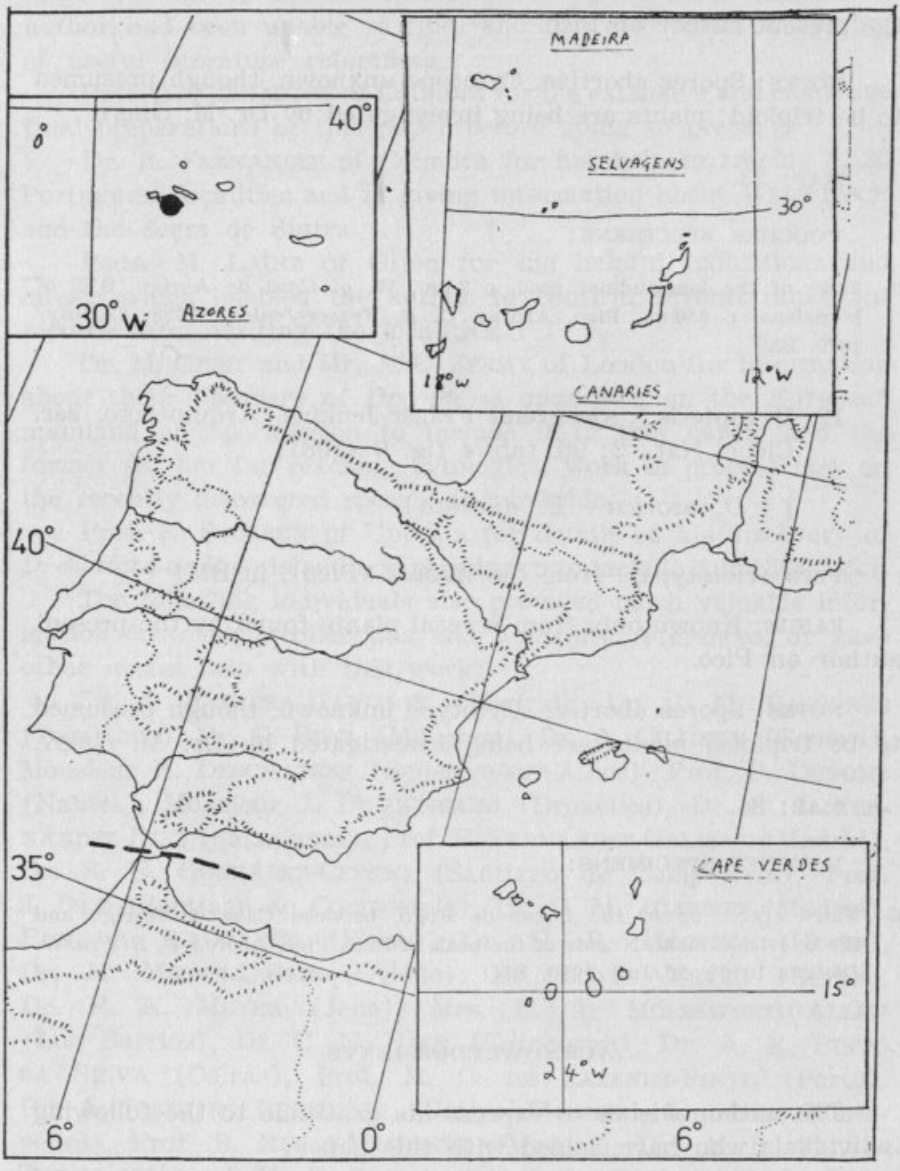
CANARIES
12°W
40°
35°
CAPE VERDES
15°
24°W
6°
0°
6°

MAP 33.


MADEIRA
SELVAGENS
30°
40°
30° W
AZORES
18° W
12° W
CANARIES
40°
35°
CAPE VERDES
15°
24° W
6°
0°
6°

MAP 34.

RANGE: Known only from rather numerous plants found by the present author on Pico.

NOTES: Spores abortive. Cytotype unknown, though presumed to be triploid; plants are being investigated by Dr. M. GIBBY.

MAP: 33.

VOUCHER SPECIMENS:

6 Edge of the longitudinal road, c 2 km. W. of Casa de Abrigo, S.E. of Madalena, c 550 m., Pico, Azores. *C. R. Fraser-Jenkins* 9628, 22/July/1979. BM!

