

typus speciei); *Killick & Vahrmeijer* 3822 (K); *Marais* 1315\* (K); *Rehmann* 6875\* (Z); *Williams* 598\* (K); *Wood* 3187, 4591\* (K) et 10279 (P).

38. *Crassula sarmentosa* Harv. in Harv. & Sond., Fl. Cap. 2: 348 (1862).

38a. Var. *sarmentosa* — Toelken, op. cit.: 119 (1977).

NATAL: *Rudatis* 1387 (P; Z); *Strey* 7361 (BR).

38b. Var. *integrifolia* Toelken in Journ. S. Afr. Bot. 41: 117 (1975); in Contr. Bolus Herb. 8: 201 (1977).

NATAL: *Strey* 7630 (BR).

21. *Crassula Schimperi* Fisch. & Mey., Ind. Sem. Hort. Petropol. 8: 56 (1841).

21a. Subsp. *transvaalensis* (Kuntze) R. Fernandes in Bol. Soc. Brot., Sér. 2, 52: 172 (1978).

Syn.: *Crassula Schimperi* var. *Schimperi* sensu Toelken, op. cit.: 133 (1977) quoad syn. pro parte.

AFR. AUSTR. (praecipue Transvaal): *Bolus* 10896 (K; Z); *Burt Davy* 18950\* (K); *Codd* 7799\* (SRGH); *Devenish* 832 (K); *D'Estourgies* s. n.\* (BR); *Hansen* 479\* (K); *Hutchinson & Mogg* 2911 (K); *Meebold* 13035\* (BR); *Nation* 144 (K); *Rehmann* 4623\*, 4887\*, 6717\* et 7171 (Z); *Rogers* 22710 (Z) et 22717\* (K); *Schlechter* 4295\* (Z); *Schlieben* 7760\* (BR) et 9408 (K; Z); *Schijff* 5365 (K); *Wells* 2536 (K); *Werdermann & Oberdieck* 1674 (K).

21b. Var. *illecebroides* (Welw. ex Hiern) Rowley in Cactus & Succ. Journ. Gt. Brit. 40, 2: 53 (1978).

Syn.: *Crassula Schimperi* var. *lanceolata* Toelken in Journ. S. Afr. Bot. 41: 117 (1975); in Contr. Bolus Herb. 8: 136 (1977) pro maxima parte, non *C. lanceolata* (Eckl. & Zeyh.) Endl. ex Walp. (1843).

AFR. AUSTR. (Transvaal, Natal, Orange Stat., Lesotho, Prov. Cap.): *Bolus* s. n.\* (K); *Burke* 381\* (K); *Cooper* 748\* et 1946\* (K); *Dieterlen* 166b (P); ?*Ecklon* 107\* (K); *Galpin* 1795 et 6618 (K); *Hepburn* s. n. (K); *Killick* 1346 (BR; LD); *MacOwan* 544\* (K); *Pont* 423 (Z); *Rehmann* 3899\* (K), 5966\* (K; Z) et 7023\* (Z); *Rudatis* 976 (P; Z); *Schlechter* 6911 (K; Z); *Toelken* 1211 (K); *Wood* 4762 (K) et s. n.\* (Z); *Zeyher* 638 et 646 (K).

27. *Crassula sebaeoides* (Eckl. & Zeyh.) Toelken in Journ. S. Afr. Bot. 41: 118 (1975); in Contr. Bolus Herb. 8: 158 (1977).

PROV. CAP.: *Schimper* s. n.\* (Z); *Schonland* 1679 (Z); *Zeyher* 2512 (Z, isolectotypus *Gramanthis gentianoidis* var. *mediae* Harv.).

94. *Crassula sediflora* (Eckl. & Zeyh.) Endl. ex Walp., Repert. 2: 254 (1843).

94a. Var. *sediflora* — Toelken, op. cit.: 373 (1977).

NATAL: *Rudatis* 903\* et 3751 (Z); *Sim* s. n. (Z); *Wood* 597\*, 1840, 4462 et 11193 (Z).

PROV. CAP.: *Tyson* 2141 (K).

117. *Crassula sericea* Schonl. in Engl., Bot. Jahrb. 45: 254 (1910).

117a. Var. *sericea* — Toelken, op. cit.: 464 (1977).

PROV. CAP.: *Schlechter* 11436 (K, fotogr.).

88. *Crassula setulosa* Harv. in Harv. & Sond., Fl. Cap. 2: 347 (1862).

88a. Var. *setulosa* — Toelken, op. cit.: 342 (1977).

TRANSVAAL: *Codd* 6478\* (K); *Leach & Bayliss* 11683 (SRGH); *Rogers* 14126 (Z); *Schlieben* 7808\* (BR); *Wasserfall* 897\* (LD).

LESOTHO: *Werdermann & Oberdieck* 1525 (BR).

- 88c. Var. *deminuta* (Diels) Toelken in Journ. S. Afr. Bot. 41: 118 (1975). — in Contr. Bolus Herb. 8: 348 (1977).

TRANSVAAL: *Wilms* 515 (z).

- 88d. Var. *rubra* (N. E. Br.) Rowley in Cactus & Succ. Journ. Gt. Brit. 40, 2: 53 (1978).

NATAL: *Wood* 4632 (z).

LESOTHO: *Werdermann & Oberdieck* 1552 (BR).

Annot.: TOELKEN (op. cit.: 351, 1977) specimen *Werdermann & Oberdieck* (PRE) sub n.° 7552 citat. An error per 1552?

- 88e. Var. *longeciliata* Toelken in Journ. S. Afr. Bot. 41: 119 (1975); in Contr. Bolus Herb. 8: 352 (1977).

NATAL: *Killick* (BR; LD).

Annot.: An species propria?

- 92b. *Crassula similis* Bak. f. in Bull. Herb. Boiss., Sér. 2, 3: 814 (1903).

Syn.: *Crassula alba* Forsk. var. *parvisepala* (Schonl.) Toelken in Journ. S. Afr. Bot. 41: 93 (1975); in Contr. Bolus Herb. 8: 368 (1977).

TRANSVAAL: *Buitendag* 546 et 904 (K); *Galpin* 900 et s. n. (K); *Junod* 1071 (z); *Leach* 11138\* (SRGH); *Meeuse* 9854 (K; SRGH); *Müller & Scheepers* 41 (K); *Rogers* 14578 et 14673 (K), 18823\* et 20172\* (z), 20147\* (K; z); *Scheepers* 613 (K); *Van der Merwe* 1307 (K); *Wager* s. n.\* (LD).

ORANGE STAT.: *Stent* 11161\* (BM).

6. *Crassula strigosa* L., Pl. Rar. Afr.: 10 (1761). — Toelken, op. cit.: 103 (1977).

PROV. CAP.: *Schlechter* 8508 (COI).

72. *Crassula subulata* L., Mantissa Alt.: 360 (1771).
- 72a. Var. *subulata* — Toelken, op. cit.: 296 (1977).
- PROV. CAP.: Galpin 11240 (BR); Schlechter 9364, 9476 et 9936 (COI).
- 72c. Var. *fastigiata* (Schonl.) Toelken in Journ. S. Afr. Bot. 41: 121 (1975); in Contr. Bolus Herb. 8: 299 (1977).
- PROV. CAP.: Werdermann & Oberdieck 961 (BR).
- 116b. *Crassula swaziensis* Schonl. in Journ. Linn. Soc., Bot. 31: 548 (1897).
- Subsp. *swaziensis* — R. Fernandes in Bol. Soc. Brot., Sér. 2, 52: 193 (1978).
- Syn.: *Crassula globularioides* Britten subsp. *argyrophylla* (Diels ex Schonl. & Bak. f.) Toelken in Journ. S. Afr. Bot. 41, 2: 106 (1975); in Contr. Bolus Herb. 8: 460 (1977).
- Annot.: Cf. R. FERNANDES (loc. cit., 1978) quoad specimen transvaalensia et swazilandiensia.
87. *Crassula tabularis* Dinter in Feddes Repert. 19: 146 (1923). — Toelken, op. cit.: 339 (1977).
- S. W. AFRICA: Seydel 1726 (LISC), 3917a (BR) et 4366\* (LD).
121. *Crassula tecta* Thunb. in Nova Acta Acad. Leop.-Carol. 6: 328 et 331 (1778). — Toelken, op. cit.: 475 (1977).
- PROV. CAP.: Kew R. Bot. Gard., XI-1913 (K, «collected nr. Prince Albert by Prof. Pearson in 1912»).
13. *Crassula tenuipedicellata* Schonl. & Bak. f. in Journ. of Bot. 40: 288 (1902). — Toelken, op. cit.: 114 (1977).
- PROV. CAP.: Schlechter 11247 (BR, isotypus).

59. *Crassula tetragona* L., Sp. Pl.: 283 (1753).
- 59a. Subsp. *tetragona* — Toelken, op. cit.: 260 (1977).  
 PROV. CAP.: *Schlechter* 9756 (COI).
15. *Crassula Thunbergiana* Schult., Syst. Veg., ed. 16, 6: 733 (1820).
- 15a. Subsp. *Thunbergiana* — Toelken, op. cit.: 119 (1977).  
 PROV. CAP.: *Schlechter* 4880 (COI; P).
101. *Crassula tomentosa* Thunb. in Nova Acta Acad. Leop.-Carol. 6: 329 et 333 (1778).
- 101b. Var. *interrupta* (Harv.) Toelken in Journ. S. Afr. Bot. 41: 123 (1975); in Contr. Bolus Herb. 8: 408 (1977).  
 PROV. CAP.: *Schlechter* 8382 (COI).
46. *Crassula umbella* Jacq., Coll. 4: 172 (1791). — Toelken, op. cit.: 219 (1977).  
 PROV. CAP.: *Hardy* 446 (z); *Schlechter* 8458 et 11119 (COI).
90. *Crassula vaginata* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 298 (1837); Toelken, op. cit.: 356 (1977).

AFR. AUSTR. (Transvaal; Swazilandia; Natal; Prov. Cap.); *Baur* 120\* (K); *Bayliss* 2062 (P; z); *Beeton* 191 (P; z); *Bernard* 8883\* (K); *Bowie* 5\* (BM); *Bolus* s. n. (BM); *Clarke* 89\* (BM); *Codd* 9509\* (K; SRGH); *Compton* 27611 et 30553\* (K); *Cooper* 1119\* (BM; K) et 2307\* (K); *Devenish* 577 et 614 (K); *Dianini* s. n.\* (K); *Galpin* 1455\* (K); *Galpin* 816, 13110\* et 14495 (K); *Glass* 1455 (K); *Guillarmod & al.* 193\* (K); *Humbert* 14975\* et 15075\* (P); *Hutchinson* 2763 (K); *Junod* 308\*, 1248\* et 2665\* (z); *Killick* 1446\* (K); *Kuntze* s. n. (K); *Liebenberg* 8169\* (K); *Long* 949 (K); *McClellan* 119 (P; z), 580 (K) et 809 (K; LD; P); *MacOwan* 35 (K); *Meeuse* 9816, 9969\* et 10080\* (K); *Moll* 635 (K; P; z); *Pegler* 439 (BM; K); *Plant* 82 (P); *Prior* s. n.\* (K); *Ranger* 247 (K); *Rehmann* 6273\* (K; z), 6721\* pro parte

et 6903\* (P; z); *Rogers* 3957, 11429\*, 18553\*, 18583\*, 19129\*, 20143\*, 20148\*, 23534\* et 30014 (K; P; z), 14625 (z) et 28371\* (K; z); *Ross* 2085\* (K); *Rudatis* 225 (BM; K; z) et 825\* (P; K; z); *Sankey* 65\* (K); *Schlieben* 9534 (K); *Sidey* 1598 (BM; K) et 1599\* (K); *Stewart* 139\* (K); *Strey* 6943 (BR; K); *Tyson* 796\* (K); *Van der Merwe* 1266 et 1296 (K); *Wager* B169\* (P); *Werdermann & Oberdieck* 2065 (K); *Wilms* 534\* (K); *De Winter* 8276 (K); *Wood* 43\* et 5247 (BM; z), 436\* (BM), 4335\* et 10758\* (K) et 11176 (P); *Wylie* in *Wood* 8955\* (P).

4. *Crassula Vaillantii* (Willd.) Roth, Enum. 1: 992 (1827). — Toelken, op. cit.: 95 (1977).

TRANSVAAL: *Rehmann* 6668\* et 6703\* (z).

PROV. CAP.: *Schlechter* 10936 (BR; COI).



**Crassula Leachii** R. Fernandes  
 Specimen *Leach* 8135 (PRE, holotypus).



Ernesto Escobar, R. Teyssandier  
Specimen Escobar 8125 (PHEL, Botany)



## NOVIDADES FICOLÓGICAS DA RIA DE AVEIRO

por

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AS últimas pesquisas sobre Rodofíceas da Ria de Aveiro permitiram-nos encontrar dois taxa novos para Portugal: *Gracilaria verrucosa* (Huds.) Papenf. var. *procerrima* Turn. e *Polysiphonia urceolata* (Lightf.) Grev. var. *formosa* J. Ag.

O primeiro taxon já tinha sido assinalado na Europa para a Inglaterra e norte da França. Na América desce do norte até Nova York. Trata-se por conseguinte de uma espécie nórdica. É de notar que a Ria de Aveiro se encontra no âmbito do mesmo paralelo — 40° — que Nova York, constituindo, portanto, a existência da referida espécie em Portugal mais um dado a favor da teoria de WEGENER, segundo a qual os dois continentes da Europa e da América, se teriam separado em datas primitivas.

O segundo taxon foi encontrado pela primeira vez em Portugal, por ocasião de pesquisas pormenorizadas efectuadas nos vários esteiros da Ria, a fim de se circunscreverem os locais em que a espécie se apresenta em quantidades industriais, tendo em vista a utilização dela para a fábrica da SICOMOL de Lavos.

É no esteiro do Carregal, entre a ponte da Varela e a praia do Arainho, que existem dois taxa de *Gracilaria verrucosa* (Huds.) Papenf. perfeitamente distintos, *G. verrucosa* var. *verrucosa* e *G. verrucosa* var. *procerrima*: a primeira não ultrapassa a dimensão de 50 cm, vive misturada com *Ruppia spiralis* (L.) Dumort. e *Potamogeton pectinatus* L., em águas baixas, ao longo das margens, raramente sobre a areia com pequena mistura de vasa, por vezes areia pura. A segunda atinge um comprimento

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de 2,40 m, vive sem mistura de *Potamogetonaceas*, em águas fundas, ao longo da parte central do mesmo esteiro, sempre abundante sobre grande altura de vasa. Além disso, apresenta-se em quantidades industriais, pois que em pouco tempo, conseguimos encher 30 sacos grandes de plástico. No entanto, esta abundância não é a mesma em toda a parte. Assim, no esteiro de Vagos há grandes tufos dela dispersos, porque aí a vasa negra não é contínua, como acontece no esteiro do Carregal, onde a planta forma uma camada contínua. E é sempre sobre vasa abundante que ela vive, ao contrário do outro taxon que existe em meios pobres de vasa.

### Fam. GRACILARIACEAE

#### Género GRACILARIA

**Gracilaria verrucosa** (Huds.) Papenf. var. **procerrima** Turn. —  
Newton, Handbook: 431 (1931).

A presente variedade afasta-se da espécie *Gracilaria verrucosa* var. *verrucosa* (Huds.) Papenf. especialmente pelo talo que atinge 2,40 m de comprimento e não somente 50 cm; pelos ramos longos e muitas vezes simples; pelo substrato sempre de vasa muito abundante, etc.

#### ECOLOGIA

Entre a ponte da Varela e a Praia do Arainho:

##### a) pH

1.º na água à superfície . . . . . 7,3

2.º na vasa . . . . . 7,5

##### b) Nitritos . . . . . Não acusou

##### c) Cloretos

1.º na água . . . . . 4,1 g Cl<sup>-</sup>/l

2.º na vasa . . . . . 1013,7 mg Cl<sup>-</sup>/100 g  
de vasa

Peso da amostra de vasa seca a 110° C . . . 37,5 g

##### d) CO<sub>2</sub> combinado:

1.º na água . . . . . 99,6 mg HCO<sub>3</sub>/l

2.º na vasa . . . . . 95,6 mg HCO<sub>3</sub>/100 g  
de vasa

Fam. **RODOMELACEAE**Género **POLYSIPHONIA**

**Polysiphonia urceolata** (Lightf.) Grev. var. **formosa** J. Ag. —  
Newton, Handb.: 347 (1931).

*P. formosa* Suhr. .

Talo formado por filamentos muito delicados, subflácidos, dispostos em tufos densíssimos de 5-12 cm de altura; cor intensamente vermelha, mas acastanhada ou escura por exsiccção; ramificação pseudodicotómica nos eixos principais. Ramos alongados e flexuosos, alternadamente ramificados; ramúsculos superiores unilaterais e subcorimbosos, ramúsculos supremos rectos ou incurvados com os ápices muitas vezes revestidos de fibras bissóides. Articulações dos eixos principais aproximadamente iguais ao diâmetro na parte inferior do talo, 2-5 vezes o diâmetro na parte média e iguais ou inferiores na parte superior. Sifões pericentrais 4. Tetrasporângios dispostos em série, no meio dos ramúsculos superiores, tornando-os fusiformes. Anterídios laterais ao longo dos ápices dos ramos, lanceolados, pendentes de um pedicelo ténue e longo. Cistocarpos curtamente pedicelados e utriculares.

*Habitat*

Ria de Aveiro, no esteiro de Mira, a sul do Bairro dos Pescadores, próximo da ponte da Vagueira, 27/IX/1979, leg. *M. Vieira*.

## ECOLOGIA

## Temperatura:

Enchente . . . . .	17° C
Vazante . . . . .	18° C

## Salinidade:

Enchente . . . . .	26 %
Vazante . . . . .	28 %

O<sub>2</sub> dissolvido ppm:

Enchente . . . . .	9,7
Vazante . . . . .	10,1

## pH:

Enchente . . . . .	8,15
Vazante . . . . .	8,0





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## O GÉNERO *CHEILANTHES* SWARTZ EM PORTUGAL \*

por

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### SUMMARY

The A. checked the available specimens of *Cheilanthes* spp. preserved in the main Portuguese herbaria. After a careful study of the species concerned, the A. concluded that part of the specimens once taken as *Ch. pteridioides* or *Ch. fragrans* do not belong to this species but must be credited to *Ch. guanchica* Bolle, *Ch. maderensis* Lowe and *Ch. tinaei* Tod. Keys are provided as well as distribution maps, and plates of each species.

O género *Cheilanthes* Swartz tem sido modernamente considerado (A. C. JERMY & H. P. FUCHS in TUTIN & al., *Fl. Eur.* 1: 10. 1964; J. FRANCO & M. L. ROCHA AFONSO in FRANCO, *Nova Fl. Port.* 1: 11-12. 1971) como estando representado em Portugal por quatro espécies.

Porém, em revisão recente do género para Espanha (C. SAÉNZ DE RIVAS & S. RIVAS-MARTÍNEZ, *Lagascalia* 8(2): 214-241. 1979), verifica-se que parte dos espécimes espanhóis em tempos identificados como *Ch. pteridioides* (Reichard) C. Chr. não pertencem a esta espécie mas devem antes ser referidos a *Ch. guanchica* Bolle, *Ch. maderensis* Lowe e *Ch. duriensis* Mendonça & Vasc.

O conhecimento deste trabalho espanhol levou-nos a pensar que seria útil proceder a uma revisão do material português a fim de verificar se haveria motivo para idênticas alterações. Assim, estudámos pormenorizadamente os espécimes preservados nos herbários do Instituto Superior de Agronomia, Lisboa (LISI), Faculdade de Ciências de Lisboa (LISU), Instituto Botânico

\* Comunicação apresentada na *Reunión Internacional de Pteridologia*, Algeciras (Out. 1980).

«Dr. Júlio Henriques», Coimbra (COI) e Instituto de Botânica Dr. Gonçalo Sampaio, da Universidade do Porto (PO), e chegámos à conclusão que, de facto, essas espécies recentemente citadas para Espanha também se encontram em Portugal, desconhecendo-se até aqui a sua existência neste país por deficiência de identificação do material herborizado.

Antes de darmos a relação dos espécimes estudados, com a sua distribuição em mapas próprios por cada espécie e notas sobre a sua ecologia, entendemos conveniente apresentar umas chaves que facilitem a identificação das sete espécies que julgámos representarem o género *Cheilanthes* Swartz em Portugal continental.

- 1 Segmentos das folhas glabros na página inferior
- 2 Folhas de ráquis fundamente sulcada, com os bordos alados, esparsamente glandulosa; pseudo-indúcio contínuo . . . . . 1. *guanchica*
- 2 Folhas de ráquis com sulco pouco profundo com os bordos não alados, ramentosa; pseudo-indúcio descontínuo
- 3 Pseudo-indúcio fimbriado; segmentos de primeira ordem oblongos . . . . . 2. *pteridioides*
- 3 Pseudo-indúcio com os lobos inteiros; segmentos de primeira ordem ovados . . . . . 3. *maderensis*
- 1 Segmentos das folhas ramentosos na página inferior
- 4 Limbo coberto por ramentos filiformes na página superior . . . 7. *vellea*
- 4 Limbo glabro na página superior
- 5 Limbo densamente revestido por ramentos clatrados na página inferior . . . . . 6. *marantae*
- 5 Limbo não ramentoso, provido de pêlos glandulosos na página inferior
- 6 Limbo ± esparsamente coberto por pêlos curtos (com 2-5 células) . . . . . 4. *tinaei*
- 6 Limbo densamente coberto por pêlos compridos (com 5-9 células) . . . . . 5. *hispanica*

1. *Ch. guanchica* Bolle, *Bonplandia* 7: 107 (1859).

#### ALGARVE

Serra de Monchique, Caldas, *J. d'Ascensão Guimarães*, VI-1887 (LISU, P-512); Monchique, *A. Moller*, VI-1887 (COI).

Esta espécie, só muito recentemente considerada para o Sul de Espanha e Portugal (SAÉNZ DE RIVAS-MARTÍNEZ, 1979) parece ser, no nosso País, muito rara e apenas localizada nas faldas meridionais da Serra de Monchique.



2. *Ch. pteridioides* (Reichard) C. Chr., *Ind. Fil.* 178 (1905).

## BEIRA LITORAL

In rupestribus, ad flum. Mondego, prope Conimbricam, *Welwitsch*, VIII-1848 (LISU, P-2616).

## ESTREMADURA

Serra de Candeeiros, pr. Olhos de Água, *C. Tavares*, 29-XII-1953 (LISU, P-55349) + Sintra, pr. Penaferrim, *J. de Vasconcellos*, IX-1951 & 11-IV-1952 (LISI) + pr. Santa Luzia, retro Loires, *Welwitsch*, II-1853 (LISU, P-2615) + Lisboa, Tapada da Ajuda, *J. d'Ascensão Guimarães*, III-1885 (LISU, P-511); *A. Veneno*, III-1932 (LISI) + Belém, *E. da Veiga 11*, s/ data (COI) + Serra d'Arrábida, *C. Romariz 1218*, 9-III-1948 (LISU, P-56481); *Welwitsch*, V-1843 (LISU, P-2616) & s/ data (LISU, P-2618); in sumis rupibus Serra d'Arrábida, *Welwitsch*, III-1842 (COI); Fôjo, *G. Pedro 6.ª sér.* 29, 25-IV-1970 (LISI); do Portinho ao Convento, *R. Palhinha & F. Mendes*, V-1908 (LISU, P-2619); Mata do Solitário, *A. Rozeira, J. Alte, G. Costa & A. Serra*, 17-IV-1968 (PO-9956); roches à l'est de Portinho, *J. Daveau*, IX-1881 (LISU, P-2612) + Serra de S. Luís, alt. 200 m, *J. Daveau*, III-1879 (LISU, P-2613).

## RIBATEJO

Serra d'Aire, près Torres Novas, *J. Daveau*, VIII-IX-1885 (LISU, P-2621 & P-2622) + murs de Constancia à Abrantès, *J. Daveau 1129*, VI-1884 (LISU, P-2624).

Esta espécie, tal como actualmente definida, tem uma distribuição que corresponde ao Centro Ocidental de Portugal, em zonas calcárias e muros argamassados.

3. *Ch. maderensis* Lowe, *Trans. Cambr. Phil. Soc.* 6: 528 (1838).

*Ch. fragrans* auct. lusit., non [L.] Webb & Berth. (1847), p. p.

## TRAS-OS-MONTES

Bragança, *P.º Barros Carneiro*, 24-III-1944 (PO-6274) + Moga-douro, S. Pedro, *J. R. dos Santos Junior*, I-1925 (PO-2796 p. p.).

## ALTO DOURO

Carrazeda d'Anciães, Ribalonga, *J. de Vasconcellos*, III-1940 (LISI) + Regoa, *M. Paulino d'Oliveira*, V-1879 (COI); muros da Quinta da Vacaria, s/ col., 1-II-1879 (LISU, P-2609 & P-2614) & s/ col., 3-III-1879 (LISU, P-2608) + Pinhão, entre Ferrão e Gouvinhas, c. 100 m, *P. Silva, Rozeira, Teles & Rainha*, s/ data (PO-6709) + Urros, Seixo do Vieiro, *P. Lopes & G. Pedro* 629, 24-IV-1941 (LISI) + Figueira de Castelo Rodrigo, Barca d'Alva: Cabeço do Varandas, *G. Pedro* 832, 1-V-1941 (LISI) e estrada para Freixo [de Espada-à-Cinta], *A. Rozeira, G. Costa & J. Araújo*, 5-V-1967 (PO-26970) + Freixo de Espada-à-Cinta, Quinta do Saltinho, *G. Pedro* 758-A, 27-IV-1941 (LISI).

## DOURO LITORAL

Serra do Valongo, Porto, s/ col. e s/ data, n.º 2007 (COI).

## BEIRA BAIXA

Abas da Serra [da Estrella], Covilhã, *A. R. da Cunha*, VI-VII-1881 (LISU, P-2611) + Castelo Branco, S. Martinho, *A. R. da Cunha*, VI-1881 (LISU, P-2629).