12. **Dryopteris × sjoegrenii** Fraser-Jenkins, Arquipélago, sér. Ciênc. Nat., 2: 96, tab. 4 fig. 9 (1981).

(= D. azorica × D. dilatata)

TYPE (Holotype): from the Azores (Pico), in BM!

RANGE: Known only from several plants found by the present author on Pico.

NOTES: Spores abortive. Cytotype unknown, though presumed to be triploid; plants are being investigated by Dr. M. GIBBY.

MAP: 34.

VOUCHER SPECIMENS:

6 Third crater up of the Bocas de Fogo, between Casa de Abrigo and the television mast, N. side of the peak of Pico, Pico, Azores. *C. R. Fraser-Jenkins* 10108, 20/July/1080. BM!

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Lastly he expresses his reluctant but none-the-less genuine thanks and forgiveness to the railway station porter at New Delhi main station (India) who, having permanently relieved him of a suitcase containing among other things the only manuscript of the present paper, kindly decided later to take the risk of handing in the papers to the British Embassy who promptly returned them to the author, thus enabling the present paper to be produced as originally planed.

APPENDIX

Unlocated specimens are as follows:

1. *D. oreades*. St. Martin Lautesque [? Pyrénées Orientales]. *A. Naudin*, 15/July/1885. MPU!
2. *D. dilatata*. Vallée Lagrave, vers le col, 1800 m., Pyrénées Orientales, France. *L. Conill*, 11/April/1922. TL! [? nr. Canigou].
3. *D. dilatata*. Babanslu. *L. Marty*, 14/Nov/1908. TL!
4. *D. expansa*. Babanslu. *L. Marty*, 14/Nov/1908. TL!
5. *D. affinis* subsp. *affinis*. Gorges de La Courbière, 700 m. 10/July/1915. TL!
6. *D. filix-mas*. Foret de Gabon, Lampy. Sept. TL!
7. *D. filix-mas*. Balcera [? Aude]. *L. Marty*, 7/Aug/1911. TL!
8. *D. filix-mas*. Roc de Marcam. 8/Aug/1913. TL!
9. *D. affinis* subsp. *affinis*. St. Leger. *Gèze*, 15/May/1898. TL!
10. *D. filix-mas*. Bazillac. *Gèze*, 20/May/1896. TL!
11. *D. filix-mas*. Castenyadell. *Masferrer*, 22/July/1869. BC (72463)! [? Catalunia].

12. *D. filix-mas.* Pyrénées Orientales, Mossetau, Cadillan. *Sennen,* 8/Sept/1902. BC!
13. *D. filix-mas.* Ad rivulos in silvis, pr. Thavand. Herb. *Willkommii,* Herb. *Costa,* 24/July/1860, BC!
14. *D. filix-mas.* La Fanera, La Sellera. *Quag. Codina,* 1908. BCF (271)!
15. *D. remota.* Ravin de La Vialle, Bord. de ruisseau avec cascade. *Corvil* 9, 12/Nov/1976. P!
16. *D. affinis* subsp. *affinis.* Benduión, Asturias, Spain. *C. Martinez.* MA (204)!
17. *D. affinis* subsp. *affinis.* Alto del Conio, Asturias. *E. Guinea* 1161, 30/July/1952. MA (164904)!
18. *D. oreades.* Guarramillas, Sa. de Guadarrama, Spain. *F. Beltrán,* July/1911. MA (231)!
19. *D. affinis* subsp. *borreri.* Pajonal, Cáceres. *Rivas Mateos* 2264, Julio. MAF (44475)!
20. *D. filix-mas.* Gredos, Las Charresas. *Rivas Mateos* 2264, 19/July/1924. MAF (65969)!
21. *D. affinis* subsp. *borreri.* Toledo, Montes de Toledo, Puerto de Los Canchales (Toledo). *S. Rivas & E. F. Galiano,* 11/June/1961. SEV! MAF (60650)!
22. *D. affinis* subsp. *affinis.* Ribeiro da Queimada. *Valdemar dos Santos Soldado* 9. COI!
23. *D. affinis* subsp. *borreri.* Frankreich, Pyr. Or., La Jasse, 330 m., Forêt de Lorède. *W. Zeller,* 27/May/1957. ZT!
24. *D. filix-mas.* Viador, La Pez. *J. Fernández-Casas,* 4/Aug/1970. Herb. Fac. Cienc., Univ. Auton. Madrid!