## ALGARVE

Serra de Monchique, Picota, 700 m, *J. d'Ascensão Guimarães*, VI-1887 (LISU, P-512-A).

Esta espécie parece preferir locais abrigados e de clima subcontinental, com solos mais frequentemente xistosos.

4. *Ch. tinaei* Tod., *Giorn. Sci. Nat. Econ. Palermo* 1: 217-218 (1866).

*Ch. duriensis* Mendonça & Vasc., *Anais Inst. Vinho Porto* 15(4): 47 (1956).

*Ch. fragrans* auct. lusit., non [L.] Webb & Berth. (1847), p. p.

*Ch. pteridioides* auct. lusit., non (Reichard) C. Chr. (1905), p. p.

## TRAS-OS-MONTES

Miranda do Douro, margens do rio Douro, *R. Palhinha & F. Mendes*, VI-1914 (LISU, P-2620); *Rozeira & J. Castro*, 13-IV-1944 (PO-3288).

## ALTO DOURO

Teixeiró, Caldinhas (Baião), *P. Lopes & G. Pedro* 58, 22-III-1941 (LISI) + Sabrosa, pr. dum ribeiro, *A. Rozeira & J. Castro*, 13-II-1945 (PO-4974); Sabrosa, Chanceleiros, *Rozeira & J. Castro*, 13-II-1945 (PO-4973); Sabrosa, estrada para Gouvães, *G. Costa, A. Serra & Bernardino*, 29-IV-1973 (PO-27045) + Casais do Douro, Quinta das Carvalhas, Vale das Pombas, *G. Barbosa, M. Myre & G. Pedro* 3475, 24-IV-1942 (LISI) + S. João da Pesqueira, Soutelo, Monte de N.<sup>a</sup> Senhora de Lourdes, *A. Rozeira, D. Barreto & A. Serra*, 29-VI-1969 (PO-26971) + Ribalonga, *J. de Vasconcelos*, III-1940 (LISI) + Carrazeda d'Anciães, Tua, Tralhariz, *G. Barbosa & M. Myre* 3902, 10-V-1942 (LISI); Tua, Fiolhal, *G. Barbosa & M. Myre* 3962, 10-V-1942 (LISI); entre a estação de c. f. de S. Mamede de Ribatua e a povoação, *G. Barbosa & M. Myre* 3975, 13-V-1942 (LISI) + Alijó, S. Mamede do Tua, margem do rio Tua, *Rozeira & J. Castro*, 16-IV-1943 (PO-021) + Carrazeda d'Anciães, Foz Tua, *A. Rozeira, D. Barreto, G. Costa & A. Serra*, 21-V-1970 (PO-27040) & 3-IV-1971 (PO-27044) + Entre a Régua e Mesão Frio, *M. Ferreira*, VII-1879 (COI) + Régua, Salgueiral, *P. Lopes & G. Pedro* 98, 23-III-1941 (LISI); Galafura, Ciderma, *F. Mendonça & J. Vasconcellos* 432, 11-IV-1941 (LISI) + entre Pinhão e Régua, *Rezende, Alexandre, A. Serra & Bernardino*, 8-IV-1976 (PO-27048) + Vila Seca de Armamar, Vale do Tedo, *A. Mendonça & J. de Vasconcellos*, I-1941 (LISI) + Valença do Douro, Serro de Sendões, *P. Lopes & G. Pedro* 472, 15-IV-1941 (LISI) + Santa Marta de Penaguião, Casal da Gaivosa, *A. Rozeira, A. Serra, Bernardino & Carlos*, 2-III-1974 (PO-27046) + Tabuaço, Quinta do Seixo, *A. Rozeira, A. Serra, Bernardino & Carlos*, 3-III-1974 (PO-27047) + Vila Nova de Fozcoa, entre Vesúvio e Vargelas, ribeira da Teja, *G. Barbosa & M. Myre* 4884, 13-X-1942 (LISI) + entre Almendra e Castelo Melhor, Serro de S. Gabriel, *G. Pedro* 2037, 2-VI-1941 (LISI) + Figueira de Castelo Rodrigo, Barca d'Alva, Quinta da Pedriça, *A. Rozeira, D. Barreto, G. Costa & A. Serra*, 9-1-1971 (PO-27041) + Freixo de Espada-à-Cinta, Poiães, Quinta do Saltinho, *G. Pedro* 758, 27-IV-1941 (LISI).

## BEIRA TRANSMONTANA

Almeida, Vale de Marcos, *A. R. da Cunha*, VII-1884 (LISU, P-2623).

## DOURO LITORAL

[Amarante, Telões], Vendas Novas, *E. Johnston*, 23-II-1890 (PO-2794) + Alfena, Ponte Ferreira (arred. do Porto), *E. Johnston*, VII-1894 (COI) + Marco de Canavezes, Vila Boa de Quires, Remungoso, no caminho para a Torre, *G. Costa*, 7-II-1971 (PO-27042) + Porto, Ameieira, pr. Monte dos Burgos, *J. Castro*, 17-VII-1941 (PO-022 & 6456) + Fanzeres, Aguiar do Sousa, Rio Tinto e Porto, *A. Luso*, s/ data (COI).

## BEIRA ALTA

Viseu: Vil de Moinhos, *M. Ferreira*, VII-1886 (COI); margens do Dão, *M. Ferreira*, VII-1886 (COI) + Mangualde, *A. Moller*, VII-1884 (COI) + próx. Ponte da Atalhada (Mondego), *A. Moller*, VII-1886 (COI) + arred. Oliveira do Conde, Petrofeira, *A. Moller*, VII-1886 (COI).

## BEIRA LITORAL

Cabrizes, Zorro, marg. do Mondego, *J. Henriques*, IV-1880 (COI) + arred. Coimbra, Brasfemes, *M. Ferreira*, VI-1889 (COI) + Ponte da Murcella, Moura Morta, *M. Ferreira*, V-1882 & V-1895 (COI) + Lousã, *A. Moller*, VI-1879 (COI) + Goes, Ponte do Sotão, *J. Henriques*, VI-1883 (COI) + Serra da Lousã, *A. Moller*, V-1883 (COI).

## BEIRA BAIXA

Covilhã, pr. Refúgio, *A. Rozeira*, *K. Koepp* & *G. Costa*, 25-IV-1962 (PO-7108) + Alpedrinha, Pucarinha, *A. R. da Cunha*, VII-1883 (LISU, P-2625).

## RIBATEJO

de Constância à Abrantes, *J. Daveau* 1129, VI-1884 (COI).

## ALTO ALENTEJO

Castelo de Vide, Senhora da Penha, *A. R. da Cunha*, VI-1882 (LISU, P-2627) + Marvão, Covões, *A. R. da Cunha*, VI-1882 (LISU,

P-2626) + Portalegre, Tapada dos Carteiros [Carreteiros], A. R. da Cunha, VI-1882 (LISU, P-2628) + Vila Viçosa: Tapada Real, Monte das Pedras Escorregadias, A. Fernandes & Sousa 1603, 5-V-1947 (COI); Canto da Asseca, A. Fernandes & Sousa 1917, 9-V-1947 (COI).

Esta espécie parece ser frequente em solos graníticos ou xistosos, sobretudo nas bacias dos rios Douro, Vouga, Mondego, Tejo e alto Guadiana, em sítios frescos e um tanto sombrios.

Nos espécimes com folhas já adiantadas, os pêlos glandulosos, que são sempre curtos e pouco densos, por vezes caducam em grande parte, pelo que não é de estranhar a sua inclusão em outras espécies do género, como, por exemplo, *Ch. pteridioides*, por botânicos menos experientes neste grupo de fetos. A existência desses pêlos deu origem a que MENDONÇA e VASCONCELLOS (1956) supusessem tratar-se dum híbrido entre *Ch. pteridioides* e *Ch. hispanica*.

5. *Ch. hispanica* Mett., *Abh. Senckenb. Naturf. Ges.* 3: 74 (1859).

TRAS-OS-MONTES

Mirandela, Torre de D. Chama, a caminho de Valpaços, à Fonte do Pedro, P. Lopes & G. Pedro 2762, 14-X-1941 (LISI) + Mogadouro, S. Pedro, J. R. dos Santos Junior, I-1925 (PO-2796 p. p.).

ALTO DOURO

Mirandela, Serra de Passos, crista do fragão da Soalheira, G. Pedro 2797, 15-X-1941 (LISI); arred. de Mirandela, exp. S. W., F. Mendonça & J. de Vasconcellos 370, 8-IV-1941 (LISI); Mirandela, Rozeira & J. Castro, 29-III-1942 (PO-023) + Vila Real, margem do rio Corgo, Rozeira & J. Castro, 1-XII-1943 (PO-5203) + [Carrazeda d'Anciães] Tua, a caminho de Fiolhal, G. Barbosa & Myre 3919, 10-V-1942 (LISI); Tralhariz, G. Barbosa & F. Garcia 7413, 18-X-1944 (LISI); Ribalonga, G. Pedro 3270, 20-IV-1942 (LISI) + Moncorvo, Cabeço do Baldoeiro, marg. direita do rio Sabor, J. R. Santos Junior, 25-III-1967 (PO-26969) + [Lamego] Estremadouro, F. Mendonça & J. de Vasconcellos 5303, 27-IV-1943 (LISI) + Peso da Régua, Fonte de Ciderma, F. Mendonça & J. de Vasconcellos 432-A, 11-IV-1941 (LISI) + [S. João da Pesqueira]

pr. Cachão da Valeira, *G. Pedro* 3419, 20-IV-1942 (LISI) + Castelo Melhor, S. Gabriel, exp. S., *G. Pedro* 2040, 27-VI-1941 (LISI) + Seixo do Vieiro, Urros, *P. Lopes & G. Pedro* 630, 27-IV-1941 (LISI); Ligares, Fragão do Candedo, *G. Barbosa, M. Myre & G. Pedro* 3573, 30-IV-1942 (LISI); Freixo de Espada-à-Cinta, a 5 km de Barca d'Alva, *A. Rozeira, K. Koepp & G. Costa*, 14-XII-1961 (PO-7107); Penedo Durão, *A. Taborda de Moraes* 3898, 29-IX-1938 (COI).

#### DOURO LITORAL

Santo Tirso, Caldas da Saúde, *P.º Barros Carneiro*, 16-XII-1944 (PO-5012) + pr. a Valongo, na serra, *J. Castro*, 10-VI-1936 (PO-024); Queira, *G. Costa & M. Araújo*, 21-III-1963 (PO-26968); Valongo, a sul, marg. do rio Ferreira, *E. Johnston*, 30-VIII-1891 (PO-3562) & 5-V-1901 (PO-2795), e *A. Rozeira*, 11-IV-1936 (PO-7110); entre a estação e a ponte, *A. Rozeira, Martins d'Alte & J. Castro*, 9-VIII-1949 (PO-3783); Campo, *G. Costa & J. Araújo*, 16-V-1965 (PO-7109) + Paredes, Aguiar do Sousa, Fundalva, *J. Castro & G. Costa*, 6-VII-1965 (PO-5991); Castelo de Aguiar do Sousa, *J. Castro & G. Costa*, 12-IV-1956 (PO-6216) + Vila Nova de Gaia, Crestuma, *E. Johnston*, 2-X-1888 (PO-2800); Fontinha, *J. Castro & G. Costa*, 17-III-1958 (PO-7011) + Gondomar, foz do Sousa, Esposade, *G. Costa & J. Araújo*, 28-V-1966 (PO-7110) + Penafiel, ribeira de Couce, pr. a Sebolinho, *D. Barreto, G. Costa & A. Serra*, 3-IV-1971 (PO-27043) + arred. do Porto, *A. Luso*, s/ data (COI).

#### BEIRA TRANSMONTANA

Mata de Lobos, Navarra, *F. Garcia & J. Pedrogão* 6322, 13-IV-1944 (LISI); estrada de Figueira de Castelo Rodrigo à Guarda, ao km 145, próx. ao rio [Coa], *A. Rozeira, K. Koepp & G. Costa*, 16-XII-1960 (PO-7106) + Almeida, rio Coa, *M. Ferreira*, s/ data (COI).

#### BEIRA ALTA

Alvarenga, a 2 km para Arouca, *J. Matos & A. Diniz* 9727, 9-VII-1966 (COI) + S. Pedro do Sul, s/ col. n/ data (COI) + Viseu, Serra de Santa Luzia, *M. Ferreira*, VII-1886 (COI) + Serra do Caramulo, Cabeço de Cão, *M. Ferreira*, VI-1884 (COI).

## BEIRA LITORAL

Oliveira do Conde, A. Moller, VII-1886 (COI) + pr. Conimbricam, Welwitsch, VIII-1848 (LISU, P-2635 & P-2636); Serra do Dianteiro, M. Ferreira, IX-1877 (COI); Dianteiro, M. Ferreira, VII-1883 (LISI; LISU, P-2630 & P-2634); Valbom, A. Moller, VII-1883 (COI) + Penacova, Penedo do Castro, A. Reis Moura, 29-XI-1965 (COI) + Lousã, G. Franqueira, VII-1894 (COI); Serra da Lousã, pr. da vila, A. Moller, VI-1879 (COI); N.ª Senhora da Piedade, U. Beau 2050, 5-VI-1963 (COI); Serra da Lousã, A. Moller, V-1883 (COI) e pr. Pontão da Cerdeira, C. N. Tavares, 13-XII-1953 (LISU, P-55572).

## BEIRA BAIXA

Castelo Branco, Feiteira, A. R. da Cunha, VI-1881 (LISU, P-2637) + Zibreira, R. Palhinha, IV-1930 (LISU, P-2631) + Ferreira do Zêzere, Machial, M. Ferreira, VI-1914 (COI); Lagar do Gato, I. Nogueira, T. Almeida & A. Diniz 10963, 27-II-1970 (COI) + Vila Velha de Rodão, a caminho de Fratel, A. Fernandes, J. Matos & F. Cardoso 7699, 26-III-1961 (COI).

## ALTO ALENTEJO

Beirã, arredores, R. Palhinha & F. Mendes, V-1913 (LISU, P-2632) + Portalegre, Senhora da Pena, A. R. da Cunha, VI-1882 (LISU, P-2638); Portalegre, A. Moller, VI-1891 (COI) + Alegrete, Sesmarias (Touril), A. R. F. Raimundo, 12-VI-1952 (LISI) + Azinha-linho, pr. estrada de Mourão, R. Palhinha & F. Mendes, V-1909 (LISU, P-2633) + Belver, Penha dos Abotoreiros, J. Z. O. Simões, VIII-1886 (COI).

Espécie ibero-norteafricana de sítios secos, de preferência insolados, frequentemente de exposição Sul, com solos de características xistosas ou cristalofílicas, delgados, em fendas ou interstícios de rochas.

6. *Ch. marantae* (L.) Domin, *Biblioth. Bot. (Stuttgart)* 20: 133, adnot. 1 (1915); P. Silva, *Agron. Lusit.* 30 (3/4): 190-191 (1970).

## TRAS-OS-MONTES

Vinhais, Ousilhão, entre Lombeira de Fontrelas e Tuela, P. Silva, B. Rainha & J. Martins 7833 (LISE) + Bragança, Donai, Serro 3.º,

Sardoal de Donai, *P. Silva, B. Rainha & J. Martins* 7852 (LISE); Donai, Cabeço do Joguinho, *P. Silva & B. Rainha* 7186, 1963 (LISE) e *P. Silva, B. Rainha & J. Martins* 7414 (LISE) + Macedo de Cavaleiros, pr. de Lagoa, abaixo Lombo dos Pojos, *P. Silva, B. Rainha & J. Martins* 7685 & 7739 (COI; LISE) + Mogadouro, Soutelo, pr. Piçarrão, *P. Silva, B. Rainha & J. Martins* 7808 (LISE).

Esta espécie, primeiramente colhida em Portugal, próximo de Bragança em 1963 por P. SILVA e colaboradores, encontra-se, segundo este autor, confinada às fendas das rochas serpentínicas do Nordeste transmontano português.

7. *Ch. vellea* (Aiton) F. Muell., *Fragm. Phytogr. Austral.* 5: 123 (1866).

Syn. *Notholaena lanuginosa* (Desf.) Desv. ex Poir. in Lam., *Encycl. Méth. Bot. Suppl.* 4: 110 (1816).

#### ALTO DOURO

Pinhão, entre Ferrão e Gouvinhas, *P. Silva, Rozeira, Teles & Rainha*, 28-V-1955 (PO-7012) + [Vila Seca de Armamar] Vale do Tedo, *P. Lopes & G. Pedro* 2499, 3-X-1941 (LISI) + Freixo de Espada-à-Cinta, *J. Castro*, 6-VI-1950 (PO-5475/6) & *A. Rozeira, K. Koepf & G. Costa*, 11-XII-1960 (PO-7111) & 4-XII-1961 (PO-7112); Poiares, Quinta da Foz do Ribeiro do Mosteiro, *G. Pedro* 1799, 22-VI-1941 (LISI); entre a Quinta da Malhadinha e a ribeira do Mosteiro, *G. Barbosa & F. Garcia* 8536, 2-V-1946 (LISI); Poiares, margem do Douro, *P. Lopes & G. Pedro* 714, 26-IV-1941 (LISI), *G. Barbosa, M. Myre & G. Pedro* 3691, 1-V-1942 (LISI), *A. Rozeira & J. Castro*, 11-IV-1944 (PO-5268), *A. Rozeira, D. Barreto, G. Costa & A. Serra*, 23-V-1970 (PO-27049) & *Alexandre, A. Serra & Bernardino*, 12-VI-1975 (PO-20965) + [Figueira de Castelo Rodrigo] Barca d'Alva, marg. esq.<sup>a</sup> do rio Águeda, *F. Mendonça & J. de Vasconcellos* 6187, 6-IV-1944 (LISI) & Barca d'Alva, junto à ponte, *Barros Neves & al.*, 11-III-1973 (COI).

#### ESTREMADURA

In rupestribus excelsis de Serra da Arrabida [*Welwitsch*], 1848-1845 (LISU, P-2606); in rupestribus editoribus de Serra da Arrabida, *Welwitsch*, IV-1847 (LISU, P-2607).



## BAIXO ALENTEJO

Mértola, A. Moller, IV-1888 (COI; LISU, P-1688); marg. da ribeira de Oeiras, prox. da ponte, M. Bravo Liva 283, 5-IV-1958 (LISI).

## ALGARVE

Silves, S. Bartolomeu de Messines, Barrocal da Gralheira, L. Sobrinho & F. Augusto, 23-IV-1968 (LISU, P-66722) + Albufeira, Serra da Gralheira, C. Romariz & E. J. Mendes, 13-III-1953 (LISU, P-55235); Gralheira, A. Fernandes, J. Paiva & J. Matos 10111, 25-II-1968 (COI); Barrocal da Gralheira, R. Fernandes & al. 10486, 23-IV-1968 (COI) + Tavira, Almargem, E. da Veiga, s/ data (COI).

Espécie acentuadamente xerofílica, preferindo, por isso, locais bastante secos e insolados, em fendas de rochas xistosas ou calcárias.

Antes de concluir, não queremos deixar de agradecer ao Sr. ALFREDO DA CONCEIÇÃO que amavelmente se prontificou a fazer os desenhos que acompanham este trabalho.

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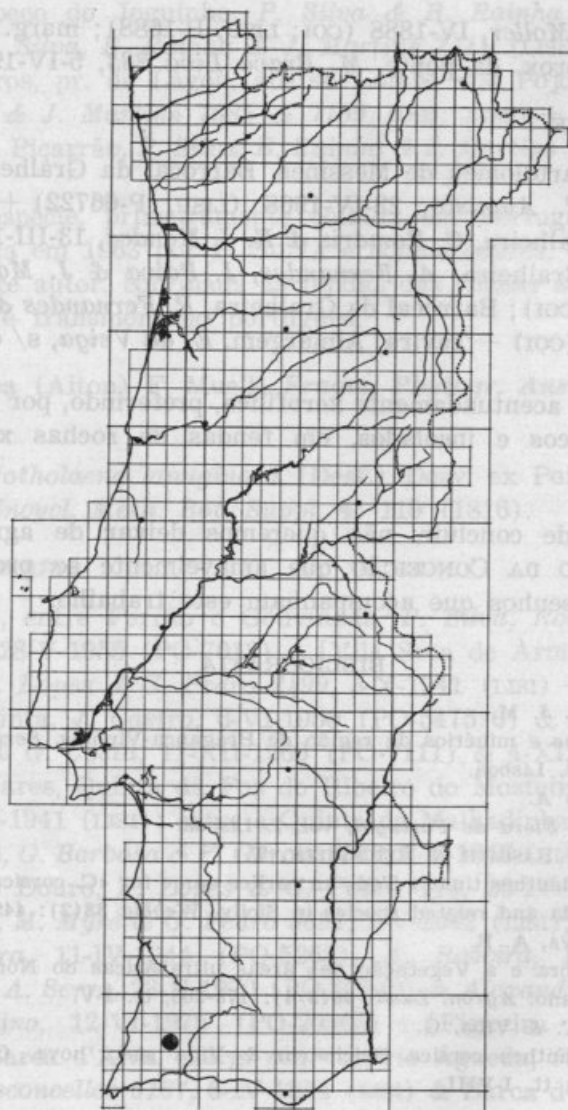
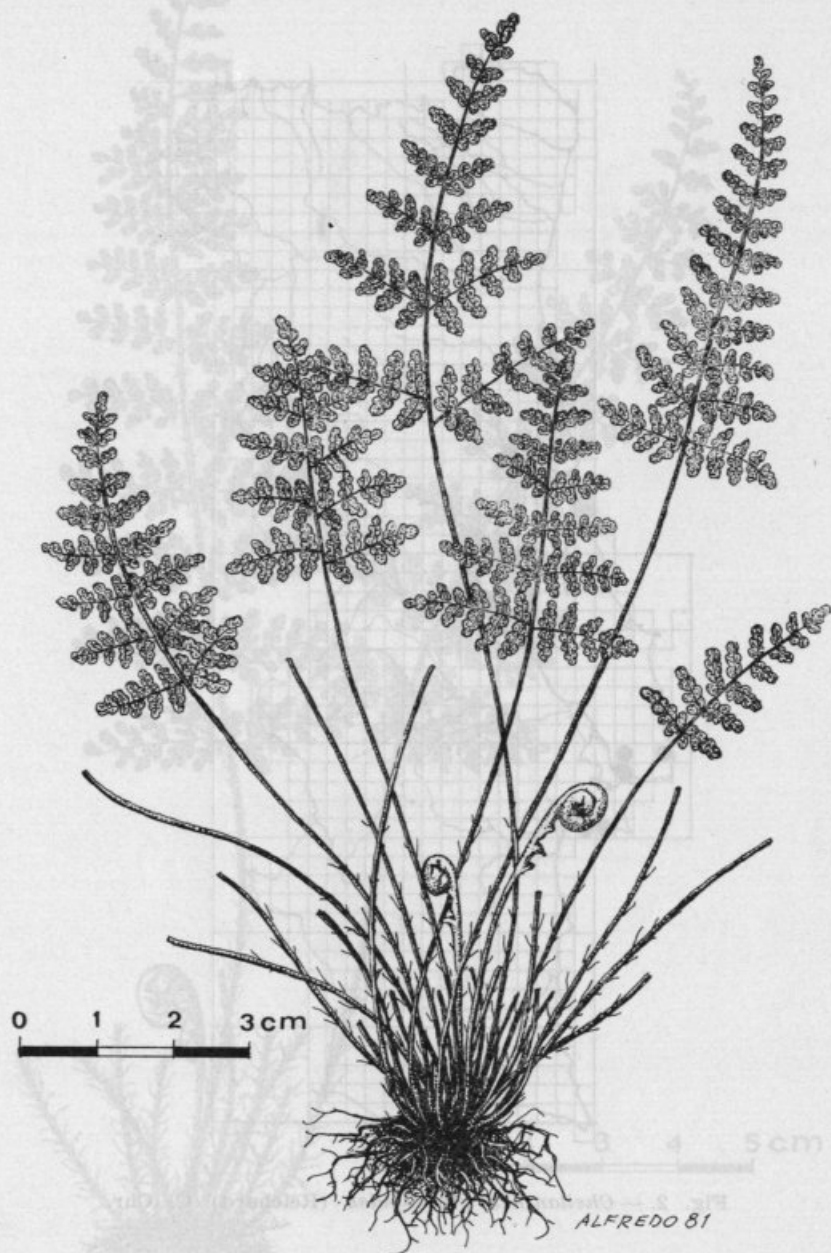


Fig. 1. — *Cheilanthes guanchica* Bolle



*Cheilanthes guanchica* Bolle

*Cheilanthes pteridoides* (Reichard) C. Chr.

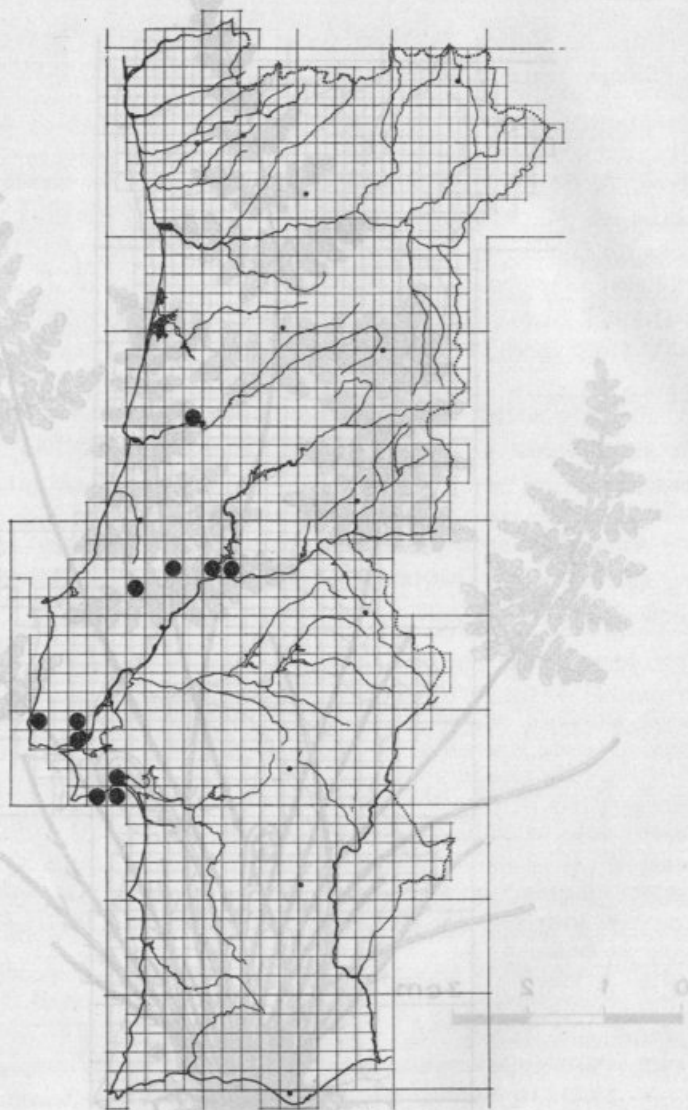


Fig. 2. — *Cheilanthes pteridioides* (Reichard) C. Chr.



*Cheilanthes pteridioides* (Reichard) C. Chr.

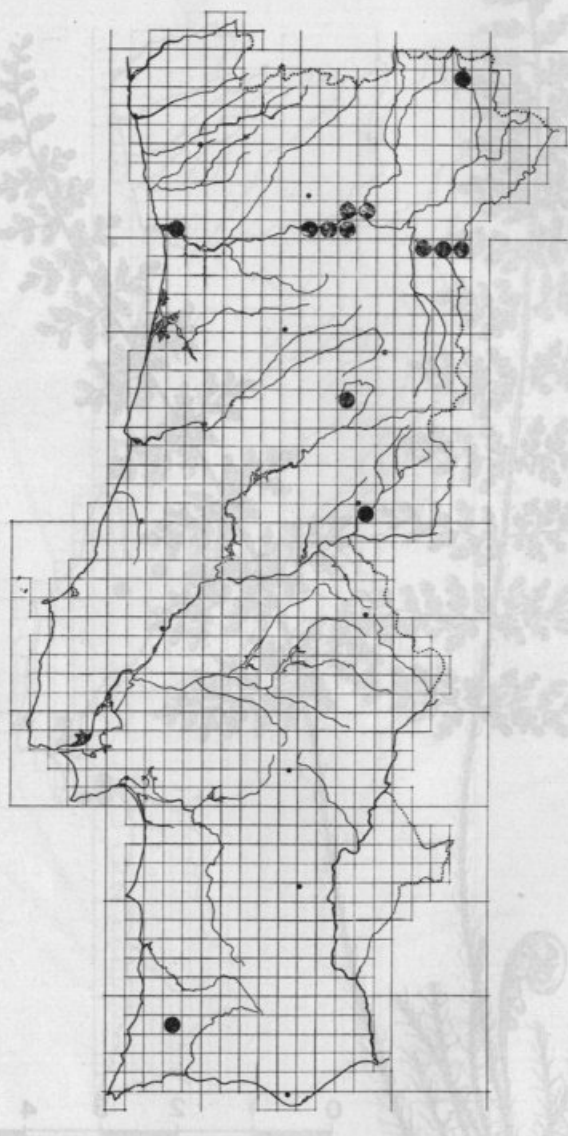


Fig. 3. — *Cheilanthes maderensis* Lowe



*Cheilanthes maderensis* Lowe

Fig. 4. — *Cheilanthes maderensis* (Lowe) Tuck.

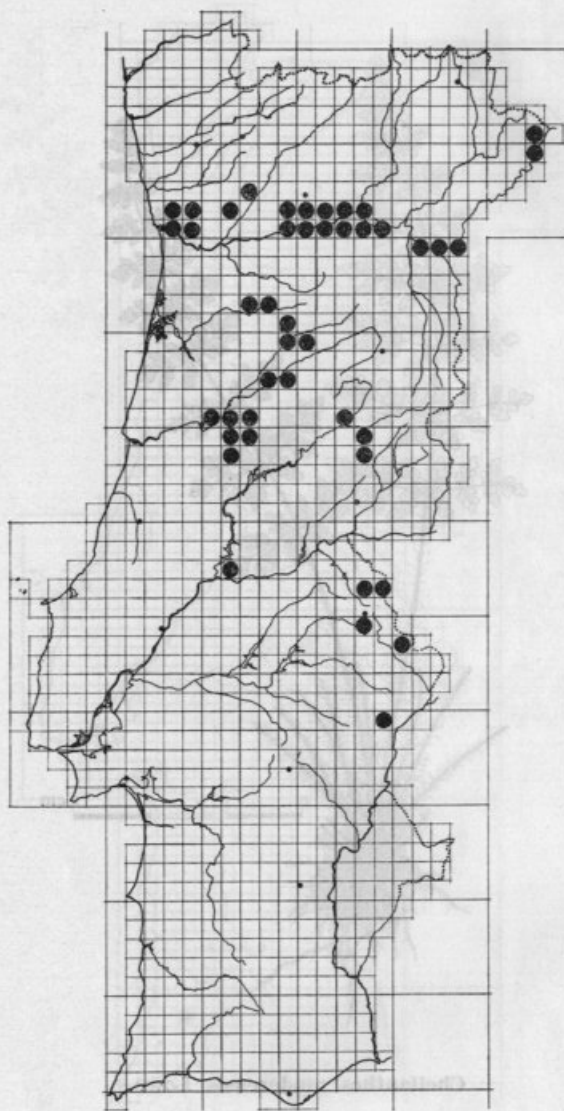
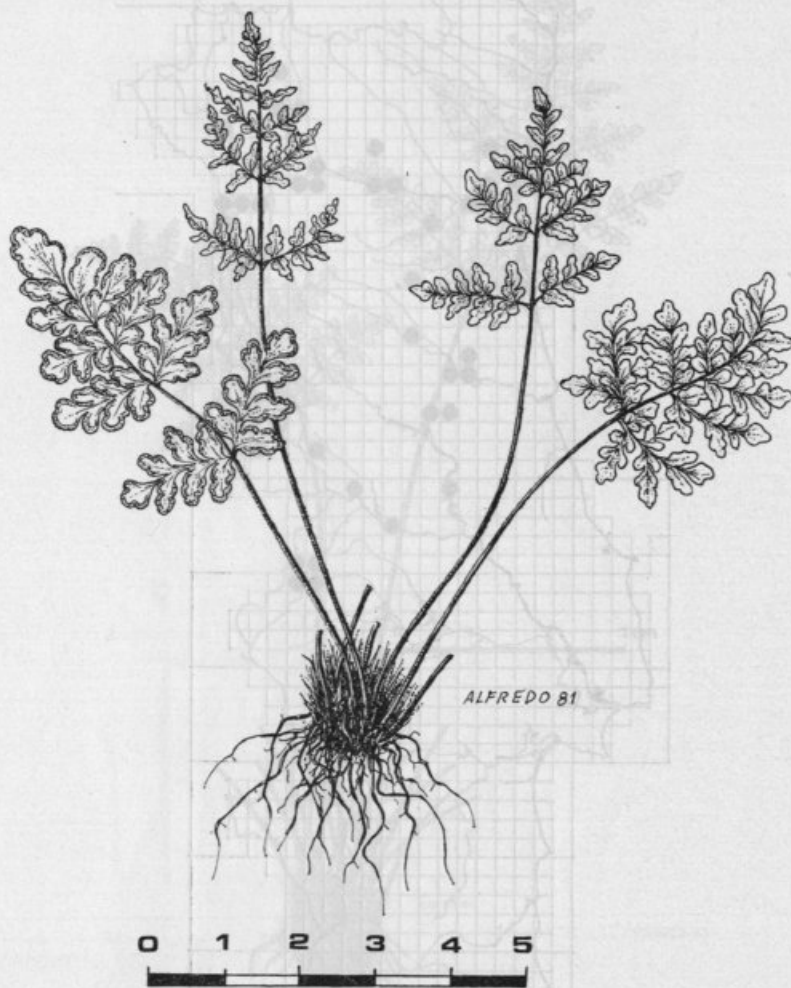
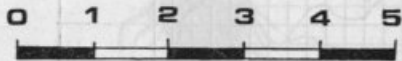


Fig. 4. — *Cheilanthes tinaii* Tod.





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*Cheilanthes tinaei* Tod.

*Cheilanthes tinaei* Mett.

Fig. 5. — *Cheilanthes tinaei* Mett.

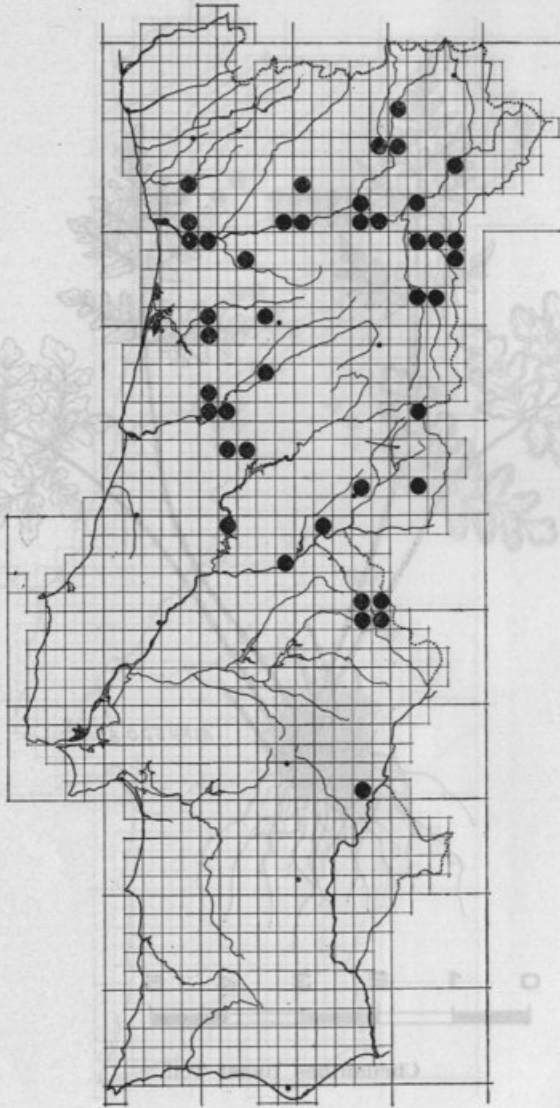
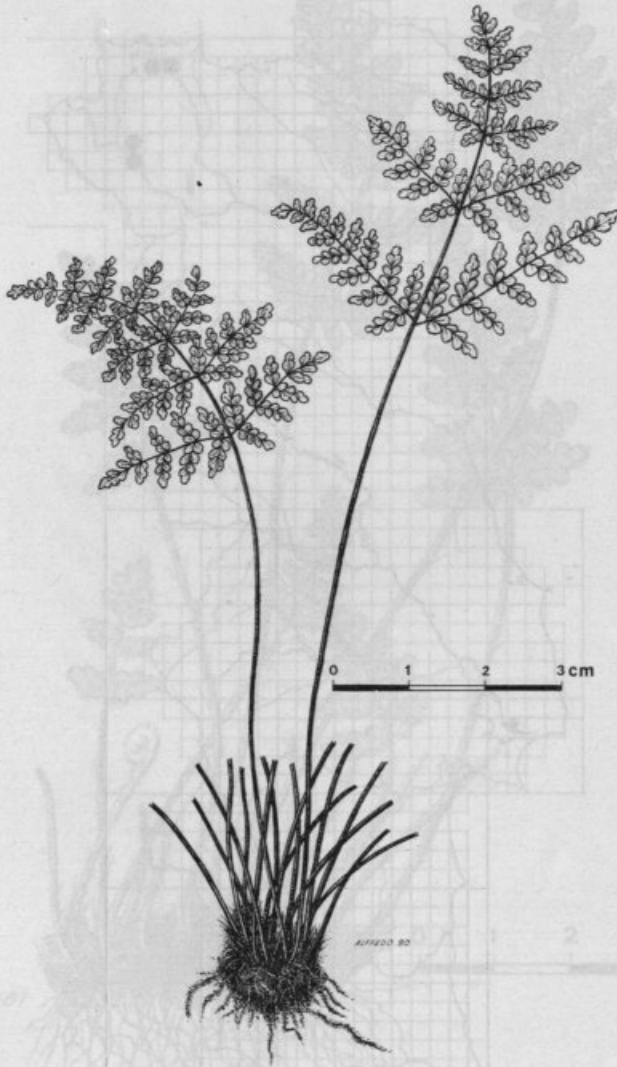


Fig. 5. — *Cheilanthes hispanica* Mett.



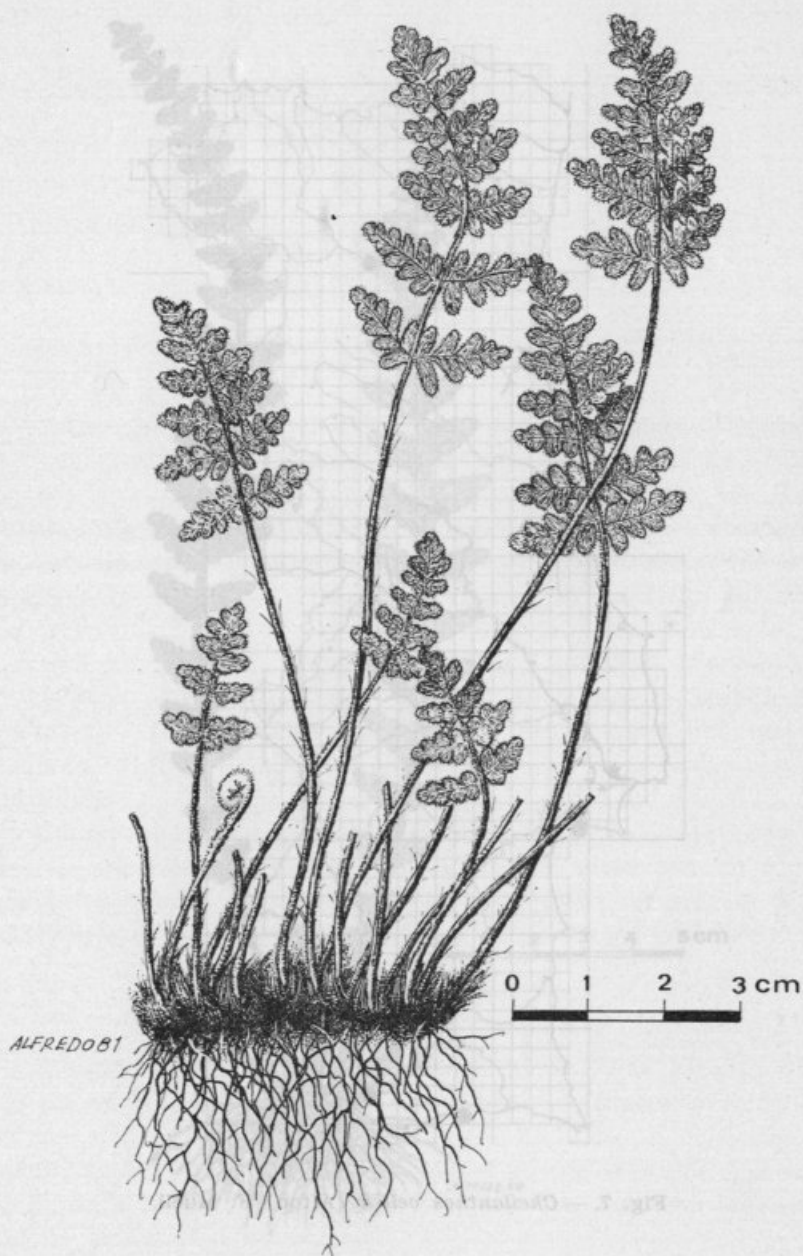
*Cheilanthes hispanica* Mett.

Fig. 8. — *Cheilanthes hispanica* (L.) Donnell

*Cheilanthes hispanica* (L.) Donnell



Fig. 6. — *Cheilanthes marantae* (L.) Domin



*Cheilanthes marantae* (L.) Domin



Fig. 7. — *Cheilanthes vellea* (Aiton) F. Muell.

COMUNICAÇÕES PARA O CONHECIMENTO  
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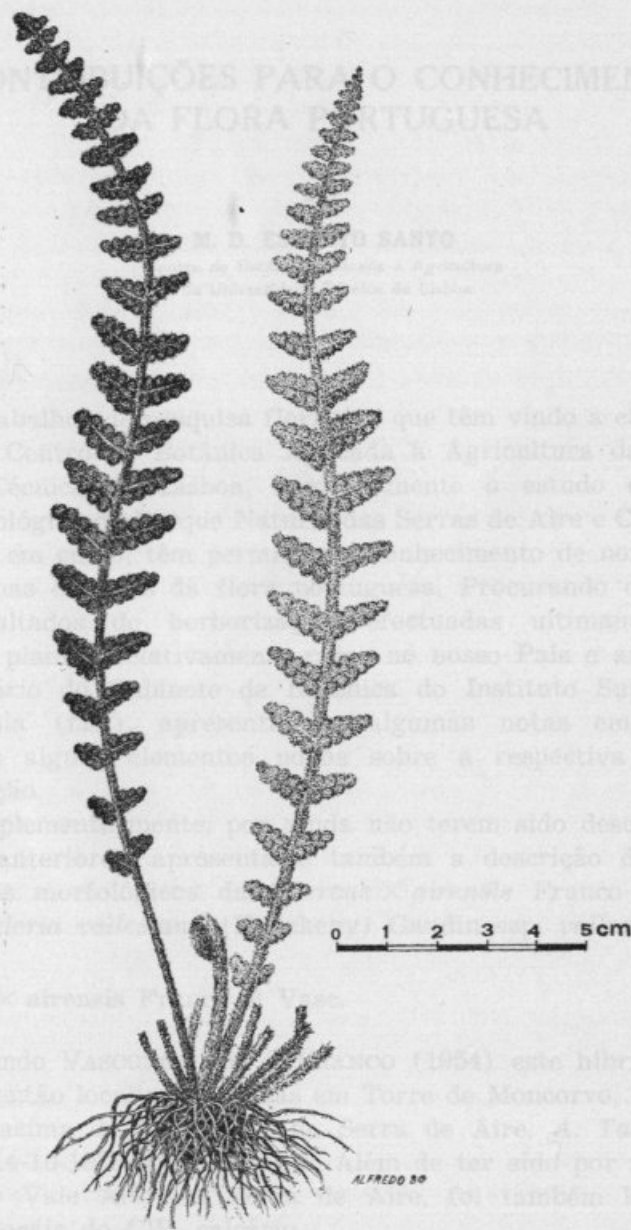
ALFREDO S. S. SANTO  
de Lisboa e Coimbra

OS trabalhos que têm vindo a efectuar-se na Comissão de Estudos de Botânica da Universidade de Lisboa, sob a direcção do Sr. Dr. António de Almeida, têm tido como objecto principal o estudo de indole fitossociológica das plantas que vivem em Seras de Aire e Candeeiros, e a descoberta de novas áreas de distribuição de algumas espécies. Procurando dar conta dos resultados das pesquisas efectuadas, e de algumas plantas encontradas, apresentamos ao Sr. Dr. Almeida, algumas notas em que se fornecem alguns dados sobre a respectiva área de distribuição.

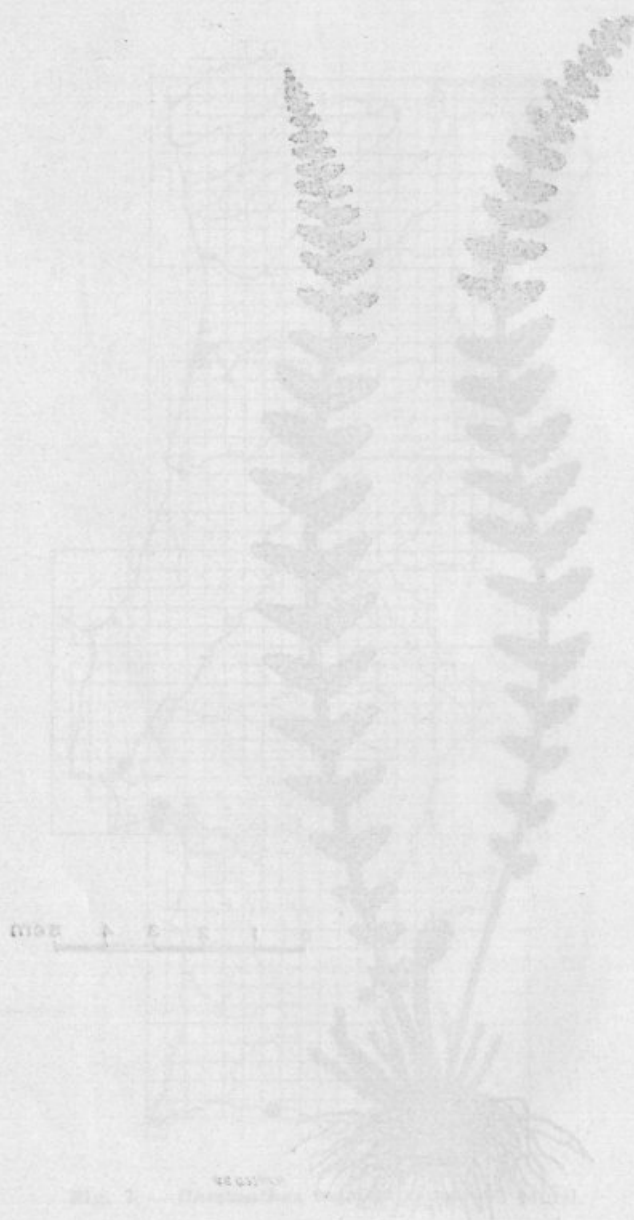
Complementando os trabalhos já publicados por outros autores, apresentamos também a descrição de alguns caracteres morfológicos de *Cheilanthes vellea* Franco & Vaz, e da *Cheilanthes vellea* Franco & Vaz.

Segundo Vaz e Franco (1954) este híbrido tinha sido encontrado na Torre de Moncorvo, Alcanena (Alentejo), e na Serra de Aire. A *Cheilanthes vellea* Franco & Vaz foi descrita por estes autores em 1954. Também foi localizada noutras localidades do Alentejo.

*Cheilanthes vellea* Franco & Vaz é uma planta relativamente rara, encontrada na Serra de Aire (Alentejo) e na Serra de Aire, também na Serra de Aire.



*Cheilanthes vellea* (Aiton) F. Muell.



*Chelidonium majus* (L.) Murr.



## CONTRIBUIÇÕES PARA O CONHECIMENTO DA FLORA PORTUGUESA

por

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OS trabalhos de pesquisa florística que têm vindo a efectuar-se no Centro de Botânica Aplicada à Agricultura da Universidade Técnica de Lisboa, nomeadamente o estudo de índole fitossociológica do Parque Natural das Serras de Aire e Candeeiros que está em curso, têm permitido o conhecimento de novas áreas de algumas espécies da flora portuguesa. Procurando dar conta dos resultados de herborizações efectuadas ultimamente, de algumas plantas relativamente raras no nosso País e arquivadas no herbário do Gabinete de Botânica do Instituto Superior de Agronomia (LISI), apresentam-se algumas notas em que se reuniram alguns elementos novos sobre a respectiva área de distribuição.

Complementarmente, por ainda não terem sido descritos por autores anteriores, apresenta-se também a descrição de alguns caracteres morfológicos da *Quercus* × *airensis* Franco & Vasc. e da *Koeleria vallesiana* (Honckeny) Gaudin ssp. *vallesiana*.

### **Quercus** × **airensis** Franco & Vasc.

Segundo VASCONCELLOS & FRANCO (1954) este híbrido tinha sido até então localizado apenas em Torre de Moncorvo, Alcanena (Minde, acima de Vale Alto, na Serra de Aire, A. *Taborda de Morais*, 14-10-1938, COI) e Loulé. Além de ter sido por nós visto acima de Vale Alto, na Serra de Aire, foi também localizado noutros locais do CW. calcário.

*Espécimes*: Vila Nova de Ourém, Fátima — num pinhal relativamente ralo, perto do Sardaçal, alt. 380 m (21-5-1980; M. *Lousã* & J. *Monjardino*) e na Lomba Ataão, também na Serra de Aire,

alt. 450 m (13-11-1980; *M. Lousã & M. D. Espírito Santo*); Porto de Mós — São Bento, num mato entre Azelhas e Casal dos Correias, alt. 475 m (16-7-1980; *M. Lousã & M. D. Espírito Santo*) e Alvados, Cabeço do Algardoiro, num carrascal, exp. SW, alt. 375 m (6-11-1980; *M. Lousã & M. D. Espírito Santo*).

À descrição de VASCONCELLOS & FRANCO (1954) podemos acrescentar que os amentos masculinos têm a ráquis estrelado-hirsuta; perianto lobado, com lobos ovado-obtusos de margem escariosa, ciliada; estames com filetes lineares, glabros e anteras glabras um pouco maiores que os filetes, cordiforme-oblongas e mucronadas. Os amentos femininos são parvifloros (1-3 flores) de pedúnculo com cerca de 5 mm, estrelado-pubescente; invólucro sub-globoso com escamas imbricadas e aplicadas, ovadas e agudas, pubescentes segundo uma faixa marginal, glabras a meio; estiletos coniventes, alongados, insensivelmente dilatados em estigmas espessos bi-fendidos, livres e recurvado-divergentes.

*Distribuição*: NE., CW. calc. e SE. mer.

***Cerastium brachypetalum* Pers. ssp. *tauricum* (Sprengel) Murb.**

À distribuição indicada por MÖSCHL (1951), rectificada mais tarde por R. FERNANDES (1962) e mencionada por FRANCO (1971), deve juntar-se o CW. calc. em função dos seguintes espécimes: Porto de Mós — Costa de Mira, sobre as Ventas do Diabo, alt. 525 m (30-4-1980; *M. Lousã, M. D. Espírito Santo, I. Moreira & M. L. Rosa*); Costa de Mira, sob as Ventas do Diabo, alt. 425 m (30-4-1980; *M. Lousã & M. D. Espírito Santo*); Costa de Alvados, alt. 425 m (19-5-1980; *M. Lousã & J. Monjardino*).