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CONTRIBUIÇÃO PARA O ESTUDO DO GÉNERO *CYSTOPTERIS* BERNH. EM PORTUGAL CONTINENTAL E INSULAR

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SUMMARY

Owing to some discrepancies among old and new literature dealing with *Cystopteris* in Portugal, Azores, Madeira and Canary Islands, the A. decided to make a full revision of the matter. So, all the available specimens, in Portuguese herbaria as well as in the British Museum (Natural History), London, and the Royal Botanic Gardens, Kew, were carefully studied (including spore observation at the scanning microscope); some field research was also done. As the result of all this work, the A. concluded that the *Cystopteris* specimens checked should be placed into the three following species: 1) *C. fragilis* (L.) Bernh.; 2) *C. dickieana* R. Sim; and *C. viridula* (Desv.) Desv. Hence, *C. fragilis* seems now restricted to a few mountain places in NE Portugal, above 700 m altitude; *C. dickieana*, now mentioned for Portugal for the first time, seems to be more commoner in the same area, above 600 m (rarely coming down till 200 m in its more western part of the range, in the Douro valley); and *C. viridula* (commonly referred by other authors as *C. diaphana*) is the commonest species in Portugal, from the sea-level to ca. 950 m, and the sole found in the Azores and Madeira, as well as in the Canary Islands.

TODOS os autores portugueses que, desde o fim do século passado, referem o gén. *Cystopteris* Bernh. (HENRIQUES, 1895; SAMPAIO, 1909, 1913 e 1947; PEREIRA COUTINHO, 1913 e 1939; MENEZES, 1914; PALHINHA, 1966; FRANCO, 1971), consideram-no representado no nosso País apenas pela espécie *C. fragilis* (L.) Bernh. No entanto, PEREIRA COUTINHO (l. c.) notou a existência duma variação nas terminações das nervuras das folhas, pelo que menciona uma variedade que denominou *diaphana*, por supor tratar-se da mesma entidade que o *Polypodium diaphanum* Bory.

Será contudo interessante notar que já em 1911 LITARDIÈRE a referira para Portugal (Cintra e Serra da Guardunha), na categoria subespecífica (subsp. *diaphana*).

Mais recentemente, ROTHMALER & P. SILVA (1939), tomando, quanto a nós incorrectamente, a *C. diaphana* (Bory) como sinónimo da *C. regia* (L.) Desv., negam a sua existência em Portugal continental.

J. A. CRABBE (1964: 18) não refere para a Europa a *C. diaphana* (Bory) Blasdell e dá uma ampla descrição de *C. fragilis* (L.) Bernh. de modo a incluir as espécies *C. alpina* (Roth) Desv. e *C. regia* (L.) Desv., cujos caracteres foliares, no que respeita ao ápice dos dentes dos segmentos e à terminação das nervuras, são semelhantes aos de *C. diaphana*. Com tão lato critério, todas as plantas portuguesas do género cabem nesta descrição alargada de *C. fragilis*, o que terá levado autores modernos como PALHINHA (1966) e FRANCO (1971) a omitir qualquer referência a *C. diaphana* (Bory) Blasdell.

Uma nota de C. R. FRASER-JENKINS sobre *C. diaphana* (Bory) Blasdell, recentemente publicada nos cadernos da OPTIMA (*Willdenowia* **10**: 230. Dec. 1980), afirma a ocorrência em Portugal desta espécie com base apenas em dois exemplares, um de Matosinhos e outro de Monchique, mas admitindo a sua maior expansão no País.

A afirmação deste autor levou-nos a considerar oportuno procedermos à revisão do material português disponível, tanto continental como insular.

Por outro lado, o trabalho de JERMY & HARPER (1971) sobre a morfologia dos esporos no complexo «*C. fragilis*» deu-nos a ideia de realizar idêntico estudo sobre esporos do material português, o qual não fora abrangido por aquele trabalho. Para o efeito, observámos e fotografámos no microscópio de varrimento esporos de quase todos os espécimes disponíveis. Utilizámos o microscópio da Universidade Nova de Lisboa.

O estudo dos espécimes dos Açores e da Madeira mostrou-nos que as respectivas folhas apresentam dentes geralmente emarginados ou por vezes mais ou menos truncados obliquamente, terminando as nervuras foliares nos chanfros ou nos ápices truncados dos dentes. Este carácter, próprio da sect. *Emarginatae* (BLASDELL, 1963), levou-nos a admitir a hipótese de não ser