*Distribuição*: NE., NW. mer., CW. calc., CS. plist. e Alg.

***Crambe hispanica* L.**

À distribuição indicada anteriormente por PINTO DA SILVA (1948), rectificada mais tarde por MALATO-BELIZ (1960) e referida por FRANCO (1971) deve juntar-se uma nova localidade na Estremadura, onde já tinha sido colhida na Serra de Montejunto (próximo de Pragança, COI, duplicado do LISE n.º 20359, *Bento Rainha*, 6-6-1947).

*Espécime*: Porto de Mós, Costa de Mira, sobre as Ventas do Diabo, alt. 525 m (30-4-1980; *M. Lousã, M. D. Espírito Santo, I. Moreira & M. L. Rosa*).

*Distribuição*: Trás-os-Montes e Alto Douro, CE., CW. calc. e SE.

***Vicia villosa* Roth ssp. *pseudocracca* (Bertol.) P. W. Ball**

Baseado na descrição feita por R. FERNANDES (1954) foi determinado como pertencente a esta subespécie um exemplar anteriormente identificado como sendo *Vicia benghalensis* L. for. *benghalensis*. Assim, à distribuição anteriormente dada, há a acrescentar:

*Espécime*: Elvas, ao 4.º km na estrada St. Eulália-Monforte, (22-5-1957; *Joaquim T. Antunes Barradas*).

*Distribuição*: Barca d'Alva, arred. da Nazaré, arred. de Elvas.

***Lathyrus tingitanus* L.**

À área referida por MALATO-BELIZ (1960) e FRANCO (1971) para esta leguminosa rara, há a acrescentar no Alto Alentejo um novo espécime: Évora, depois de Nossa Senhora da Graça do Divor, na estrada para Arraiolos (5-5-1980; *António Lopes Aleixo*).

*Distribuição*: CW. aren., CE. mer. e SE. set.

***Anthyllis vulneraria* L. ssp. *lusitanica* (Cullen & P. Silva) Franco**

Referida por FRANCO (1971) apenas para o NE., CN., CE. e CS. arrab., foi por nós encontrada em várias localidades das Serras de Aire e Candeeiros.

*Espécimes*: Vila Nova de Ourém, Fátima — perto do Sardaçal, num pinhal relativamente ralo, alt. 380 m (21-5-1980; *M. Lousã & J. Monjardino*) e entre Chão da Serra e Goucha Larga, num olival muito esparso, alt. 460 m (21-5-1980; *M. Lousã & J. Monjardino*); Torres Novas — Chancelaria, num mato da Goucha Larga, alt. 447 m (21-5-1980; *M. Lousã & J. Monjardino*); Pedró-

gão, junto ao ponto mais alto da Serra de Aire, num mato ralo, alt. 678 m (18-6-1980; *M. Lousã & M. D. Espírito Santo*), num mato 50 m para Leste do anterior (18-6-1980; *M. Lousã & M. D. Espírito Santo*) e entre este e Vale Fojo, alt. 525 m (18-6-1980; *M. Lousã & M. D. Espírito Santo*); Porto de Mós — Costa de Alvados, num arrelvado frequentemente pastoreado, alt. 425 m (19-5-1980; *M. Lousã & J. Monjardino*), 100 m a Sul do ponto anterior, entre as formações rochosas de calcário, alt. 500 m (19-5-1980; *M. Lousã & J. Monjardino*), entre Serro Ventoso e Chão das Pias, junto ao Carvalho, num mato muito ralo, alt. 450 m (19-5-1980; *M. Lousã & J. Monjardino*), próximo de Serro Ventoso, numa comunidade rupícola dos Malhadais (24-4-1980; *J. A. Franco, M. Lousã & M. D. Espírito Santo*), num mato anteriormente queimado da Serra dos Candeeiros, acima do Lagar de Ferro, alt. 330 m (16-4-1980; *M. Lousã, M. D. Espírito Santo, I. Moreira & M. L. Rosa*) e 100 m a Sudeste deste local, numa linha de água, alt. 350 m (16-4-1980; *M. Lousã, M. D. Espírito Santo, I. Moreira & M. L. Rosa*); Alcobaça, numa parede rochosa da Serra dos Candeeiros, a Nordeste do Casal do Doutor, alt. 380 m (7-5-1980; *M. Lousã & J. Monjardino*).

*Distribuição*: NE., CN., CE., CW. calc. e CS. arrab.

### ***Helianthemum apeninum* (L.) Miller**

Planta rara, dada na bibliografia consultada (COUTINHO, 1939; FRANCO, 1971; P. SILVA, 1968; P. SILVA & SOBRINHO, 1951; ROZEIRA, 1944 e SAMPAIO, 1946) apenas para o Nordeste e Serra de Montejunto, foi esta espécie encontrada em nova localidade.

*Espécime*: Porto de Mós, Serro Ventoso, junto ao Carvalho, na estrada para S. Bento, alt. 450 m, num mato ralo (19-5-1980; *M. Lousã & J. Monjardino*).

*Distribuição*: NE e serras do CW. calc.

### ***Scandix australis* L. ssp. *microcarpa* (Lange) Thell.**

Na Nova Flora de Portugal, FRANCO (1971), refere que este *taxon* se encontra na bacia do Alto Douro e Douro sup., arred. de Torres Novas (próx. da nascente do Almonda, COI n.º 2944,

*Mendonça & F. de Sousa*, 31-4-1935), Serra d'Ossa e W do conc.º Loulé. Além desta informação, há a acrescentar no CW. calc. duas novas localidades.

*Espécimes*: Porto de Mós, Costa de Alvados, num arrelvado, alt. 425 m (19-5-1980; *M. Lousã & J. Monjardino*); Tomar, Valdonas (7-4-1979; 866A, *M. Lousã*).

*Distribuição*: Bacia do Alto Douro e Douro sup., CW. calc., Serra d'Ossa e W do conc. de Loulé.

### **Cachrys trifida** Miller

Esta rara umbelífera, que apenas era conhecida dos arredores de Coimbra e do SE. meridional, aparece também mais a sul do CW. calcário.

*Espécime*: Alcanena, num mato da Serra de St. António, situado entre Carvalheiros e a Lapa da Cerejeira, alt. 440 m (16-7-1980; *M. Lousã & M. D. Espírito Santo*).

*Distribuição*: Arred. de Coimbra, Serra de St. António e SE. mer.

### **Ferula communis** L. ssp. *communis*

A distribuição referida por FRANCO (1971), há a acrescentar o CW. calc. onde foi por nós localizada.

*Espécime*: Porto de Mós, entre S. Bento e o Covão do Sabugueiro, alt. 500 m (25-6-1980; *M. Lousã & M. D. Espírito Santo*).

*Distribuição*: Bacias do alto Douro e do Sabor, CE., CW. calc. e SE. set.

### **Chaenorrhinum organifolium** (L.) Fourr. ssp. *organifolium*

As elevações calcárias da Estremadura, de onde já era conhecida — Serra de Montejunto, Palmela, Serras da Arrábida e S. Luís — referidas por R. FERNANDES (1970), há a acrescentar a Serra dos Candeeiros, onde foi por nós encontrada.



*Espécimes*: Porto de Mós, Serro Ventoso, antes do Chão das Pias, junto ao Carvalho, alt. 450 m (19-5-1980; *M. Lousã & J. Monjardino*); Alcobaça, Benedita — Portela das Cruzes, num pinhal novo, alt. 456 m (19-3-1981; *M. Lousã & M. D. Espírito Santo*) e Casal do Guerra, perto de uma pedreira, alt. 325 m (16-4-1980; *M. Lousã, M. D. Espírito Santo, I. Moreira & M. L. Rosa*).

*Distribuição*: Trás-o-Montes e Alto Douro, CW. calc. e SE. mer.

### **Gagea polymorpha** Boiss.

Esta planta, de folhas homomórficas, pedicelos esparsamente silosos e tépalas trinérveas, foi encontrada por nós na Serra de Aire onde é muito rara.

*Espécime*: Torres Novas, Chancelaria, num mato da Goucha Larga, alt. 447 m (17-3-1981; *M. Lousã, M. D. Espírito Santo & I. Moreira*).

*Distribuição*: Regiões elevadas da Serra de Aire.

### **Ornithogalum pyrenaicum** L.

Segundo SAMPAIO (1946) esta liliácea, apesar de pouco abundante, aparece de Norte a Sul do País. Um pouco mais concretamente era dada em 1939 por PEREIRA COUTINHO, principalmente para a região montanhosa de Trás-os-Montes e Minho a Monchique. Foi por nós encontrada na Serra de Aire onde é muito pouco frequente.

*Espécime*: Torres Novas, Pedrógão, num mato ralo junto ao ponto mais alto da Serra de Aire, sobre Vale Alto, alt. 678 m (18-6-1980; *M. Lousã & M. D. Espírito Santo*).

A localização referida nas floras portuguesas, aliada às consultas feitas ao material herborizado, arquivado nos herbários do Instituto Superior de Agronomia e Instituto Botânico Dr. Júlio Henriques da Universidade de Coimbra, permite-nos dar para este espécie a seguinte

*Distribuição:* Regiões montanhosas do NE., CW. calc. e CW. olissip. e Serra de Monchique.

**Muscari neglectum** Guss. ex Ten.

Já encontrada no CW. calc. (Coimbra, J. L. M. Pinheiro, Fevereiro de 1897), foi esta espécie por nós localizada mais a Sul nas Serras de Aire e Candeeiros.

*Espécimes:* Vila Nova de Ourém, Fátima, encosta norte da Goucha Larga, na Serra de Aire, alt. 500 m (21-5-1980; M. Lousã & J. Monjardino); Torres Novas — Chancelaria, na Goucha Larga, alt. 447 m (21-5-1980; M. Lousã & J. Monjardino), Pedrógão, entre o cimo da Serra de Aire e Vale Fojo, alt. 525 m (18-6-1980; M. Lousã & M. D. Espírito Santo) e junto ao ponto mais alto da Serra de Aire, alt. 678 m (18-6-1980; M. Lousã & M. D. Espírito Santo); Porto de Mós, Arrimal, na Serra dos Candeeiros, acima do Lagar de Ferro, alt. 330 m (16-4-1980; M. Lousã, M. D. Espírito Santo, I. Moreira & M. L. Rosa).

De acordo com as fontes indicadas para o *taxon* anterior, damos para esta espécie a seguinte

*Distribuição:* NE. (T. Q.), CW. calc., CS. arrab., SW. set., Barlav. e Sotav.

**Koeleria vallesiana** (Honckeny) Gaudin ssp. *vallesiana*

Citada por PINTO DA SILVA (1956), para o Norte do Ribatejo (próximo de Paialvo e Alcanede), esta planta rara no nosso País, foi também por nós encontrada um pouco mais a Oeste, já na Estremadura.

*Espécimes:* Porto de Mós, na vertente SW da Serra dos Candeeiros, acima do Lagar de Ferro, num mato sobre solo calcário, alt. 330 m (16-4-1980; M. Lousã, M. D. Espírito Santo, I. Moreira & M. L. Rosa); Alcobaça, numa parede rochosa calcária da Serra dos Candeeiros, a NE do Casal do Doutor, alt. 360 m (7-5-1980; M. Lousã & J. Monjardino).

Estes exemplares diferem um pouco da descrição feita por PINTO DA SILVA (1956), no que respeita às folhas basilares. Segundo este autor estas folhas são de limbo estreitamente

(até 1 mm) conduplicado-setáceo, um tanto rígido, mais ou menos sinuoso-encurvado, levemente denticulado nas margens e muitas vezes provido próximo da base, de cada lado da lígula, de algumas (até 10) sedas rígidas, com cerca de 1 mm, fortemente 5-nérveo, com 5 cm de comprimento ou menos. Nos exemplares por nós encontrados, as sedas rígidas, que se encontram de cada lado da lígula, prolongam-se por vezes até cerca de metade do limbo, tornando-se nesta mais sedosas. Sempre com 5 nervuras, além das folhas de limbo conduplicado-setáceo, também aparecem folhas basilares planas, com limbo até 2 mm de largura e 11 cm de comprimento, celheado, com algumas sedas rígidas de cada lado da lígula. Pensamos que estas últimas surjam num estado fenológico posterior à formação das primeiras, já que com o espigamento (MOREIRA & VASCONCELLOS, 1976), as folhas basilares conduplicado-setáceas secam, restando as folhas basilares planas.

*Distribuição:* CW. calc.

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THIS paper considers the cytology of six species of *Stida* L. in Nigeria whose taxonomy has been recently treated by Greenwood (1936). These species, which revealed four different chromosome numbers, are *S. bifida* Johnston ex Cavanilles; *S. conyfolia* L.; *S. glava* (Rottbusch) Ugborenjo; *S. wrens* L.; *S. spinosa* (L.) Ugborenjo and *S. ovata* Forsk.

Apart from the report of the author on the cytogenetics of the *Stida rhombifolia* complex (1982) and the work of Scott-Evans & Ugborenjo (1980) on the cytogenetics of the allied species of the genus — *S. acule* complex, *S. parvicornis* and *S. scyridis*, there is no evidence in Nigeria of any cytological work done on any of the six species being treated here. It is this lack of information on the cytology of these species coupled with the cytological variation exhibited by them that have necessitated the publication of this paper which will no doubt add to the pool of information on the cytology of the six species in particular and the genus *Stida* in general.

#### MATERIAL AND METHODS

In addition to the flower buds collected from plants and fixed during field survey, root tips and flower buds were obtained from plants in cultivation in the Biological Garden of the Department of Biological Sciences of the University of Lagos. These were used for the cytological studies.

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## CYTOLOGICAL STUDIES ON SIX SPECIES OF *SIDA* L. IN NIGERIA

by

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### INTRODUCTION

THIS paper considers the cytology of six species of *Sida* L. in Nigeria whose taxonomy has been recently treated by UGBOROGHO (1980). These species, which revealed four different chromosome numbers, are *S. linifolia* Jussieu ex Cavanilles, *S. cordifolia* L., *S. pilosa* (Retzius) Ugborogho, *S. urens* L., *S. spinosa* (L.) Ugborogho and *S. ovata* Forskål.

Apart from the report of the author on the cytogenetics of the *Sida rhombifolia* complex (1982) and the work of SCOTT-EMUAKPOR & UGBOROGHO (1980) on the cytogenetics of the allied species of the genus — *S. acuta* complex, *S. garckeana* and *S. scabrida*, there is no evidence in Nigeria of any cytological work done on any of the six species being treated here. It is this lack of information on the cytology of these species coupled with the cytological variation exhibited by them that have necessitated the publication of this paper which will no doubt add to the pool of information on the cytology of the six species in particular and the genus *Sida* in general.

### MATERIAL AND METHODS

In addition to the flower buds collected from plants and fixed during field survey, root tips and flower buds were obtained from plants in cultivation in the Biological Garden of the Department of Biological Sciences of the University of Lagos. These were used for the cytological studies.

Preparation of specimens for the study of stomata, pollen grains and chromosomes are as for UGBOROGHO 1973 and SCOTT-EMUAKPOR & UGBOROGHO 1980. Chromosome study was made at full mitotic metaphase with  $\times 10$  eyepiece and  $\times 40$  objective lenses of a Wild Compound Microscope. The same magnification was often used for the study of stomata and pollen grains.

## RESULTS

1. *S. linifolia* is a diploid species with a somatic chromosome number of 14 (Plate 1) and a basic number of  $x = 7$ . The chromosomes are too small (c. 2.0-3.0  $\mu\text{m}$ ) and similar in appearance for a detailed study of the karyotype to be undertaken. Meiosis was regular with normal tetrads. The mean percentage of fertile pollen grains was 98.52.

Voucher specimens for chromosome counts.

CROSS RIVER: Near Senior Staff Club, University of Calabar, Calabar, *R. E. Ugborogho* 579 (LUH); Opposite Calabar Zoo, Awka st., Calabar, *R. E. Ugborogho* 590 (LUH). KADUMA: Shika Paddock, c. 1.6 km. from Shika Research Main Office, Zaria, *R. E. Ugborogho* 475 (LUH). LAGOS: Agronoclimatological station, University of Lagos, Akoka, *R. E. Ugborogho* 126 (LUH); By Sports Field, Faculty of Education, University of Lagos, Akoka, *R. E. Ugborogho* 130 (LUH); Biological Garden, University of Lagos, Akoka, *R. E. Ugborogho* 326 (LUH). SIERRALEONE: Freetown, *G. K. Berrie* s. n. (LUH).

2. *S. cordifolia* is a tetraploid species with  $2n = 28$  (Plate 2). The basic chromosome number for this species is also 7. The chromosomes are similar and between 2.0 and 3.5  $\mu\text{m}$  long. Meiosis was regular with normal tetrads. The mean percentage of fertile pollen grain was 99.20.

Voucher specimens for chromosome counts.

KWARA: Gulende, Ilorin, *R. E. Ugborogho* 409 (LUH). LAGOS: c. 46 m. from pumping station, Bar Beach, Lagos, *R. E. Ugborogho* 173 (LUH); By the side of Awori Ajeromi District Council Maternity Centre, Ajegunle, *R. E. Ugborogho* 213 (LUH); Bar Beach, Badagry, *R. E. Ugborogho* 667 (LUH). OYO: Opposite International Institute of Tropical Agric., Ibadan, *R. E. Ugborogho* 383 (LUH). U. S. A.: Miami, Florida, *M. B. Meagher* 1329 (LUH, Univ. of Miami Herbarium).

3. The somatic complement of *S. pilosa* is 56 (Plate 3). This is an octoploid species with a basic chromosome number of 7. This is the only species with a pronounced variation in chromosome sizes (1.5-3.5  $\mu\text{m}$ ). Details of the chromosome behaviour at meiosis have not been studied. However, tetrads were normal in all the specimens studied. The mean percentage of fertile pollen grains was 97.96.

Voucher specimens of chromosome counts.

LAGOS: Near Ikeja Car Testing Centre, Ikeja, *R. E. Ugborogho* 322 (LUH); Near petrol filling station, University of Lagos, Akoka, *R. E. Ugborogho* 663 (LUH); By Biology Annexe, Dept. of Biological Sciences, University of Lagos, Akoka, *R. E. Ugborogho* 769 (LUH). OYO: Forestry Research Institute, Ibadan, *R. E. Ugborogho* 539 (LUH).

4. *S. urens* has a somatic chromosome number of 32 (Plate 4). The chromosomes are very small (c. 1.5-2.0  $\mu\text{m}$ ) and similar in appearance. This species has a basic chromosome number of  $x = 8$ . Tetrads were normal and mean pollen grain fertility was 99.55%.

Voucher specimens of chromosome counts.

BAUCHI: By No. 2, Catering Rest House, Bauchi, *R. E. Ugborogho* 493 (LUH). NIGER: Opposite M. T. D. Police Station, Tegna, *R. E. Ugborogho* 508 (LUH). OYO: Plot X38, Forest Hill, nr. Catering Rest House, Ibadan, *R. E. Ugborogho* 540 (LUH). SIERRALEONE: Freetown, *G. K. Berrie* s. n. (LUH).

5. The somatic chromosome complement of *S. spinosa* is 28. This is a diploid species with a basic chromosome number of  $x = 7$ . The chromosomes are very small (c. 1.5-2.0  $\mu\text{m}$ ) and similar in appearance. Plate 5 shows the haploid chromosome number. Meiosis is regular with normal tetrads. The mean percentage of fertile pollen grains was 99.60.

Voucher specimens of chromosome counts.

KADUNA: Shika Paddock, c. 1.6 km. from Shika Research Main Office, Zaria, *R. E. Ugborogho* 471 (LUH). KANO: Kafin Mai Yaki Village, *R. E. Ugborogho* 480 (LUH); Zara Village, Kano-Bauchi Road, *R. E. Ugborogho* 488 (LUH).

6. *S. ovata* is also a diploid species with a somatic chromosome number of 28 (Plate 6) and a basic chromosome number of  $x = 7$ . The chromosomes of this species are also very small

(c. 1.5-2.0  $\mu\text{m}$ ) and similar. Tetrads were normal and mean percentage of fertile pollen grains was 98.29.

Voucher specimens of chromosome counts.

KANO: Zaria-Kano Road, 1 km. from Gainawa Village, *R. E. Ugborogho* 483 (LUH); Zaria-Kano Road, 18 km. to Kano, *R. E. Ugborogho* 484 (LUH).

The chromosome numbers obtained for these six species of *Sida* studied in other parts of the World are listed in Table 1. Table 2 shows morphological features of the species which exhibit some noteworthy results in relation to chromosome numbers.

#### DISCUSSION

This study was undertaken to elucidate the cytology of the species of *Sida* considered here. As the results revealed, there are four chromosome levels in these six species of *Sida* in Nigeria. These are  $2n = 14$  (one taxon),  $2n = 28$  (three taxa),  $2n = 32$  (one taxon) and  $2n = 56$  (one taxon).

DARLINGTON & WYLIE (1955) reported basic chromosome number of  $x = 7, 8$  and  $11$  for the genus *Sida*. According to the cytological observation reported here, the basic chromosome numbers for these six species of *Sida* are  $x = 7$  and  $8$ .

According to the published chromosome numbers (Table 1) from other parts of the world, different chromosome numbers have been reported for three of the species considered in this paper by the following authors. HAZRA & SHARMA (1971) reported  $2n = 32$  for *S. cordifolia* in India. For *S. pilosa*, SKOVSTED (1941) reported  $2n = 14$  from Ceylon; ADHIKARY (1963)  $2n = 34$  from India and HAZRA & SHARMA (1971)  $2n = 32$  from India; while for *S. spinosa*, MANGENOT, S. & G. (1962) reported  $2n = 14$  from Africa. It should however be mentioned that the same number of chromosomes obtained from these species of *Sida* in Nigeria were also reported by other authors. While all or most of the counts in Table 1 are probably correct, some of the taxa could have been wrongly identified by the researchers.

SKOVSTED is likely to be correct in the case of *S. pilosa* since he reported the octoploid number of  $n = 28$  for the tropical

TABLE 1

Published chromosome counts of *S. linifolia*, *S. cordifolia*, *S. pilosa*, *S. urens*, *S. spinosa* and *S. ovata*

Species & Authority	Date	2n	n	Origin
<i>S. linifolia</i> Jussieu ex Cavanilles				
1. MANGENOT, S. & G.	1962	14	—	Africa
<i>S. cordifolia</i> Linnaeus				
1. SKOVSTED, A.	1941	28	—	Australia, Sudan
2. HAZRA, R. & SHARMA, A.	1971	32	—	India
<i>S. pilosa</i> (Retzius) Ugborogho				
1. SKOVSTED, A. (as <i>S. veronicifolia</i> )	1935	—	28	America
	1941	14	—	Ceylon
2. ADHIKARY, A. K. (as <i>S. veronicifolia</i> )	1963	34	—	West Bengal, India
3. HAZRA, R. & SHARMA, A.	1971	32	—	India
<i>S. urens</i> Linnaeus				
1. SKOVSTED, A.	1935	32	—	Africa and America
<i>S. spinosa</i> (L.) Ugborogho				
1. SKOVSTED, A.	1935	—	7	Tropics
	1941	28	—	Queensland, Australia
2. MANGENOT, S. & G. (as <i>S. alba</i> )	1962	14	—	Africa
3. ADHIKARY, A. K.	1963	28	—	West Bengal, India
<i>S. ovata</i> Forskål				
1. SKOVSTED, A. (as <i>S. grevioides</i> )	1935	c. 28	—	Africa
	1941	28	—	Sudan
2. BATES, D. M.	1967	—	14	Tanzania

American variety of the species in 1935. His report of  $2n = 14$  for the variety of the same species in Ceylon (1941), if the taxon was correctly identified, it should be a diploid form of the species which I am yet to see. A somatic chromosome number of 32 for *S. cordifolia* reported by HAZRA & SHARMA (1971) is exactly the same somatic chromosome number obtained for *S. urens* by SKOVSTED (1935) and the author in this paper. It is therefore likely that HAZRA & SHARMA made a mistake of identification in this case. If the identification was correct, then the plant

investigated cytologically by HAZRA & SHARMA should be an aneuploid form of *S. cordifolia* in India. This is most unlikely especially since they in the same publication reported the same somatic chromosome number for *S. pilosa* in India.

ADHIKARY (1963) reported  $2n = 34$  for *S. pilosa* in India. This again may be due to wrong identification or error in counting. If the taxon was correctly identified, then the variety should be an aneuploid form of the species. However, since ADHIKARY (1963) and HAZRA & SHARMA (1971) obtained two different somatic chromosome numbers for *S. pilosa* in India, it becomes important to re-investigate the cytology of this species in that country.

Several researchers on angiosperm cytogenetics, cytotaxonomy and Biosystematics including STEBBINS (1941 & 1950), RANDOLPH, ABBE & EINSET (1944) in STEBBINS (1950), UGBOROGHO (1973 & 1982) and MEHRA & REMANANDAN (1973) have shown that morphological features, especially micromorphological features like stomata and pollen grains, are correlated with polyploid levels in a genus whose species exhibit different chromosome numbers. According to STEBBINS (1950), «The popular conception that polyploidy usually produces gigas types, which are larger than their diploids ancestors, is now known to be true only in special instances, particularly if the original diploid is strongly heterozygous, as is true of the progenitor of the first known gigas tetraploid, that of *Oenothera lamarckiana*». Also STEBBINS (1941) working on *Stipa lepida* observed that the autotetraploids had at one instance significantly broader leaves and in another significantly narrower leaves than their diploid ancestors. UGBOROGHO (1973), working on *Cerastium arvense* complex in North America, showed that features like stomata, pollen grains, seeds and petals are constantly larger in size in the tetraploid than in the diploid forms. Also UGBOROGHO (1982) reported that morphological features like stomata, anthers and pollen grains are usually more in sizes in the tetraploid than the diploid forms.

On the other hand, MEHRA & REMANANDAN (1973) reported that the diploid forms of *Avena fatua* which grew at altitude 1,500 m. had morphological features which were constantly greater in size than those of the tetraploid which grew at a higher altitude of 2,300 m. Such morphological features he listed as internode, leaf, sheath, raceme, spikelet, glume, lemma, palea and pollen grains. He also observed that the diploid plant was



generally taller (110 cm.) than the hexaploid (66 cm.). This no doubt is an example of the drastic effect of altitude on plant growth and development.

As shown in Table 2, no morphological feature correlates with ploidy levels in the six species of *Sida* considered here. Apart from pollen diameter of *S. pilosa* which is more than that of any other species, this octoploid species exhibits morphological features which are either smallest in the polyploid series (e. g.

TABLE 2  
Morphological features in relation to chromosome number

Characters Mean values	Species					
	Linifolia 2n = 14	Cordifolia 2n = 28	Spinosa 2n = 28	Ovata 2n = 28	Urens 2n = 32	Pilosa 2n = 56
Stomata length $\mu\text{m}$	26.47	36.75	26.55	30.21	30.66	33.00
Stomata breadth $\mu\text{m}$	16.89	23.54	17.63	22.71	20.55	24.65
Pollen diameter $\mu\text{m}$	96.43	101.86	97.61	90.05	98.61	113.87
Fruit diameter mm	5.17	6.25	3.28	7.08	3.28	3.07
Carpel length mm	2.22	3.24	2.06	3.40	1.88	2.30
Carpel breadth mm	1.43	1.97	0.99	2.53	0.99	0.98

fruit diameter) or of about the same size as those of plants with lower chromosome numbers. *S. urens*, an aneuploid, exhibits morphological features which are more or less of the same size as those of the tetraploid species. Even certain morphological features (e. g. Fruit diameter, carpel length and breadth) are more in size in the diploid plant, *S. linifolia* with  $2n = 14$ , than *S. urens* with somatic chromosome number of 32.

The leaf shape of the diploid species is linear to linear-lanceolate, while in the tetraploid and octoploid species the leaves are usually ovate and cordate at the bases (UGBOROGHO 1980).

Despite all the morphological and cytological differences discussed above, the six species still have many features in common. Such features are mainly observed in the floral morphology and reproductive system of the species (UGBOROGHO 1978). Thus it could be concluded that the species considered here could have evolved from related but different diploid species. The variation in the chromosome size of *S. pilosa* is an evidence of allopolyploidy.

## ACKNOWLEDGEMENTS

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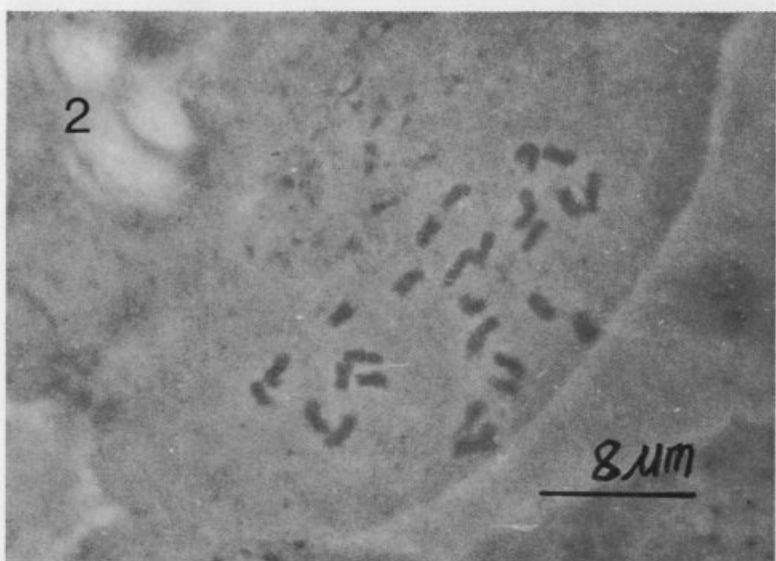
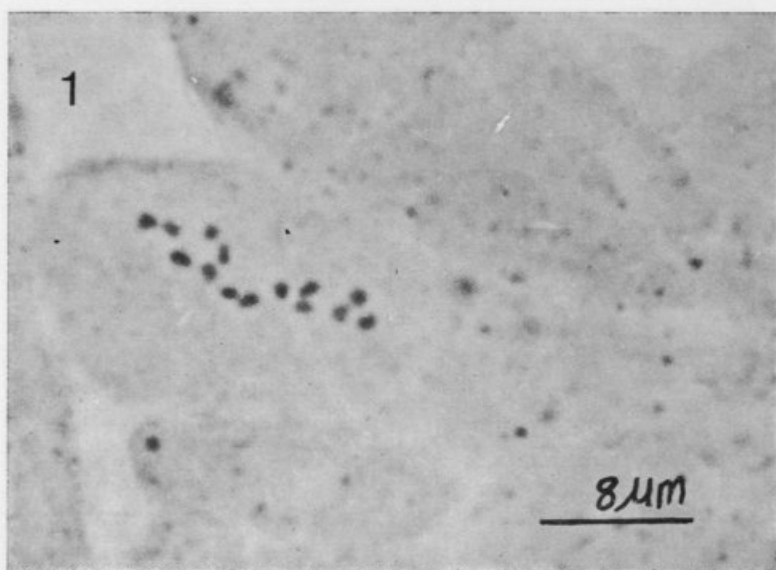
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2n = 14.
2. *S. cordifolia* from Badagry, Lagos state. Ugborogho 597.  
2n = 26.

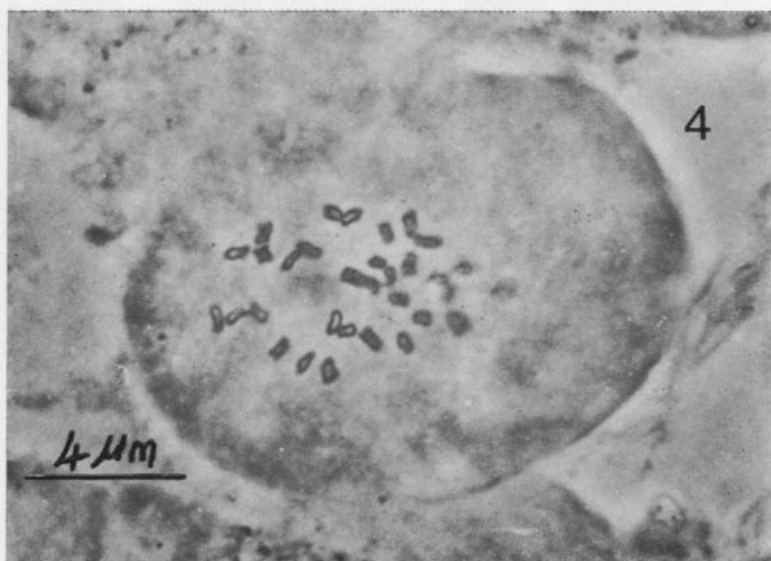
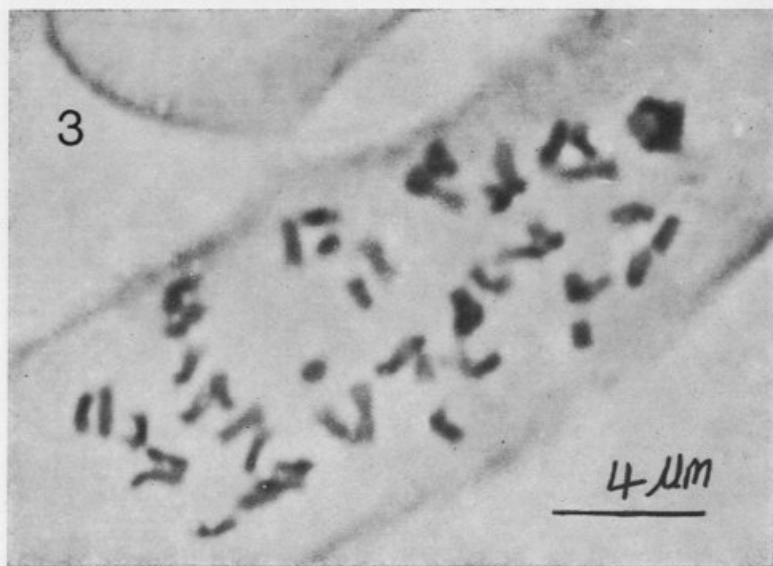




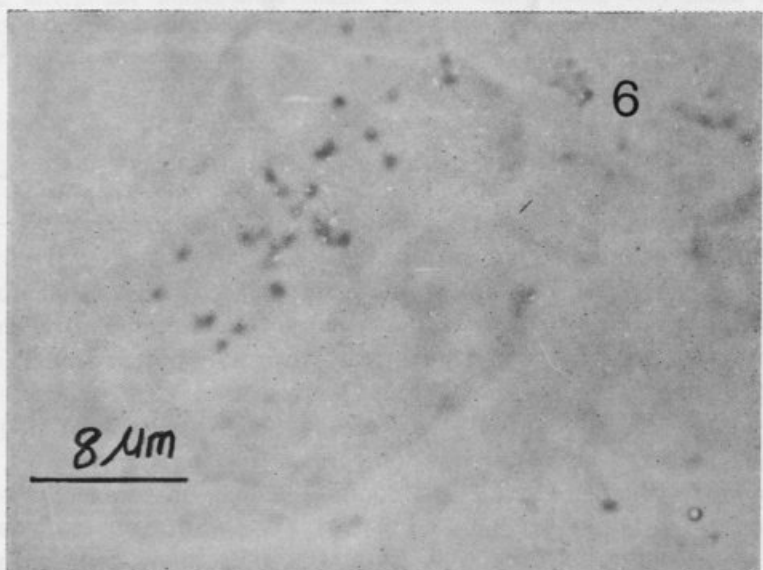
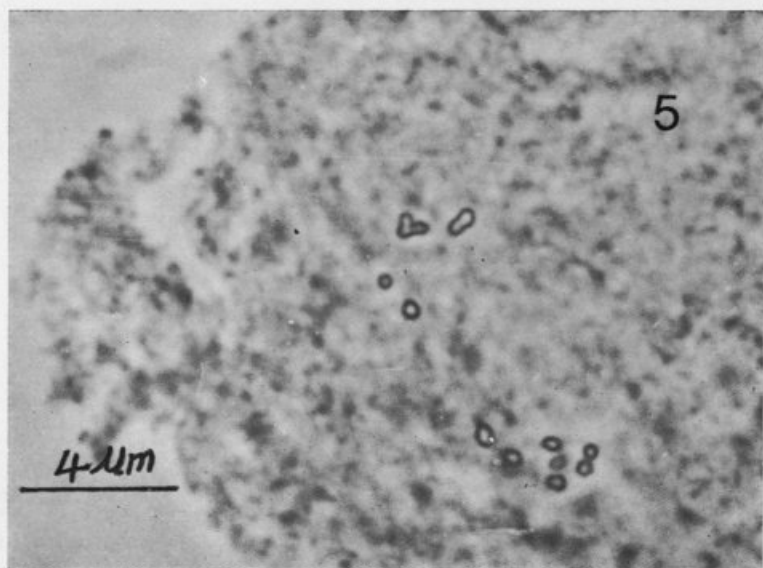


1. *S. linifolia* from Calabar, Cross River state. Ugborogho 590.  
2n = 14.
2. *S. cordifolia* from Badagry, Lagos state. Ugborogho 667.  
2n = 28.

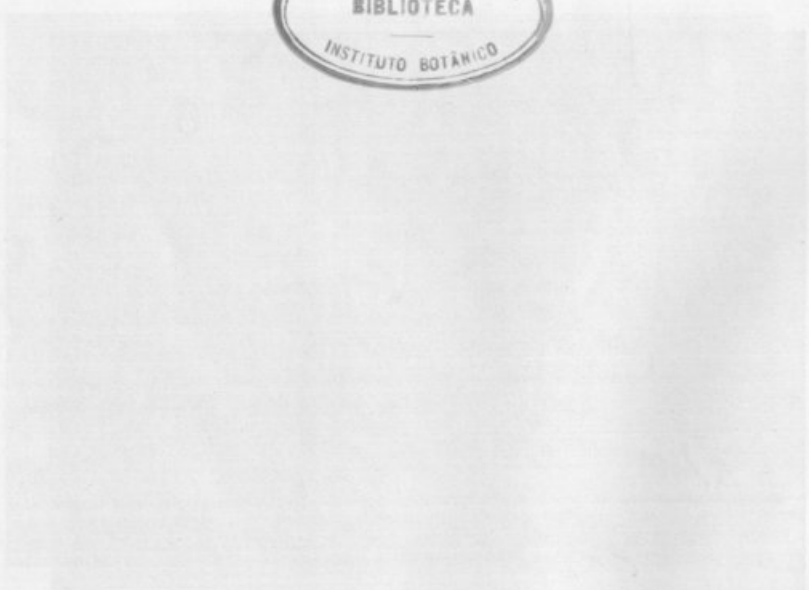
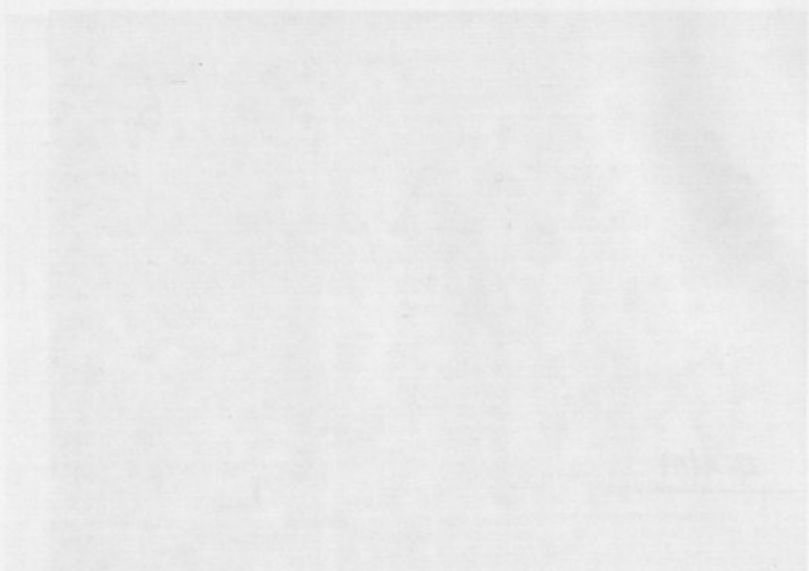




3. *S. pilosa* from University of Lagos, Akoka campus, Lagos state. Ugborogho 663.  $2n = 56$ .
4. *S. urens* from Bauchi, Bauchi state. Ugborogho 493.  $2n = 32$ .



5. *S. spinosa* from Zara village, Kano state. Ugborogho 488.  
 $2n = 14$ .
6. *S. ovata* from Gainawa village, Kano state. Ugborogho 483.  
 $2n = 28$ .



1. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
2. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
3. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
4. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
5. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
6. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
7. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
8. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
9. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).  
10. *Urtica dioica* L. (Urticaceae). - *Urtica dioica* L. (Urticaceae).



## PADRÃO DE BANDAS C EM *CREPIS VESICARIA* L.

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### SUMMARY

The somatic chromosomes of *Crepis vesicaria* were analysed on the basis of their morphology and heterochromatin (C-banding) pattern. All the chromosomes were submetacentric and all but one have only small, proximal heterochromatic blocks. The chromosome IV have also a large proximal band. The nature and relationship between the heterochromatin in metaphasic chromosomes and in interphasic nuclei are discussed. No direct correlation between heterochromatic blocks on metaphasic chromosomes and interphasic nuclei were found. On the other hand, very small stained dots were observed on the lightly stained portions of the metaphasic chromosomes.

### INTRODUÇÃO

O desenvolvimento de técnicas que permitem distinguir a cromatina em duas categorias principais, heterocromatina e eucromatina, tem aberto novas perspectivas no estudo da evolução cromossômica. Dez anos depois da descrição do primeiro cariótipo com bandas C em vegetais (VOSA, 1971) ainda são poucos os gêneros estudados com esta técnica e pouco é ainda conhecido da interrelação desses dois componentes da cromatina e seu papel na adaptação e evolução das plantas.

As *Asteraceae* se destacam como uma das famílias vegetais que têm recebido maior atenção por parte dos citotaxonomistas (ver SOLBRIG, 1977 para revisão), tendo alguns taxons como o gênero *Anacyclus* (EHRENDORFER & al., 1977) e mesmo a tribo *Anthemideae* (NAGL & EHRENDORFER, 1974), recebido tratamento citotaxonomico mais sofisticado. O gênero *Crepis*, um dos primeiros a merecer estudo cariotípico e cariosistemático detalhado

(BABCOCK, 1947), foi também um dos primeiros a ser analisado com essa técnica. SCHWEIZER (1973) apresenta um padrão de bandas C em *Crepis capillaris* e SILJAK-YAKOVLEV & CARTIER (1979) apresentam o cariótipo bandeado de *C. capillaris*, *C. conyzefolia* e *C. praemorsa* subsp. *dinarica*.

O presente trabalho apresenta um idiograma com bandas C de *C. vesicaria* ( $2n = 8$ ), compara este com os das demais espécies acima citadas e discute ainda alguns aspectos da natureza da heterocromatina nessa espécie.

#### MATERIAL E METODOS

Sementes de *C. vesicaria*, obtidas do Jardim Botânico de Coimbra, foram colocadas para germinar em placas de Petri, pre-tratadas com 8-hidroxiquinolina 0,002M por 5h, a 6° C, fixadas em Carnoy 3:1 e um dia depois preparadas segundo a técnica de MARKS (1975) ligeiramente modificada. As raízes eram lavadas três vezes em água destilada (10 minutos cada) depois de retiradas do fixador e hidrolisadas por 10 minutos em ácido acético 45 % pré-aquecido a 60° C. Uma ponta de raiz era esmagada em ácido acético 45 % frio e a lâminula retirada pelo método do gelo seco. As lâminas eram deixadas secar por um dia e então mergulhadas em uma solução saturada de hidróxido de bário [ $6,3 \text{ g Ba (OH)}_2$  em 100 ml de água destilada] por 10 minutos a 45° C. Em seguida, as lâminas eram lavadas em água destilada e colocadas em uma cubeta contendo  $2 \times \text{SSC}$  pré-aquecido em banho-maria a 60° C por 1,30 horas. As lâminas eram então novamente lavadas e coradas numa solução de Giemsa a 2 % (1 ml de Giemsa em 49 ml de tampão Sörensen pH 6,8) e montadas em Euparal.

Algumas raízes foram coradas com o método usual de Feulgen para comparar o efeito da técnica de bandeamento com a coloração normal.

#### RESULTADOS

Em núcleos meristemáticos corados com Feulgen é notório a grande quantidade de cromocentros característicos dessa espécie. Quando tratados pelo método de bandas C uma parte desses cromocentros coram-se intensamente com o Giemsa e outra parte mais fracamente (Fig. 1). Os cromossomos metafásicos (Fig. 2)



Fig. 1. — Núcleos interfásicos de *C. vesicaria* preparados segundo a técnica de bandeamento. Note o grande número de regiões heterocromáticas (cromocentros).

Fig. 2. — Cromossomos metafásicos bandeados. Ao longo das regiões menos coradas são visíveis pequenos pontos heterocromáticos (seta).

Segundo o autor, a localização dos cromocentros em *Crepis vesicaria* coincide com o cromossomo de menor braço curto e de menor tamanho, ou o imediatamente anterior a este (Rastocers, 1947).

apresentam bandas centroméricas puntiformes semelhantes às encontradas em cromossomos humanos por EIBERG (1974). Em um único par cromossômico, aparece uma forte banda terminal. O número total de bandas visto nos metafásicos é bem menor que o número de cromocentros visíveis nos núcleos interfásicos. Contudo, nos cromossomos metafásicos, além das bandas proximais e da terminal, um grande número de pontos bem pequenos

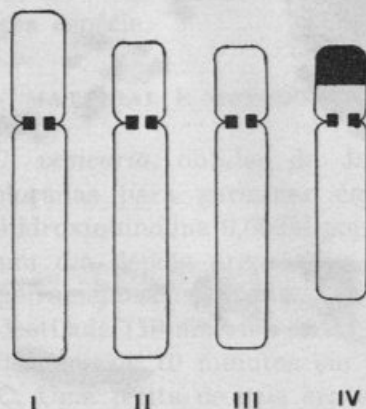


Fig. 3. — Idiograma de *C. vesicaria* com padrão de bandas C. Os cromossomos estão alinhados pelos centrômeros e ordenados pelo tamanho. Regiões heterocromáticas muito pequenas não foram incluídas.

são vistos ao longo dos cromossomos, sugerindo alguma equivalência aos cromocentros mais fracamente corados.

A Fig. 3 mostra um idiograma dos cromossomos bandeados de *C. vesicaria*, baseado nos valores médios de extensão apresentados na Tabela 1. Os cromossomos estão numerados simplesmente por ordem de tamanho, uma vez que o tradicional uso de letras em cariótipos de *Crepis*, introduzido por NAVASHIN (1925), além de uma certa arbitrariedade, mencionada por BABCOCK (1947), pode gerar confusão nos outros cariótipos já estabelecidos no gênero.

TABELA 1

Medições dos cromossomos mitóticos de *Crepis vesicaria* L.

N.º	Dimensões ( $\mu$ )	r*	Forma
I	7.0 = 2.2 + 4.8	2.18	sm **
II	6.3 = 1.6 + 4.7	2.94	sm
III	6.0 = 1.5 + 4.5	3.00	sm
IV	5.6 = 1.5 + 3.6	2.40	sm

\*r — Proporção entre braços (longo/curto). A forma, definida a partir de r, foi tomada de LEVAN & al. (1964).

\*\*sm — Submetacêntrico.

### DISCUSSÃO

O padrão de bandas C de *Crepis vesicaria* distingue-se claramente das demais espécies desse gênero até agora estudadas. A característica mais marcante, é a quase total ausência de bandas largas e a restrição da heterocromatina às porções centroméricas, ao longo dos cromossomos, em forma de pequenos pontos. Esse tipo de banda centromérica tem sido interpretado por EIBERG (1974) como sendo o próprio centrômero. CLAPHAM (1977, 1978) tem demonstrado em vários organismos, que a coloração diferencial das regiões centroméricas em forma de pontos («dot-like») reflete diferenças estruturais, em relação ao restante do cromossomo e que, a essas regiões cabe melhor o termo cinetócoro (CLAPHAM & OSTERGREN, 1978).

Em *C. vesicaria* não foi possível visualizar nenhuma constrição secundária que indicasse o cromossomo satelitado. NAVASHIN (1925) e BABCOCK (1947) observaram que as espécies de *Crepis* com quatro pares de cromossomos frequentemente não evidenciam constrições secundárias. Contudo dois tipos de argumentos favorecem a hipótese de ser o cromossomo número IV (Tabela 1) satelitado. Primeiro, nas espécies bandeadas de *Crepis*, em que foi evidenciado o satélite, este coincide com a banda mais forte e terminal do braço curto de um cromossomo sub-metacêntrico. Segundo, na quase totalidade das espécies cariotipadas, o cromossomo satelitado coincide com o cromossomo de menor braço curto e de menor tamanho, ou o imediatamente anterior a este (BABCOCK, 1947).

SCHWEIZER (1973) observou que as bandas encontradas em *Crepis capillaris* são menos distintas que aquelas observadas noutros gêneros, confirmando os resultados de CASPERSON & al. (1969) que não encontraram padrões de bandas evidentes nessa espécie, quando corada com diferentes fluorocromos. Estes últimos autores, salientam ainda que a heterocromatina em *Crepis* está distribuída em unidades muito pequenas. Em *C. vesicaria* a única banda terminal e as centroméricas são sempre constantes em todas as células e podem ser claramente observadas tanto em prófase quanto em metáfase. Além dessas, um número relativamente grande de pequenos pontos escuros aparecem irregularmente ao longo dos cromossomos metafásicos. GREILHUBER & SPETA (1978) têm também observado, em *Scilla mischtschenkoana*, que a heterocromatina pode ser detectada na forma de pequenos pontos mais ou menos dispersos no cromossomo. O facto de que em núcleos interfásicos de *C. vesicaria* corados com Feulgen ou bandeados, há um maior número de cromocentros que o total de bandas encontradas, sugere uma relação entre os cromocentros em excesso, especialmente aqueles menores e menos corados, e os pequenos pontos ao longo dos trechos eucromáticos nos metafásicos. Esses cromocêntrons fracamente corados e que não formam efetivamente bandas metafásicas poderiam ser explicados pela existência de trechos heterocromáticos muito pequenos dispersos ao longo do cromonema, semelhantes aos detectados por APPELS & PEACOCK (1978), que quando no estágio de intérfase, estariam fusionados constituindo cromocêntrons. Por outro lado, esta heterocromatina «dispersa», poderia se expressar como pontos mais corados ao longo das regiões eucromáticas dos cromossomos metafásicos. Pode ainda ser considerada a possibilidade de não adequação da técnica para revelar plenamente a heterocromatina (FISKESJÖ, 1974).

Assim como, do esforço monumental de BABCOCK em analisar o cariótipo de dezenas de espécies de *Crepis*, resultaram informações até hoje fundamentais para a compreensão da evolução cariotípica em plantas, mais dados sobre o padrão de bandas C nesse gênero, poderão ajudar a compreender o significado filogenético da heterocromatina.

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## **DRYOPTERIS IN SPAIN, PORTUGAL AND MACARONESIA**

by

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### **SUMMARY**

General phytogeographical aspects of the complex fern genus *Dryopteris* are discussed in relation to the Iberian peninsula and Macaronesia, pointing out some of the connections between the Macaronesian and Atlantic European mainland fern floras and the floristic richness of the two regions. The 19 species present in the area are outlined with brief descriptions, ranges and recently discovered systematic details. A new species, not previously reported or even collected, is described, *D. corleyi* Fraser-Jenkins. Each species is mapped throughout the area, including, for completeness, the French side of the Pyrenees, using the U. T. M. 50 km. square grid system (as used by JALAS and SUOMINEN, 1972), extended to include Macaronesia on a one spot per island basis according to ERIKSSON, HANSEN and SUNDING (1974 & 1979). Spot maps were constructed as a result of working through almost all the main European herbaria, especially those particularly relevant to the area, and are based on completely revised identification of the specimens contained therein. In addition most of the relevant literature has been worked through and records checked against specimens and either rejected, or accepted as literature records with open circles. Doubtful cases are recorded with question marks. The specimen selected to act as a voucher for each spot, or the relevant literature source, is listed after each species so that the maps can be verified when necessary. The maps show clearly the true distribution patterns, which have not been accurately delineated before due to confusion between species. A section on hybrids follows giving 12 hybrids, including further maps; many of the hybrids having been discovered only very recently. An appendix lists specimens seen whose location could not be found and the bibliography lists not only the references from the text but also the literature references which have been worked through for recording purposes, so that all the records given in any of the references listed have been considered.

## INTRODUCTION

EXTENSIVE modern systematic revision of the complex genus *Dryopteris* in recent years has considerably clarified and reshaped taxonomic treatment of the genus. The pioneer cytota-xonomic work was carried out by MANTON (1950) and later workers have followed her method of approach and extended it to include chemotaxonomic evidence and to cover further groups of species throughout the European flora which she did not work on. Much detailed nomenclatural revision has also been carried out recently and as a result literature on pteridophytes before the 1950's is generally markedly out of date, incomplete and sometimes inaccurate. Although much of Northern Europe is now well covered by modern floristic works dealing with ferns, most of Southern Europe is not; for example in Greece, the Balkans, Italy, France and perhaps most of all in the Iberian Peninsula. In Spain two of the standard floristic works for ferns are still the treatment of WILLKOMM in WILLKOMM and LANGE (1861) and of COLMEIRO Y PENIDO (1889) as there is no modern flora of the whole of Spain and the great bulk of modern Spanish work is confined to numerous highly local studies of small regions, with an ecological bent and often with limited knowledge of the taxonomy of the species listed. The situation is somewhat better in Portugal, a much smaller area, with the floras of SAMPAIO (1909 and 1947), PEREIRA COUTINHO (1931 and 1939) and FRANCO (1971), though none of these contain accurate modern treatments of *Dryopteris*. Flora Europaea (TUTIN *et al.*, 1964) was a little too early to contain the major part of the recent revision of the genus and the same applies to a certain extent to the maps of JALAS and SUOMINEN (1972), which also contain a number of inaccurate records due partly to confusion, and which are generally unverifiable as there are no cited voucher specimens to act as a base-line. Detailed revision and mapping of the genus in the Iberian peninsula is therefore overdue and it is aimed to fill this gap with the present paper.

The area included in this study is the whole of Spain (including the Balearic Islands and, in order not to bisect a natural region, the French side of the Pyrenees), Portugal and the whole of Macaronesia (including the Azores, Madeiran archipelago, Salvage (Selvagen) Islands, Canaries and Cape Verde Islands). Maca-

ronesia is included partly because it is included in FRANCO's Flora of Portugal (1971) and belongs politically to Portugal and Spain, but also, more importantly, because as far as ferns are concerned there are indisputable close connections between the Lusitanian or Atlantic seaboard flora, especially between that of North and West Spain and Portugal, and that of Macaronesia. In addition to the many well-known examples of species occurring in both areas, a rather large number of species previously thought to be only Macaronesian has recently been discovered on the mainland, which emphasises the connection further.

Most prevalent among the fern species long known to be present in Macaronesia and as Atlantic species on the mainland are undoubtedly the members of the Hymenophyllaceae, *Trichomanes speciosum* Willd., *Hymenophyllum wilsonii* Hook. and *H. tunbridgense* (L.) Smith and in *Dryopteris*, *D. aemula* (Ait.) O. Ktze. Interestingly both *Hymenophyllum tunbridgense* and *Dryopteris aemula* occur again in N. E. Turkey where a similarly high rainfall occurs, and another species, *D. oreades* Fomin, occurs in the Caucasian and Transcaucasian regions, N. E. Turkey, Atlantic Europe and the wetter parts of the West Mediterranean, but not in Macaronesia. Two other examples of Macaronesian-mainland connections within *Dryopteris* that have only recently become clear are the presence in Macaronesia and in the subatlantic South-Western triangle of Europe (as defined by a line from North-Western Europe south-eastwards to Turkey and the Caucasus, and in the case of *D. dilatata*, to Northern Iran), of *D. affinis* (Lowe) Fraser-Jenkins subsp. *affinis* and *D. dilatata* (Hoffm.) Gray. *Cheilanthes vellea* (Ait.) Muell, *C. marantae* (L.) Domin and several species in the genus *Asplenium* have also long been known from both areas. Ferns relatively recently discovered in Spain and/or Portugal and present in Macaronesia include some interesting discoveries by MOLESWORTH-ALLEN (1966, 1967 and 1971) in South-West Spain and others from elsewhere: *Psilotum nudum* (L.) Pal.-Beauv. (S.W. Spain and the Cape Verde Islands), *Christella dentata* (Forssk.) Brownsey & Jermy, *Diplazium caudatum* (Cav.) Jermy (S.W. Spain, introduced in Portugal, N.W. Spain and N. Spain), *Pteris palustris* Poir., *Culcita macrocarpa* Presl (for a summary of its occurrence in Iberia and details of its new discovery in Oviedo, see FRASER-JENKINS & LAÍNZ, in prep.), *Cystopteris viridula* (Desv.) Desv. [= *C. diaphana* auct., non

(Bory) Blasdell, see ROCHA-AFONSO, 1982, in prep.] (Portugal, Spain, S.W. France etc. and Macaronesia), *Cheilanthes maderensis* Lowe, *Cheilanthes tinaei* Tod. (= *C. corsica* Reichstein & Vida, *C. duriensis* Mendonça & Vasc.), *Cheilanthes guanchica* Bolle (= *C. sventenii* Benl) and *Dryopteris guanchica* Gibby & Jermy. More recently DIEZ-GARRETAS and SALVO-TIERRA (1979) have published on the presence of *Polypodium cambricum* L. subsp. *macaronesicum* (Bobrov) Fraser-Jenkins in Greuter (sub *P. macaronesicum* Bobrov) in South-Western Spain; this is a geographical subspecies of the European *P. cambricum* L., previously reported as confined to the Canary Islands. Apart from subsp. *cambricum*, widespread in West and South Europe, there is a third subspecies, subsp. *azoricum* (Vasc.) Nardi, confined to the Azores. The three subspecies differ consistently but only slightly from each other and are clearly very closely related. It should be mentioned however that SALVO-TIERRA's voucher specimens of «*P. macaronesicum*» in GDA (nos. 5884-5886!) were *P. × shivasiae* Rothm. (= *P. cambricum* × *P. interjectum* Shivas) which explains the hybrids mentioned by DIEZ-GARRETAS and SALVO-TIERRA (1979: 11); and the material labelled «*P. macaronesicum*» and sent by SALVO-TIERRA from Malaga University to R. H. ROBERTS of Bangor (who, in the author's opinion, knows the genus in Europe in more detail than any other workers, past or present) was all *P. cambricum* subsp. *cambricum* (ROBERTS, pers. comm. 1980 and 1981). Another specimen cited was that of MOLESWORTH-ALLEN (Sierra de Ojén, no. 8724, 9/May/1974, now in BM!), which was again not subsp. *macaronesicum* but subsp. *cambricum*. The confusion was clearly caused in part by the high sporangial annulus cell number in several of the populations of subsp. *cambricum*, and though ROBERTS (1966, 1970 and 1980) has pointed out that subsp. *cambricum* can frequently have a high number of annulus cells, much of the available literature ignores this and refer such plants to subsp. *macaronesicum* in error. However one of the specimens cited (MGC 1125, Castellar de la Frontera) and illustrated, is indeed subsp. *macaronesicum*, though the origin of the specimen requires confirmation and study of the exact and undisturbed locality by MOLESWORTH-ALLEN in 1982 has revealed only subsp. *cambricum*. The record of *P. cambricum* subsp. *macaronesicum* from mainland Europe is therefore not accepted here at present, pending further investigation. Some

details of Macaronesian-mainland connections as far as ferns are concerned are also given by FRASER-JENKINS (1982), where it is mentioned that the flora becomes more African in character further South in Macaronesia, especially in the Cape Verde Islands, and that some of the Macaronesian species, such as *Dryopteris guanchica* and *D. crispifolia* Rasbach, Reichstein & Vida, have some of their closest relatives in Africa rather than, or in addition to, Europe, as part of an ancient tertiary European and African flora now mostly extinct in Africa.

Taken as a whole, the area of Iberia and Macaronesia is remarkably rich in ferns, especially in *Dryopteris* species. There are 19 species of *Dryopteris* present, 10 of them occurring in Macaronesia and 13 occurring on the European mainland (including the Balearic Islands), with 4 species in common; 6 of the 19 species occur on the African mainland. The total number of *Dryopteris* species for the whole of the European type flora, from Macaronesia eastwards to Iran and Western Siberia is 23, so that over three-quarters of the European species are represented in the present area, a higher total than in the whole of the rest of the European region. The reason for this is undoubtedly mainly because *Dryopteris* is a genus of mesophytic plants and temperate high rainfall areas are thought to have existed on the Atlantic seaboard and particularly in Macaronesia since the early tertiary period, probably without interruption up until the present day; whereas the climate of South Central Europe has become much drier and harsher since the late tertiary period and also the effects of periglacial conditions in and North of the Pyrenees-Alps-Carpathians-Caucasus line greatly impoverished the flora there. In addition the climate and relief of the Iberian peninsula are markedly varied so that within the genus *Dryopteris* there are various different phytogeographical elements present there, many of them at or near to the South-Western limits of their distribution, though outlying relict populations may also occur in the mountain refugia of Northern Morocco and Algeria in North Africa, similar to the refugia in the Sierra Nevada of South-Eastern Spain and nearby, where isolated populations of *Dryopteris* survive. The North and North-Western coastal regions of Spain and North and Central Portugal offer equable and lush habitats suitable for *Dryopteris* and include a few species that are rare in the rest of Europe or absent; thus, as most of the

distribution maps show, the main fern-belt in the Iberian peninsula is along the North and down the West coastal regions, which contain both widespread European species [e. g. *D. filix-mas* (L.) Schott, *D. affinis* subsp. *borreri* (Newm.) Fraser-Jenkins and *D. dilatata*] and Macaronesian or Lusitanian/Atlantic elements (e. g. *D. aemula*, *D. guanchica*, *D. oreades* and probably to be considered here, *D. affinis* subsp. *affinis*). Iberia also contains an extended range of mountains, the Cordillera Cantabrica, nearly connected to the Pyrenees so that these two high mountain regions together allow various boreal and Central-European subalpine species to extend their ranges into Spain [*D. expansa* (Presl) Fraser-Jenkins & Jermy, *D. carthusiana* (Vill.) Fuchs, *D. submontana* (Fraser-Jenkins & Jermy) Fraser-Jenkins, *D. affinis* subsp. *stilluppensis* (Sabr.) Fraser-Jenkins, and *D. remota* (A. Br.) Druce]. The Pyrenees themselves contain a mixture of Atlantic species (particularly in their Western parts) and North- and Central-European ones. In general the whole of the rest of Spain and South Portugal has a semi-arid climate with a very hot summer and very cold winter, and harsh steppe-like conditions prevail, similar to those of much of North Africa or Anatolian Turkey. *Dryopteris* species are absent there except for their presence in some interesting areas of montane refugia. The most important of these is the series of ranges that together are known as the «Cordillera Central», extending from near to the Western Pyrenees and Eastern part of the North coastal mountains in an almost unbroken chain South-Westwards towards the Serra da Estrela in Portugal. The offlying Sierras de la Demanda, Neila, Urbion, Cebollera and del Moncayo lie to the immediate North-East of the line; the Cordillera itself includes, from the North-East, the Sierras de Ayllón, Guadarrama, Malagon, Sierra and Paramera de Avila, Sierras de Gredos and Bejar and immediately to its West, the offlying Montes de Gata and Sierra de la Peña de Francia. Directly West of these are the Serra da Guardunha and Serra da Estrela in Portugal. Across the Tajo (Tagus) river to the South of the Sierra de Gredos are the Sierra de Guadalupe and Montes de Toledo, which contain scattered populations of *Dryopteris affinis* (subsp. *affinis* and subsp. *borreri*) and *D. dilatata* and may be considered to be an offlying part of the Cordillera Central. The importance of this chain of mountain ranges is that they clearly acted as a migration route down

which no less than five *Dryopteris* species have presumably been able to pass, bringing *D. expansa* and *D. oreades* to their only stations in Portugal, in the Serra da Estrela—though *D. expansa* appears now to be very scattered, or partially obliterated in the Cordillera Central, perhaps due to over-hot and dry conditions. The presence of *D. affinis* subsp. *borreri* in the Serra da Estrela, but otherwise only in North Portugal, taken together with its presence in the Cordillera Central, as reported in the present paper, is probably another such example. *D. filix-mas*, *D. affinis* subsp. *affinis* and *D. dilatata* also occur in or near the Cordillera Central, though *D. affinis* subsp. *affinis* has most certainly reached Portugal more generally via the North and West of Iberia, and *D. dilatata* has almost certainly migrated into the Western parts of the Cordillera from Portugal and the Western seaboard, as it is apparently confined to a few of the Western ranges and is absent from most of the Cordillera, though reported in error for *D. expansa*. Apart from the Cordillera Central there exist a few other mountain refugia in East and South-East Spain containing *Dryopteris*, and two in South-West Spain. The Sierra de Aracena in Huelva, S.W. Spain, contains *D. affinis* subsp. *affinis*, its nearest verified station otherwise being in the Serras de São Mamede and Sintra in East and West Central Portugal, though there are some unconfirmed reports from the Serra de Monchique, S. Portugal and from Cadiz province, S. Spain. The Sierra del Aljibe, Cadiz, contains *D. filix-mas* and there are also reports of *D. filix-mas* from N. Central Andalucía. The Sierras de Cuenca and Albarracin in East Spain contain *D. filix-mas*, which should perhaps be considered to be distantly connected to the East Pyrenean population via various scattered populations extending down the coastal mountains of Eastern Spain. The most distant and remote refugia of all are the mountains of South Eastern Spain, presumably only containing *Dryopteris* species now because of their great height, as they lie in extremely hot and arid areas; these are the limestone Sierra de Segura containing *D. filix-mas* and *D. submontana* and Sierra Tejada containing *D. submontana*, and the Sierra Nevada (nearly 3500 m. high) and associated ranges, containing both calcareous and non-calcareous rocks, with *D. affinis* subsp. *affinis* and subsp. *borreri*, *D. submontana*, *D. tyrrhena* Fraser-Jenkins & Reichstein and *D. filix-mas*. As far as *Dryopteris* is concerned

the most likely phytogeographical connection of this group of mountains would appear to be up the East coast of Spain towards the Pyrenees even though all but *D. filix-mas* must be assumed to have been obliterated over this area and *D. filix-mas* itself appears not to extend continuously (or more or less so) South of Teruel Province. It is possible too that *D. affinis* subsp. *affinis*, which occurs on the South side of the Sierra Nevada and is much less common than ssp. *borreri* in the area, could have arrived using a Western migration route, as it probably also did in Northern Morocco.

*D. tyrrhena* is one of the most interesting *Dryopteris* species in Spain, showing as it does an old relict West Mediterranean Cerno-Sardian distribution pattern with which its occurrence in the Sierra Nevada is perfectly in accord. One species, *Dryopteris pallida* (Bory) C. Chr. ex Maire & Petitm., occurs on limestone on the Balearic Island of Mallorca where it occurs mostly, but not entirely, as a distinct subspecies, subsp. *balearica* (Lit.) Fraser-Jenkins. The species itself otherwise occurs as a Central and East Mediterranean species, fragmenting into a number of subspecies and related taxa further eastwards in Western Asia.

The general relationships of the Macaronesian flora are complex; however it seems likely that *D. oligodonta* (Desv.) Pichi-Sermolli, though an endemic, should be considered an African element, being a member of the section *Marginatae* Fraser-Jenkins (1983, in press.), which contains the *D. inaequalis* (Schlecht.) O. Ktze. group widespread in East and South Africa and rather less so in the West; the *D. marginata* (Wall. ex Clarke) Christ group of the Himalayas and China etc. belongs to the same section. The distribution of *D. oligodonta* only in the Cape Verdes and Canaries would appear to support its African connections. *D. penteri* (Krass.) C. Chr. on the Cape Verdes is another member of the *Marginatae* and is also an African mainland species. The Madeiran endemic, *D. aitoniana* Pich. Serm., is difficult to place except as a very distant relative of the mediterranean *D. pallida* group in the section *Pallidae* Fraser-Jenkins (1983, in press.). *D. aemula* and *D. affinis* may well be of European origin in Macaronesia (Canaries — rare, Madeira and Azores) as both occur in Western Europe and the Caucasus, and *D. affinis* has a probable relative, *D. wallichiana* (Spreng.) Hyl. (section *Fibrillosae* Ching)



in the Himalayas and China etc. which appears to have spread from there to various parts of the world, perhaps during the tertiary period, and may have had connections with Europe via Iran then, though it no longer occurs in Europe (see FRASER-JENKINS, 1980*b*). *D. aemula* [Section *Aemulae* Fraser-Jenkins (1983, in prep.)] appears to have distant relatives in *D. gymnophylla* (Bak.) C. Chr. and *D. chinensis* (Bak.) Koidz. of the Far East, but no other close phylogeographical connections. The only close relative of *D. intermedia* (Mühl.) Gray subsp. *maderensis* (Milde ex Alston) Fraser-Jenkins and *D. azorica* (Christ) Alston is *D. intermedia* subsp. *intermedia* of North America. Of the three tetraploid species (*D. dilatata*, *D. guanchica* and *D. crispifolia*), all of which involve the *D. intermedia*/*D. azorica* genome, it seems almost certain that *D. crispifolia* must be an Azorean neoendemic, arising in situ from its two ancestors, *D. aemula* and *D. azorica*, which both occur together there. *D. dilatata* (Hoffm.) Gray is rare in the Azores and occurs in the absence of one its ancestors, *D. expansa*; it may well have reached the Azores from the European mainland and has become very slightly altered in morphology from the extensive European population. Perhaps the most confusing species is *D. guanchica* as it is impossible to extrapolate any clear facts about its origin — wherever it occurs it is at present lacking one ancestor, and where both presumed ancestral species occur together, on Madeira (*D. intermedia* subsp. *maderensis* and *D. aemula*), it does not occur. However the picture has recently become somewhat expanded as there is a somewhat similar species, *D. antarctica* (Bak.) C. Chr. (= *D. callolepis* C. Chr.), present in East and South-East Africa, the Mascarenes, and Amsterdam Island, which is not only tetraploid like *D. guanchica*, but has a markedly similar chemistry, and is almost certainly relevant to *D. guanchica* and its origins. *D. guanchica* is confined to the Canaries, Portugal and Spain and may perhaps be tentatively considered an African element; a somewhat similar distribution pattern to that of *D. callolepis* and *D. guanchica* combined is that of the *Adiantum reniform* L. aggregate, which occurs in West China, the Mascarenes (Madagascar and Réunion), Kenya, Malawi and Macaronesia (Cape Verdes, Canaries and Madeira), though not in Europe (despite fossil material from Southern France). Unconfirmed reports also exist from South Africa.

## TREATMENT OF SPECIES

In the following pages species are listed in systematic order, ranging from the narrow-fronded 1-2 pinnate species, *D. affinis*, of the *D. wallichiana* group, through the *D. filix-mas* and *D. pallida* groups to the most highly dissect, triangular fronded, *D. aemula*, *D. inaequalis* and *D. dilatata* groups. A key is given (p. 190), but it should be borne in mind that because of considerable infraspecific variation a proportion of specimens will not key out correctly, so that comparison with the description in the text is most important.

For each species there is a brief synonymy including reference to WILLKOMM & LANGE (1861) where relevant, a note on the whereabouts of the type specimen, a diagnostic description and comparison with species close to it, a brief note on its habitat, details of range within the area and in general, and nomenclatural or systematic details with references. Details may also be given of some erroneous reports or confusions where the situation needs clarification. For each species a map is given together with a list of voucher specimens or literature records from which the map was constructed.

The maps are based on the 50 km. U. T. M. grid [also used by JALAS & SUOMINEN (1972)], extended to include all of Macaronesia on a single spot per island basis, virtually as treated by ERIKSSON, HANSEN and SUNDING (1974 & 1979). In South-West France the spots extend eastwards only to XP2, CH3 and EH2 in each horizontal row. It has been considered most important to undertake a complete revision of the data published so far, mainly because virtually no modern specialists in the genus have so far been involved in a study of *Dryopteris* over the area, and as the genus is a complex and critical one, only recently revised, a number of species have been missed out in many works and many others have been confused. The older literature in particular is highly unreliable, but much modern literature also contains numerous misidentifications. Literature references are therefore considered to be unreliable and where possible the maps have been based on actual specimens seen and identified anew. For this purpose a complete revision of the relevant material in the following herbaria [abbreviated as per HOLMGREN, KEUKEN and SCHOFIELD (1981)] has recently been carried out by the author:

B, BC, BCF, BM, BR, CGE, COI, E, ELVE, FCO, G, G-BOIS, G-BU, G-DC, GDA, JACA, JE, K, KR, LISE, LISFA, LISI, LISU, LIV, LTR, LY, MA, MAF, MANCH, MGC, MPU, P, P-JU, P-LA, PAMP, PO, RUEB (in ZT), SA, SANT, SEV, TL, VAL, Z, ZT, ZVS, herb. AEPNA (Diputación de Alava), Vitoria, herb. Universidad Laboral, Gijón (including herb. M. LAÍNZ and herb. J. M. ARGÜELLES SÁEZ), herb. Facultad de Ciencias, Universidad de Granada, herb. F. ESTEVE-CHUECA, Universidad Laboral, Alcalá de Henares, herb. J. FERNÁNDEZ-CASAS and C. M. JÜARISTI, Facultad de Ciencias, Universidad Autónoma, Madrid, herb. S. E. GONZÁLEZ-CRESPO, Facultad de Ciencias, Universidad de Santiago de Compostela, herb. Facultad de Ciencias Biológicas, Universidad Complutense, Madrid, herb. J. DUVIGNEAUD, Bruxelles, herb. T. REICHSTEIN, Basei and herb. J. VIVANT, Orthez, almost all of which the author has visited and worked through, or otherwise has had all their material sent on loan.

The *D. filix-mas* and *D. affinis* aggregate and part of the *D. dilatata* aggregate has also been examined from M. Over a number of years the author has also checked certain rarer or more confused species or hybrids, in connection with previous work, from the following herbaria, the species including *D. oreades*, *D. remota*, *D. submontana*, *D. tyrrhena* and *D. guanchica*: ABN, BAS, BERN, BP, BPU, BRNM, BRNU, BUC, BUCA, BUCG, C, CL, CLA, CLF, DBN (formerly DUB), DE, FI, FI-W, GB, GFW, GOD, H, I, ICEL, ISTF, KRA, KRAM, L, LAU, LD, LDS, LE, NMW, O, OXF, PECS, PR, PRC, S, SIB, SZE, SZU, TBI, TFC, TGM, UME, UPS, W, and WU.

Specimens selected for use as vouchers for the solid spots in the maps are the more modern ones available (within the last 10 to 20 years if possible) that were identifiable without doubt (i. e. immature or inadequate specimens were normally rejected when in doubt) and were well within the square concerned. After each map the voucher specimens or literature records are listed. The most recent specimens were chosen because there has been a great deal of forest clearance, or burning, and destruction of habitat in recent years, increasing recently apparently beyond the control of the governments concerned, particularly in Spain, where fires are frequently left to burn with no attempt to extinguish them, and natural forest is all too often removed or replaced with commercial conifer or *Eucalyptus* areas, poor in

natural flora and fauna. This has caused the drying up and impoverishment of many areas so that the range of many species has decreased considerably. Thus the specimens listed are usually not the first collection or report made from each square, though they may be, or may be the only collection made. Secondly a large amount of literature has been examined and considered, resulting in four courses of action: (i) where the square concerned is already taken up by a specimen seen, the literature record has been superceded by the specimen; (ii) where the square is unoccupied and in the author's opinion the record is probably reliable, an open circle has been placed; (iii) where the square is unoccupied and in the author's opinion the record is doubtful, but may be correct, a question mark has been placed; (iv) where the square is unoccupied and the author has strong reasons to suspect that the record is incorrect (e. g. due to clear cases of confusion), it has been rejected. Thus any record appearing in the literature references listed at the end but not covered in the maps has been deliberately excluded (though it is possible that not all the records have been seen in the starred references, which were not seen in full). Nevertheless it is emphasised that the only reliable records are those based on specimens seen, and recorded with a solid dot; it is hoped that more information may later be forthcoming concerning the open circles and question marks and that further collections will be made to help bridge some gaps (e. g. *D. submontana* probably occurs in several of the higher calcareous ranges between the Central Cordillera Cantabrica and the Pyrenees, but has not yet been collected). Three problems arise from this treatment which also require consideration: (i) Many older specimens and literature records are given with vague localities, particularly for mountain ranges covering more than one spot. Fortunately none of these cover areas completely unoccupied in the maps and it has not therefore been necessary to consider them, though it is possible that some adjoining spots may thus be left vacant in error; (ii) The records given in JALAS & SUOMINEN (1972) have no list of voucher specimens and are thus without recorded basis. The work for these maps was carried out by Prof. E. F. GALIANO and Prof. B. VALDÉS at Sevilla and Prof. P. MONTSERRAT at Jaca, for Spain, and by Prof. J. DO AMARAL FRANCO and Dr. M. L. ROCHA AFONSO of Lisboa and Dr. A. R. PINTO DA SILVA of Oeiras and their

colleagues, for Portugal, and it has not been possible to discover the original information for every Spanish spot, despite efforts to do so and the help of people who were involved; in particular there are a number of records based only on JALAS & SUOMINEN (1972), but some of the original notes (for the ferns only) have been lost at Sevilla (E. F. GALIANO and B. VALDÉS, pers. comm., 1980). These permanently uncheckable map records are not considered to be reliable, but cannot on the other hand be completely ignored. Therefore, if the square concerned is not otherwise occupied, the more likely ones are placed with a query, or occasionally an open circle if they are very likely to be correct, and the unlikely ones have been rejected; (iii) A number of localities could not be found without detailed local knowledge due to the persistent vagueness of localities given for both older and more modern specimens, particularly where the name of a minor topographical feature or a very small hamlet is given without stating where it is in relation to a larger town. Much of the modern literature is little better. The unplaced specimens, having been much reduced with the invaluable help of Prof. P. MONTSERRAT (for Spain) and Dr. R. FERNANDES (for Portugal), are listed in the appendix and it is hoped that these can be evaluated at a later date. More complete localities on labels are much to be desired and encouraged. It seems from the maps that there has been a certain amount of under-collection, particularly in North-West Spain and in some of the more isolated medium altitude Sierras elsewhere, where further records may possibly be expected in time, particularly, perhaps, in Andalucía (e. g. the N.E. Sierra de Segura (Las Cabras and Revolcadores); Sierra de Magina; Sierra de María; Sierra de Baza and perhaps Sierra Harana and Sierra de Gádor). The author hopes to encourage the holders of private herbaria to place at least first sets in a recognised institute herbarium where they are readily available for study; this particularly applies to published records which are effectively baseless unless a specimen is collected and deposited in a herbarium. A considerable proportion of records are now unverifiable due to the loss of private herbaria after the death of an author and thus cannot be definitely accepted, others were made without the collection of a specimen, which leads to further difficulties and errors, and in any event it is necessary to follow the authors in their frequent moves from institute to institute in order to

examine their herbaria. This problem is noticeably greater in Spain than in most other European countries.

In the maps:

- = specimen seen and verified.
- o = literature record, probably correct.
- ? = literature record, doubtful, but possibly correct.
- blank square = unrecorded or record rejected (i. e. any records contained in the literature references listed, but not appearing on the maps).

The list of voucher specimen seen includes an abbreviation for the herbarium where each specimen is deposited. The squares from which specimens came are lettered according to the U. T. M. 50 km. square grid system, with the following numbered additions for Macaronesia:

- 1-9. *Azores*: 1 = Corvo. 2 = Flores. 3 = Graciosa. 4 = São Jorge. 5 = Faial. 6 = Pico. 7 = Terceira. 8 = São Miguel. 9 = Santa Maria.
- 10-11. *Madeiran Archipelago*: 10 = Porto Santo and Desertas. 11 = Madeira.
- 12. *Salvage (Selvagen) Islands* (No *Dryopteris* present).
- 13-19. *Canary Islands*: 13 = La Palma. 14 = El Hierro. 15 = La Gomera. 16 = Tenerife. 17 = Gran Canaria. 18 = Lanzarote. 19 = Fuerteventura.
- 20-28. *Cape Verde Islands*: 20 = Santo Antão. 21 = São Vicente. 22 = São Nicolau. 23 = Sal. 24 = Boa Vista. 25 = Maio. 26 = São Tiago. 27 = Fogo. 28 = Brava.

It is hoped that at a future date some years hence a further note may be produced giving additions to the present work. Thus the author would appreciate details of any new findings of *Dryopteris* not already covered by solid spots in the present work.

#### TAXA PRESENT IN THE AREA

The following species, subspecies and hybrids occur in the area (the range given being only that contained within the area treated):

1. *Dryopteris affinis* (Lowe) Fraser-Jenkins.  
subsp. *affinis* France, Andorra, Spain, Portugal, Azores, Madeira, Canaries.  
subsp. *borreri* (Newm.) Fraser-Jenkins. France, Andorra, Spain, Portugal.  
subsp. *stilluppensis* (Sabr.) Fraser-Jenkins. France, Spain.
2. *Dryopteris filix-mas* (L.) Schott. France, Andorra, Spain, Portugal.
3. *Dryopteris oreades* Fomin. France, Andorra, Spain, Portugal.
4. *Dryopteris tyrrhena* Fraser-Jenkins & Reichstein. Spain.
5. *Dryopteris submontana* (Fraser-Jenkins & Jermy) Fraser-Jenkins. France, Spain.
6. *Dryopteris pallida* (Bory) C. Chr. ex Maire & Petitm.  
subsp. *pallida*. Balearics (Spain).  
subsp. *balearica* (Lit.) Fraser-Jenkins. Balearics (Spain).
7. *Dryopteris aitoniana* Pichi Sermolli. Madeira.
8. *Dryopteris remota* (A. Br.) Druce. France, Spain.
9. *Dryopteris corleyi* Fraser-Jenkins. Spain.
10. *Dryopteris oligodonta* (Desv.) Pichi Sermolli. Canaries, Cape Verdes.
11. *Dryopteris pentheri* (Krass.) C. Chr. Cape Verdes.
12. *Dryopteris aemula* (Aiton) O. Ktze. France, Spain, Azores, Madeira, Canaries.
13. *Dryopteris carthusiana* (Vill.) Fuchs, France, ?Andorra, Spain.
14. *Dryopteris expansa* (Presl) Fraser-Jenkins & Jermy. France, Andorra, Spain, Portugal.
15. *Dryopteris dilatata* (Hoffm.) Gray. France, ?Andorra, Spain, Portugal, Azores.
16. *Dryopteris intermedia* (Mühl.) Gray subsp. *maderensis* (Milde ex Alston) Fraser-Jenkins. Madeira.
17. *Dryopteris azorica* (Christ) Alston. Azores.

18. *Dryopteris guanchica* Gibby & Jermy. Spain, Portugal, Canaries.
19. *Dryopteris crispifolia* Rasbach, Reichstein & Vida. Azores.
20. *Dryopteris* × *tavelii* Rothm. (= *D. affinis* × *D. filix-mas*). France, Spain, Portugal.
21. *Dryopteris* × *mantoniae* Fraser-Jenkins & Corley (= *D. filix-mas* × *D. oreades*). Spain.
22. *Dryopteris* × *fraser-jenkinsii* Gibby & Widén (= *D. affinis* subsp. *affinis* × *D. dilatata*). Spain.
23. *Dryopteris* × *picoensis* Fraser-Jenkins (= *D. affinis* subsp. *affinis* × *D. azorica*). Azores.
24. *Dryopteris* × *deweveri* (Jansen) Jansen & Wachter (= *D. carthusiana* × *D. dilatata*). France.
25. *Dryopteris* × *ambroseae* Fraser-Jenkins & Jermy (= *D. dilatata* × *D. expansa*). France, Spain.
26. *Dryopteris* × *gomerica* Gibby & Widén (= *D. aemula* × *D. guanchica*). Canaries.
27. *Dryopteris* × *martinsiae* Fraser-Jenkins (= *D. aemula* × *D. crispifolia*). Azores.
28. *Dryopteris* × *cedroensis* Gibby & Widén (= *D. guanchica* × *D. oligodonta*). Canaries.
29. *Dryopteris* × *telesii* Fraser-Jenkins (= *D. crispifolia* × *D. dilatata*). Azores.
30. *Dryopteris* × *madalenae* Fraser-Jenkins (= *D. azorica* × *D. crispifolia*). Azores.
31. *Dryopteris* × *sjogrenii* Fraser-Jenkins (= *D. azorica* × *D. dilatata*). Azores.

### Key<sup>1</sup>

1. Frond once pinnate, a second time deeply pinnatifid, or becoming twice pinnate; somewhat narrowly lanceolate . . . . . 2.
1. Frond twice pinnate, a third time pinnatifid below, or three to four times pinnate; ± widest at the base . . . . . 5.
2. Lamina ± coriaceous and slightly glossy above; pinnules with straight, parallel sides, if lobed the lobes rectangular; stipe and rhachis with a predominance of linear, narrow scales . . . . . 1. *D. affinis*
2. Lamina herbaceous and ± matt above; pinnules with slightly curved and convergent sides (except the upper ones); stipe and rhachis with a predominance of lanceolate scales . . . . . 3.

<sup>1</sup> See pag. 184.



- 3. Pinnule teeth acute-tipped . . . . . 4.
- 3. Pinnule teeth  $\pm$  obtuse at the tips . . . . . 3. **D. oreades**
- 4. Stipe long, axes markedly glandular . . . . . 4. **D. tyrrhena**
- 4. Stipe  $\pm$  short, axes not glandular . . . . . 2. **D. filix-mas**
- 5. Axes and often underside of lamina glandular (visible with a lens) . . 6.
- 5. Axes and underside of lamina eglandular . . . . . 13.
- 6. Teeth on the segments hair-pointed . . . . . 7.
- 6. Teeth on the segments acute, but not hair-pointed . . . . . 9.
- 7. Segments all markedly crowded, crisped and curved upwards at the tips, and downwards at the sides . . . . . 19. **D. crispifolia**
- 7. Segments not markedly crowded or crisped (though pinnulets may be folded down on either side of their axes when growing in an exposed place) . . . . . 8.
- 8. Lamina  $\pm$  narrowly triangular-lanceolate; pinnulets arranged at c. 90° from the pinnule axes in the lowest pairs of pinnae . . 16. **D. intermedia**
- 8. Lamina widely triangular-lanceolate or somewhat deltate; pinnulets obliquely sloping and decurrent at their bases, particularly in the lowest pinnae . . . . . 14. **D. expansa**
- 9. Lamina three-times pinnate; stipe thin, purple-brown in the lower part (or more); segments curled upwards; lamina smelling markedly of cut hay when dried . . . . . 12. **D. aemula**
- 9. Lamina twice pinnate, occasionally a third time deeply pinnatifid near the base; stipe  $\pm$  thick, pale or green; segments flat; lamina not smelling of hay, but merely of dried leaf, when dried . . . . . 10.
- 10. Stipe scales pale; not present in Madeira . . . . . 11.
- 10. Stipe scales with dark centres or all dark, at least at the stipe-base; present in Madeira only . . . . . 7. **D. aitoniana**
- 11. Lamina markedly triangular-lanceolate, or deltate . . . . . 12.
- 11. Lamina narrowing slightly to the lowest pair of pinnae, or the lowest three or more pairs of pinnae the same length . . . . 4. **D. tyrrhena**
- 12. Lamina  $\pm$  narrowly triangular-lanceolate; pinnule apices with long, narrowly acute teeth, pinnule lobes with long, acute teeth mainly at their acroscopic corners; lamina and axes very densely glandular . . . . . 5. **D. submontana**
- 12. Lamina widely triangular-lanceolate, or deltate; pinnule apices and pinnule lobes with triangular, but acute-tipped teeth all over them; lamina and axes  $\pm$  sparsely glandular except when young . . 6. **D. palida**
- 13. Teeth on the segments hair-pointed . . . . . 14.
- 13. Teeth on the segments acute, but not hair-pointed . . . . . 22.
- 14. Stipe scales concolorous . . . . . 15.
- 14. Stipe scales with darker bases or centres . . . . . 17.

15. Lamina narrowly triangular-lanceolate; pinnulets  $\pm$  closely juxtaposed and mid and upper pinnae not deeply dissect . . . 13. **D. carthusiana**
15. Lamina widely triangular-lanceolate, or  $\pm$  deltate; pinnulets well separate throughout the frond . . . . . 16.
16. Lamina thin, pale- or yellow-green; lowest pinnulets markedly decurrent to the pinnule costa and falcate; stipe scales widely ovate-lanceolate . . . . . 14. **D. expansa**
15. Lamina thick, mid- to, more usually, dark-green; lowest pinnulets not markedly decurrent or falcate; stipe scales lanceolate to ovate-lanceolate . . . . . 18. **D. guanchica**
17. Lamina narrowly triangular-lanceolate, twice pinnate, a third time pinnatifid below, with closely juxtaposed ultimate lobes; stipe scales predominantly narrowly lanceolate . . . . . 8. **D. remota**
17. Lamina triangular-lanceolate, three times pinnate, with somewhat spaced out ultimate lobes; stipe scales predominantly ovate-lanceolate . . . . . 18.
18. Pinnae narrowly triangular-lanceolate (only the lowest one wider); pinnules in the lower third of the lamina rectangular . . . . . 19.
18. Pinnae  $\pm$  widely triangular-lanceolate (except the upper ones); pinnules in the lower third of the lamina  $\pm$  pointed, with sloping apices . . 20.
19. Ultimate segments markedly well separate; pinnule-costae  $\pm$  without scales, or bearing only a few, insignificant, small, brown scales on the under surface; present in Madeira only . . . . . 16. **D. intermedia**
19. Ultimate segments merely slightly separate; pinnule-costae bearing somewhat numerous, scattered, small, brown scales on the under surface; present in the Azores only . . . . . 17. **D. azorica**
20. Lamina thin, pale- or yellow-green; lowest pinnulets markedly decurrent to the pinnule costae and falcate; stipe scales widely ovate-lanceolate . . . . . 14. **D. expansa**
20. Lamina thick, mid- to, more usually, dark-green; lowest pinnulets not markedly decurrent or falcate; stipe scales lanceolate to ovate-lanceolate . . . . . 21.
21. Pinnules and lower pinnulets with a noticeable, slightly long stalk, so that they have a  $\pm$  short gap at their bases between them and the axes; pinnulets and pinnule-lobes tapering markedly from a wide base to a pointed apex (except in the uppermost pinnae); frond smelling markedly of cut hay when dried . . . . . 18. **D. guanchica**
21. Pinnules and lower pinnulets shortly stalked so that they are closely juxtaposed to the costae; pinnulets and pinnule-lobes  $\pm$  ovate, becoming rectangular in the upper pinnae; frond not smelling of hay, but merely of dried leaf, when dried . . . . . 15. **D. dilatata**

22. Lamina narrowly triangular-lanceolate; pinnules  $\pm$  shallowly lobed except at the base of the lamina; present in Spain only . . . . . 23.
22. Lamina widely triangular-lanceolate or deltate; pinnules deeply lobed except in the uppermost pinnae; present in the Canaries and Cape Verdes only . . . . . 24.
23. Stipe scales concolorous russet-brown, becoming scattered on the mid- and upper-stipe; sori with very large, tall indusia . . . 9. *D. corleyi*
23. Stipe scales pale- to mid-brown at their apices, with dark bases, and most of them with darker centres as well, scales  $\pm$  dense throughout the stipe; sori with  $\pm$  small, short indusia . . . . . 8. *D. remota*
24. Basal stipe-scales with darker centres; scales  $\pm$  thick, glossy, not becoming narrowly hair-like above; ultimate segments rectangular, with  $\pm$  insignificant teeth; pinnulae-costae bearing  $\pm$  numerous, scattered, small, ovate-lanceolate, pale-brown scales on the lower surface; present in the Canaries and Cape Verdes only . . . . . 10. *D. oligodonta*
24. Basal stipe-scales concolorous; scales thin, matt, with groups of narrowly hair-like scales on the rhachis at the junctions of the pinnae-costae and the rhachis; ultimate segments ovate-rectangular, with  $\pm$  prominent teeth; pinnule-costae bearing a very few, or no, narrowly-lanceolate, pale scales on the lower surface; present in the Cape Verdes only . . . . . 11. *D. pentheri*

1. *Dryopteris affinis* (Lowe) Fraser-Jenkins, Fern Gaz. 12: 56 (1979).

BASIONYM: *Nephrodium affine* Lowe, Trans. Cambridge Phil. Soc. 6: 525 (1838), non *Aspidium* Fischer & Meyer in Hohenacker (1938), nec «*Dryopteris affinis*» Newm., comb. inval. (= *D. filix-mas* var. *affinis* Newm.) (1854).

IMPORTANT SYNONYMS: *Polystichum abbreviatum* DC. (1805). *Aspidium distans* Viv. (1825), non *Dryopteris distans* (Hook.) O. Ktze. (1851). *Dryopteris filix-mas* var. *abbreviata* (DC.) Newm. (= «*Dryopteris abbreviata*» (DC.) Newm., comb. inval.) (1854), non sensu Newm. *Dryopteris filix-mas* var. *borreri* Newm. (= «*Dryopteris borreri*» Newm., comb. inval.) (1854). *Lastrea filix-mas* var. *paleacea* Moore (1855). *Lastrea pseudomas* Wollaston (1855). *Aspidium filix-mas* var. *subintegrum* Döll (1857). *Dryopteris paleacea* (Moore) Druce (1908), non Hand.-Mazz. (1908), nec (Sw.) C. Chr. (1911). *Dryopteris mediterranea* Fomin (1934). *Dryopteris borreri* (Newm.) Newm. ex von Tavel (1937). *Dryopteris abbreviata* (DC.) Newm. ex Manton (1950), non sensu Manton, nec (Schrad.) O. Ktze. (1891). *Dryopteris pseudomas*

(Woll.) Holub & Pouzar (1967). *Dryopteris resendeana* Rezende-Pinto (1969).

IN WILKOMM & LANGE: not separated from *Polystichum filix-mas*.

TYPE (Lectotype: FRASER-JENKINS 1980a: 108): from Madeira in K! isotype in BM!

DESCRIPTION: Fronds persistent at least for the first part of winter, once pinnate, a second time deeply pinnatifid, becoming twice pinnate below in large fronds, lanceolate. Stipe  $\pm$  short, stipe and rhachis densely scaly with mostly narrow scales, usually with  $\pm$  dark-brown basal regions. In the living plant a dark area is present at the base of the pinna-costa where it joins the rhachis. Lamina somewhat coriaceous and dark-green, but yellow-green when young. Pinna-lobes almost all adnate to the costa, noticeably parallel-sided, ranging from truncate to pointed, but usually at least somewhat obtuse, bearing very few or no teeth at their sides and  $\pm$  scattered, wide based, but acutely pointed teeth at their apices, pinnules often lobed or slightly auriculate at their bases. Indusia thick, turned down at their sides and closely surrounding the sorus, often slightly inflected below, but shrinking somewhat (or lifting) and often splitting on ripening, becoming mid-brown and often shrivelling slightly but mostly  $\pm$  persistent. Ripe (dark) spore-samples contain a noticeable though somewhat small proportion of abortive spores, visible under the microscope, as well as good spores, due to the apomictic nature of the species. Diploid apomict and triploid apomict.

RANGE IN THE AREA: The occurrence of this species near the sea in N. and W. Iberia and on low hills in South-West and West Spain and in South-Central Portugal, where *D. filix-mas* is rare or absent, though previously confused with it, reflects its more Atlantic distribution pattern; some of the localities may be considered Atlantic refugia. Some of the records of *D. filix-mas* from Cadiz Province, S. Spain, could also refer to *D. affinis*, though this needs confirmation, and despite search in ALLORGE's collections (in P) and in other herbaria, no voucher specimens have been found. MOLESWORTH-ALLEN (1977) points out that *Culcita macrocarpa* Presl, which occurs in the area, is known as «Helecho Macho»,

or Male Fern, in South-West Spain, which could also add to the confusion.

**RANGE:** The species occurs throughout Western, S. Central and Southern Europe, East to the South-West Ukraine, N. Turkey, the Caucasus, Transcaucasia and Caspian Iran, also in North-West Africa and Macaronesia (except the Cape Verdes). It is absent from the far North and North-East of Europe and dies out in the far South Mediterranean region.

**NOTES:** Because NEWMAN never made the valid combination, *Dryopteris affinis*, but accepted it only as a variety, the epithet is available for use in *Dryopteris* and must replace *D. pseudomas* or *D. borreri*. The type of *Polystichum abbreviatum* DC. is this species, though it was unfortunately taken by NEWMAN (who was followed by MANTON and other British authors) to be the same as *D. oreades*. However NEWMAN again did not make the valid combination, *Dryopteris abbreviata*, and as that epithet is pre-occupied in *Dryopteris*, *D. affinis* becomes the correct legitimate name for the present species.

The systematics of this species are complex but it appears that it may have arisen in the past, perhaps during the late tertiary period, by hybridisation between a species close to the pan sub-tropical *D. wallichiana* (Spreng.) Hyl. with other species (see FRASER-JENKINS 1980a and SMITH & FRASER-JENKINS 1982), probably including *D. oreades* and/or perhaps *D. caucasica* (A. Br.) Fraser-Jenkins & Corley. Fertility is through DÖPP-MANTONIAN apomixis (see LOVIS 1977). It has recently been divided into several different subspecies (FRASER-JENKINS 1980a) which are thought to have had different origins, arising by hybridisation with differing sexual diploid species; the subspecies occurring in the area are as below. All are somewhat variable, the variants forming local populations due to the apomictic nature of the species.

1) Subsp. **affinis**

**BASIONYM:** As for the species.

**IMPORTANT SYNONYMS:** *Polystichum abbreviatum* DC. (1805). *Aspidium filix-mas* var. *subintegrum* Döll (1857), lectotype: coll.

Döll, 1846, ex Prof. Scheyder, 1890, in KR! *Dryopteris borrieri* var. *affinis* (Lowe) Menezes, Flora do Archipelago da Madeira (1914). *Dryopteris borrieri* var. *atlantica* Oberholzer & von Tavel (1937), nom. nud. *Dryopteris filix-mas* forma *valongensis* Rezende-Pinto, Portug. Acta Biol., ser. B, vol. Henriques: 219-223 (1949). *Dryopteris abbreviata* (DC.) Newm. ex Manton (1950), non sensu Manton, nec (Schrad.) O. Ktze. (1891). *Dryopteris resendeana* Rezende-Pinto (1969). *Dryopteris borrieri* subsp. *resendeana* (Rezende-Pinto) Malagarriga, Sinops. Flora Iber. 1-25: 65 (1975), Lab. Bot. Sennen, Barcelona. *Dryopteris affinis* subsp. *affinis* var. *azorica* Fraser-Jenkins (1980), var. *disjuncta* (Fomin) Fraser-Jenkins (1980) and var. *punctata* Oberholzer & von Tavel ex Fraser-Jenkins (1980).

TYPE: As for the species.

DESCRIPTION: This subspecies has the most marked *D. affinis* morphology with dense, mostly narrow, usually  $\pm$  dark-based, brown scales (but pale in var. *azorica*) and a glossy, coriaceous lamina. The pinnae are symmetrical about their axes and are not normally developed on their basiscopic side even in the basal pinnae. The pinna-lobes or pinnules can become well separated from each other in large plants (var. *disjuncta*, mainly in Central and Eastern Europe) and are markedly rounded-truncate and normally with few teeth, though the teeth may be more or less prominent at the apices. Apart from basal auricles the pinna-lobes or pinnules are usually unlobed or with only shallow, rounded-truncate lobes. The lowest basiscopic pinnule of the lowest pinna is usually half to two-thirds adnate to the costa. Indusia thick, inflected and splitting on ripening, shrinking only slightly and mostly persistent. Diploid apomictic.

HABITAT: Banks and slopes, in woods, or among rocks and bushes on mountains, with no definite preference for calcareous or acidic rocks, though more common on the latter as they are usually less dry. From sea-level up to 2000 m. altitude or more. This subspecies is more common near the sea than the other subspecies or than *D. filix-mas*.

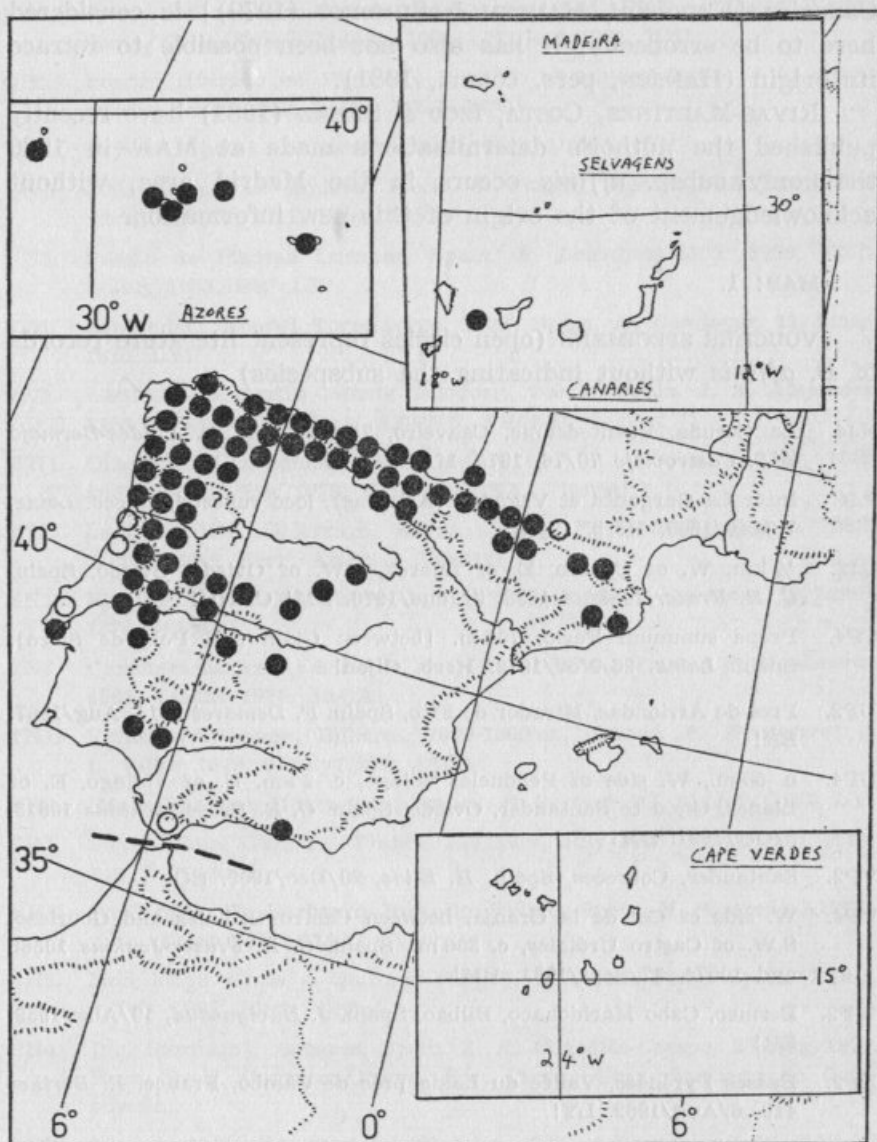
RANGE IN THE AREA: A markedly Atlantic or Subatlantic taxon. Becoming scattered and uncommon in the E. Pyrenees and Eastern

Cataluña, though occurring in the seaboard mountains of the latter. The most common *Dryopteris* along the North and West coastal regions of Iberia, but dying out South of c. 39° 30' latitude apart from a few scattered populations (Sintra, ?Monchique, Huelva, probably Algeciras, the Sierra Nevada). Of these, Prof. J. DO AMARAL FRANCO (pers. comm., 1982) points out that the Monchique record is very probably erroneous, an opinion with which the present author is in agreement; the record perhaps having been based on ESTÁCIO DA VEIGA's (1869) record of *Polystichum spinulosum* (see under *D. carthusiana*). It is very scattered in the Eastern Cordillera Central, and apparently without connection to the Pyrenees or Eastern Cordillera Cantabrica and in view of this, assuming it has not been extinguished N.W. of the Eastern Cordillera Central, it seems likely that it has extended Eastwards from central Portugal to the more Western and central parts of the Cordillera Central and to the Montes de Toledo. Rare in the Canaries (La Gomera only), but common in Madeira and the Azores. Absent from the Cape Verdes. The records in JALAS & SUOMINEN (1972), from PG4 and QF1 were in error for *D. filix-mas* (FRANCO, pers. comm. 1982).

RANGE: Western Europe from Britain (and perhaps South-West Norway) southwards and extending eastwards in rather scattered populations through the Black Forest and Alps to Austria (and perhaps further), North Turkey and the Caucasus, Macaronesia (except the Cape Verdes) and North-West Africa (Morocco). *D. affinis* was first reported from the Canary Islands by BENL & SVENTENIUS (1970: 456) and shortly afterwards by PAGE (1971), who had previously reported it in litt. (Ph. D. thesis, 1968, ined.); it occurs only on La Gomera, where it is uncommon, though it was collected there (sub *D. filix-mas*) as long ago as 1935 by CUATRECASAS (no. 332 in MA!). The report of var. *azorica* from the Canary Islands (FRASER-JENKINS 1980a) was in error for var. *affinis* and the doubtful report of *D. affinis* from the Cape Verde Islands (FRASER-JENKINS 1980a) was in error for *D. oligodonta*, which had been reported sub «*D. filix-mas* and variety» by TARDIEU BLOT (1946) and sub *D. borrieri* var. *affinis* (with *D. elongata* var. *simplex* given in synonymy, see *D. oligodonta*) by DANSEREAU (1961); see also BENL & SVENTENIUS (1970: 456).

NOTES: This subspecies probably contains two different genomes as shown by the failure of bivalent formation at meiosis in the sixteen-celled sporangia (the more frequent eight-celled sporangia have full bivalent formation). Their likely identity is with those of *D. wallichiana* and *D. oreades* respectively (see FRASER-JENKINS 1980a), though this has not been demonstrated by artificial hybridisation and also *D. wallichiana* at the present day is an apomictic species, which means that it could not itself have been the direct ancestor. Prof. REZENDE-PINTO's investigation and description of *Dryopteris resendeana* [REZENDE-PINTO & LEMOS-PEREIRA (1950) and REZENDE-PINTO (1949 & 1969)] (type in PO! and LISU!) represents an independent observation of part of the phenomenon of apomixis in *D. affinis*. The plant was described as a new taxon in view of its remarkable morphology, which, however, merely represents an abnormal monstrosity somewhat similar to some of the named monstrosities popular as garden plants in Britain. It occurred as a single plant (REZENDE-PINTO, pers. comm. 1980). The spores are normal for *D. affinis* and the monstrous characteristics are handed on to the next generation. However the origin of the plant was almost certainly from cultivation, similar to *Dicksonia antarctica* Lab., *Culcita macrocarpa* Presl and *Trichomanes speciosum* Willd., reported from the same area [REZENDE-PINTO (1939, 1940 & 1943) and LAÍNIZ (1973a)] which was not accepted by FRANCO (1971 and 1974) as of natural origin (along with *Trichomanes speciosum* [see also REZENDE-PINTO (1941 and 1943), FRANCO (1971) and LAÍNIZ (1973a)], *Lycopodium cernuum* L. [see also SAMPAIO (1915) and REZENDE-PINTO (1943)], and *Pteris palustris* Poir. (sub *P. serrulata*), all known to be introduced to various parts of Portugal), nor by GREUTER, BURDET & LONG (1981). Another garden cultivar, *Polystichum setiferum* (Forssk.) Woyнар var. *acutiloboproliferum* Wollaston has also been found recently by REZENDE-PINTO (pers. comm. 1980), at the same place and was shown to the author for identification as a possible new species. The record of *D. affinis* (sub *D. borrieri*) from the Serra de Monchique, S. Portugal, given by ROTHMALER & PINTO DA SILVA (1939) has not been confirmed (A. R. PINTO DA SILVA, pers. comm., 1981), though it is possible that the record was based on a reinterpretation of the record of *D. spinulosa* by ESTÁCIO DA VEIGA (1869) (see note sub *D. guanchica*). The record from La Palma,





MAP 1.

Correction: remove the two question marks. Convert the two open circles in Portugal, immediately south of the river Douro, into full spots.

Canaries [ERIKSSON, HANSEN & SUNDING (1979)] is considered here to be erroneous; it has also not been possible to retrace its origin (HANSEN, pers. comm., 1981).

RIVAS-MARTÍNEZ, COSTA, IZCO & SÁENZ (1981) have recently published the author's determinations made at MAF in 1980 that only subsp. *affinis* occurs in the Madrid area, without acknowledgement of the origin of this new information.

MAP: 1.

VOUCHER SPECIMENS (open circles represent literature records of *D. affinis* without indicating the subspecies).

- NJ4. La Coruña, Puentedeume, Caaveiro, 75 m, Spain. *E. Valdés-Bermejo* & *S. Castroviejo* 70/76, 1976. MA!
- PJ4. Inter La Garganta et Vegadeo (Asturias), loco rupestri, siliceo. *Lainz*, 7/May/1960. Herb. Gijón!
- QJ2. ½ km. W. of Canero, E. of Luarca, NW. of Oviedo, Oviedo, Spain. *C. R. Fraser-Jenkins* 4898, 5/June/1976. BM! CANU!
- TP4. Prope summum Fario, 700 m. [between Gijón and Pola de Siero], Spain. *Lainz*, 26/Nov/1972. Herb. Gijón!
- UP2. Pres de Arriondas, Mirador de Fito, Spain. *F. Demaret* 8514, Aug/1967. BR!
- UP4. c. 50 m., W. side of Pendueles village, c. 2 km. E. of Vidiago, E. of Llanes, Gijón to Santander, Oviedo, Spain. *C. R. Fraser-Jenkins* 10813, 3/Oct/1981. BM!
- VP2. Santander, Cobrecas, Spain. *H. Elías*, 29/Dec/1909. BC!
- 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* 10568 and 10574, 17/Sept/1981. BM!
- WP2. Bermeo, Cabo Machichaco, Bilbao, Spain. *J. Duvigneaud*, 19/Aug/1959. BR!
- XP2. Basses Pyrénées, Vallée du Laxia près de Cambo, France. *R. Berthet* 419, 6/Aug/1962. LY!
- NH1. Galice, 30 km. S. de La Coruña, N. de Ordenes, Spain. *L. Reichling* 21186, 29/June/1954. BR! M!
- NH3. Cuenca alta del Rio Mandeo (Coruña), riberas del Deo, Spain. *J. Daldá-González*, 12/Oct/1966. MA (198361)! Herb. Fac. Cienc. Biol., Univ. Complutense, Madrid (00718)!
- PH1. c. 2 km. N. of Millares, N. of Fontao, Baleira to Meira, S. of Vegadeo, Lugo, Spain. *C. R. Fraser-Jenkins* 10691, 27/Sept/1981. BM!

- PH3.  $\frac{1}{2}$  km. NE. of Fonsagrada, on Luarca road, ENE. of Lugo, Lugo, Spain. *C. R. Fraser-Jenkins* 10684, 27/Sept/1981. BM!
- QH1. Bosque ribereño en Pigueces, Somiedo, Asturias, Spain. *J. A. Fernández-Prieto* 1552, 7/June/1977. FCO!
- TN3. Pajares, Spain. *A. Lawalrée* 5437, 9/July/1953. BR!
- UN1. Peña Salon [nr. Amieva, Sierra de Ponga], Spain. *J. M. Argüelles Sáez*, 10/June/1971. Herb. Gijón!
- UN3. Puerto de Piedras Luengas, Spain. *A. Lawalrée* 5305, 5366, 5317, 5/July/1953. BR! LY!
- VN1. Santander, [above] Torrelavega, 1000', Spain. *M. Gandoger*, 11/June/1910. LY!
- VN3. Lendroño de Arriba, Monte Tologorri, 700 m., Spain. *J. A. Alejandro* 1158, 5/Sept/1979. Herb. AEPNA, Vitoria!
- WN1. Olaeta to Otxandiando, 560 m., Spain. *J. A. Alejandro* 1345, 1352 and 1353, 15/Dec/1979. Herb. AEPNA, Vitoria!
- WN3. Landeta, Mte. Galarraga, 800 m., Spain. *P. Uribe-Echebarria* 1582, 3/July/1980. Herb. AEPNA, Vitoria!
- XN1. Roquedo izda Tejos, Puerto de Velate, Spain. *J. C. Bascones*, 20/June/1976. PAMP!
- XN3. Carretera de Arette a Pa. S. Martin, 670-700 m., France. *P. Montserrat* 1569, 7/June/1975. JACA!
- YN1. Vallon d'Artigasse, Bilhères, 1000-1200 m., France. *P. Montserrat & L. Villar* 1699, 9/July/1979. JACA!
- BH3. Haute Garonne, Montrejeau, France. *P. Berthet* 317, 31/July/1962. LY!
- CH1. Cierp, Haute Garonne, France. *Lefèbvre*, July/1926. Lawalrée (1959), sub *D. × tavelii*.
- NH2. La Coruña, Mt. Barbanza, Portosin, Ruinas, Spain. *M. Pastrana* AB805, p. p., 4/Jan/1979. MA!
- PH2. Non longe nimis a Quiroga (Lugo), Alto del Buey, Spain. *Lainz*, 2/July/1965. Herb. Gijón!
- PH4. [nr. Piornedo], Ancares, Spain. *S. E. González-Crespo*, 23/Aug/1979. Herb. S. E. González-Crespo, Fac. Cienc., Univ. Santiago de Compostela!
- QH2. 3  $\frac{1}{2}$  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 Jistrodo, NNE. of Ponferrada, León, Spain. *C. R. Fraser-Jenkins* 10743, 30/Sept/1981. BM!
- VN4. Burgos, Monte Sobron, Spain. *M. Losa*, July/1926. MA (208)!
- WN2. Oquina, Spain. *P. Uribe-Echebarria & L. A. Perez Herreria*, Autumn/1975. Herb. AEPNA, Vitoria!
- YN2. Balneario de Panticosa, Spain. *A. Lawalrée* 5193, 30/June/1953. BR!



- BH4. Bco. de Ragreso, Valle de Anisclo, 1040 m., Spain. *P. Montserrat* 255, 6/April/1972. JACA!
- CH4. Collado de Prados de San Martín, 2000 m., Andorra. *S. Rivas-Martinez & M. Costa*, 27/July/1970. MAF (101346)!
- DH2. Ribas de Freser, between Salida and Puigcerda, 1010 m., Spain. *G. Lopez* 181, 19/Oct/1979. MA!
- NG1. Monte Galiñeiro, exp. N., Vigo, 500 m., Spain. *F. J. Fernández-Casas*, June/1967. BCF (7491)!
- NG3. Arredores de Melgaço, S. Gregório, Portugal. *A. Moller* 198, June/1894. COI!
- PG1. c. 800 m., 2 km. E. of Baldrey, W. side of Alto de Rodicio, W. of Laboreiro, S.W. of Castro Caldelas, between Orense and Ponferrada, Orense, Spain. *C. R. Fraser-Jenkins* 10712-10713, 29/Sept/1981. BM!
- PG3. Gorge, 3 km. W. of San Juste, c. 5 km. E. of El Barco de Valdeorras, 5 km. W. of Puente de Domingo Florez, Orense to Ponferrada, Orense, Spain. *C. R. Fraser-Jenkins* 10729, 30/Sept/1981. BM!
- NG2. Vilar de Mouros, E. de Caminha, Minho, Portugal. *J. Duvigneaud*, 21/July/1959. BR! Herb. *J. Duvigneaud*, Bruxelles!
- NG4. Minho, Serra do Gerês, inter Caldas et Pedra Bela, ravina do Azual, Junto a una linha de água. *J. Malato-Beliz, A. Raimundo & J. A. Guerra* 4411, 10/July/1958. BCF (5014)! MA (186681)! ELVE!
- PG2. Murça, margens do Tinhela, Portugal. *G. Barbosa & F. Garcia* 7322, 10/Oct/1944. LISI!
- DG2. Barcelone, Montseny, ravins, Spain. *F. Sennen*, 18/Oct/1934. MA (163747)! BM! MAF (44482)!
- DG4. Maresme, Montenegro de Ponent, Font, Spain. *P. Montserrat*, 6/July/1945. BC (622155)!
- NF1. Ponte da Pedra, pr. av Porto, margens do Leça, Portugal. *J. Castro* 127, 8/June/1941. PO!
- NF3. Oliveira, Caldas de Moledo, Ribeira de Geguintes (nr. Mesão Frio), Portugal. *F. Garcia & M. Myre* 6076, 30/June/1943. LISI!
- PF1. Carrazeda de Ansiães, São Mamede de Riba Tua, Portugal. *G. Barbosa & F. Garcia* 8235, 14/June/1945. LISI!
- VL3. c. 1300 m., reserve «Hayedo de Montejo», N.E. of Montejo de La Sierra, on road to El Cardoso de La Sierra, S.E. of Puerto de Somosierra, Guadalajara, Spain. *C. R. Fraser-Jenkins* 10767, 2/Oct/1981. BM! (following the indication of *D. affinis* made without voucher specimens, by *I. Barrera-Martinez*, pers. comm., 1981).
- NF2. Aveiro, Salreu, Portugal. *A. Luís Flores*, Aug/1914. LISU!
- NF4. Serra de Freita, estrada para Manhouce, margens de um ribeiro, Portugal. *J. Matos & A. Dinis* 9653, 7/July/1966. COI!

- PF2. Penedono, valados, Portugal. *A. Rozeira, D. Barreto & J. Araújo* 27114, 19/July/1971. PO!
- VL2. c. 1700 m., Arroyo de La Peña, N. side of upper Rio Manzanares valley, Pedriza de Manzanares, N.W. of Manzanares el Real, Colmenar Viejo to Puerto de Navacerrada, Sierra de Guadarrama, Madrid, Spain. *C. R. Fraser-Jenkins* 10755, 1/Oct/1981. BM! [following the indication of RIVAS-MARTINEZ & SAENZ DE RIVAS (1971) and RIVAS-MARTINEZ & COSTA (1975), made without voucher specimens, RIVAS-MARTINEZ, pers. comm. (1981)].
- NE1. Jalas & Suominen (1972).
- NE3. Tondela, freg. de Guardão, junto à Estância Sanatorial do Caramulo, Portugal. *N. Pizarro de Magalhães*, 20/March/1967. MGC! LISI!
- PE1. 1550 m., below Lagoa Comprida, nr. Seia, Serra da Estrela, E. of Coimbra, Beira Alta, Portugal. *C. R. Fraser-Jenkins* 4918, 3/June/1976. BM!
- PE3. Tarouca, Várzea da Serra, Vale de Espinho, Portugal. *António Alves*, 16/July/1967. LISI!
- QE1. La Herguijuela, Las Batuecas, Cáceres, Spain. *S. Rivas-Martinez* and *B. Casaseca*, 15/Dec/1973. MAF!
- TK3. Cáceres, entre Jerte y Tornavacas, Spain. *J. A. Devesa, J. Pastor & S. Talavera* 5844-78, 27/July/1978. SEV (39943)!
- UK3. Arroyo La Adrada, Valle del Fiétar, Avila, Spain. *P. Montserrat* 6104, 30/Nov/1975. JACA!
- NE4. Beira Litoral, Ceira, Portugal. *M. L. V. Chuva*, 5/April/1960. COI!
- PE2. Sítio da Serra, Alcaide, Portugal. *A. R. da Cunha*, June/1882. LISU!
- QE2. Garganta del Guadalerna, entre Serradilla y las Casas de Millan, Cáceres, Spain. *S. Rivas-Goday*, 31/May/1941. MAF (87020)!
- ND3. Ribatejo, Ferreira de Zêzere, Portugal. *M. Ferreira*, May/1914. COI!
- PD1. Beira Baixa, Vila Velha de Ródão, margens do Tejo, Portugal. *B. V. Rainha* 3027, 30/Sept/1955. LISE!
- TJ3. Alisedas del Nacimiento del Rio Almonte, Navazuelas (Cáceres), Spain. *S. Rivas-Goday & M. Ladero*, 6/Sept/1969. MAF (88072, 94314 & 77644)!
- UJ3. Montes de Toledo, entre Hontanar y Cijara, Rio Estena, Toledo, 820 m., Spain. *E. F. Galiano, S. Silvestre & B. Valdés* 1908, 29/May/1968. SEV (1412)! LTR!
- MD4. Mafra, Portugal. Franco (1971).
- PD2. Serra de S. Mamede, Portalegre, Alegrete, Ribeira de Arronches, Moinho de Baixo, Portugal. *J. Malato-Beliz & J. A. Guerra* 7644, 30/June/1969. ELVE!

- MC3. Estremadura, Serra de Sintra, Portugal. *Welwitsch*, May/1851. P! and June 1841. LISU! (see comments under *D. guanchica*).
- QC2. Galaroza, Huelva, Spain. *Gros* 28/May/1931, herb. C. Pau. MA (209)!
- PB3. Huelva, Cortegana, Spain. *B. Cabezudo* 1203/76, 28/May/1976. SEV (24180)! BM! MA (208552)!
- QB1. Huelva, Sierra de Aracena, Entre Jabugo y Castano del Robledo, Arroyo, Spain. *J. Rivera & B. Cabezudo* 4688/R, 25/May/1979. SEV (45275)!
- NB2. Monchique. Rothmaler & Pinto da Silva (1939). Also: Monchique. *Estácio da Veiga*. Colmeiro y Penido (1889).
- VF3. Fuente Agria de Portugos, Sierra Nevada, Spain. *J. Varo & J. A. Gil*, July/1975. Herb. Fac. Ciencias, Univ. Granada (806 and 807)!
- TF4. Valle rio la Miel, Algeciras, Spain. Allorge & Allorge (1945). Sierra de Palma, Algeciras, Spain. *Rowy* (1887). Algeciras, Spain. Clemente (1807). Castellar de la Frontera, La Almoraima, Spain. Ceballos (1929).
2. Caldeira Branca, grassy slopes, 550 m., Flores, Azores. *C. M. Ward* 50, 28/July/1967. BM!
4. Ilha de São Jorge, Picos da Esperança, Azores. *A. Gonçalves da Cunha & L. G. Sobrinho*, 21/Aug/1938. LISU!
5. Cliffs below Cabeço Gordo, S. side of La Caldeira, Faial, Azores. *C. R. Fraser-Jenkins* 9605, 18/July/1979. BM!
6. Longitudinal road, S.E. of Madalena, below & W. of P. do Pico, Pico, Azores. *C. R. Fraser-Jenkins* 9619, 22/July/1979. BM!
7. Terceira, Pico da Bagacinha, Biscoitos, estrada do Mato pr. da Lagoa do Negro, Azores. *J. Ormonde* 162, 25/Aug/1966. LISU! LISE! PO! COI.
8. Nr. top of Lagoa do Fogo caldeira, on N. side, São Miguel, Azores. *C. R. Fraser-Jenkins* 9694, 29/July/1979. BM!
11. Casas do Rabaçal, 970 m., Madeira. *G. Benl*, 6/Aug/1970. M!
15. 1100 m., top of Mña. Quemada, nr. side road to Agulo, El Cedro, La Gomera, Canaries. *C. R. Fraser-Jenkins* 4213, 31/3/1974. BM!

2) Subsp. *borreri* (Newm.) Fraser-Jenkins, *Willdenowia* 10: 110-111 (1980).

BASIONYM: *Dryopteris filix-mas* var. *borreri* Newman, *Hist. Brit. Ferns*, ed. 3: 189 (= «*Dryopteris borreri*» Newm., comb. inval.) (1854).

IMPORTANT SYNONYMS: *Lastrea filix-mas* var. *paleacea* Moore (1855). *Lastrea pseudomas* Wollaston (1855). *Nephrodium filix-mas* var. *obtusum* Post, Flor. Syria Palest. Sinai, ed. 1: 910 (1896). *Dryopteris paleacea* (Moore) Druce (1908), non Hand.-Mazz. (1908), nec (Sw.) C. Chr. (1911). *Dryopteris mediterranea* Fomin (1934). *Dryopteris borrieri* (Newm.) Newm. ex von Tavel (1937). *Dryopteris pseudomas* (Wohl.) Holub & Pouzar (1967). ?*Dryopteris affinis* subsp. *robusta* Oberholzer & von Tavel ex Fraser-Jenkins (1980).

TYPE (lectotype, FRASER-JENKINS, 1980a: 111): from England in BM!

DESCRIPTION: Varying from an obvious *D. affinis* to a plant with less characteristic morphology, which is often mistaken for *D. × tavelii*. Scales  $\pm$  dense, with mixed narrow and wide ones, dark-based or  $\pm$  pale, lamina slightly coriaceous, markedly less glossy and dark than in subsp. *affinis*. The basal pinnae are often asymmetrical and developed on their basiscopic side. The pinna-lobes or pinnules are usually more or less crowded and vary from markedly squarely-truncate (which is not normal in subsp. *affinis*) to somewhat pointed, though usually the former; bearing more, and usually prominent, acute pinnule-teeth. Pinnules usually bearing several rectangular side-lobes in large plants, especially the basiscopic ones in the lowest pinnae. The lowest basiscopic pinnule of the lowest pinna is usually fully stalked. Indusia somewhat thick, though thinner than in subsp. *affinis*, varying from inflected to merely curved down closely around the sorus, shrivelling and lifting more than in subsp. *affinis* on ripening (but not as much as in *D. filix-mas*), mostly persistent. Spores more abortive and slightly larger than in subsp. *affinis*. Triplod apomictic.

HABITAT: As for subsp. *affinis*, but perhaps occurring more commonly than that subspecies on calcareous rocks, though showing no definite preference. From c. 50-2000 m. altitude. Not as common near the sea as subsp. *affinis*.

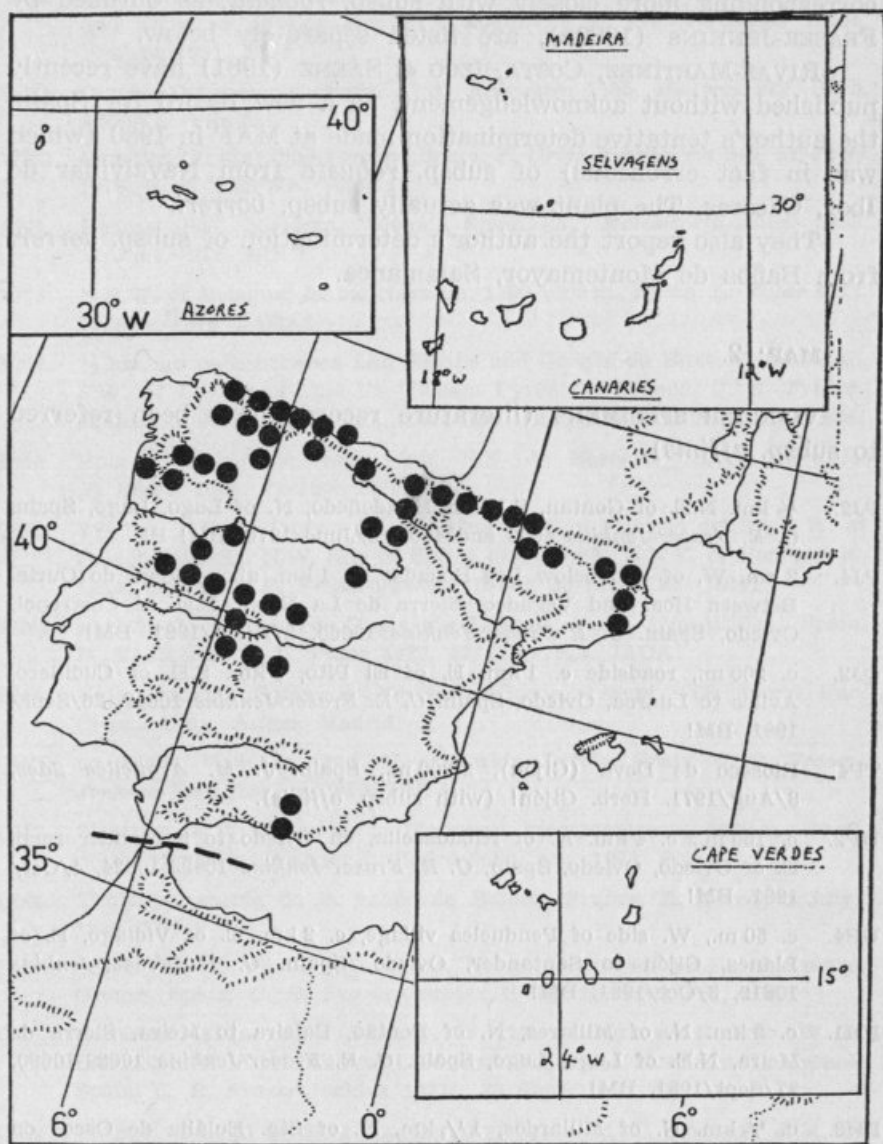
RANGE IN THE AREA: Somewhat Subatlantic. Scattered and less common than subsp. *affinis* except in the Pyrenees (including the E. Pyrenees and the seaboard mountains of Cataluña), the

Eastern and central Cordillera Central, Burgos, La Rioja (= Logroño), and the Sierra Nevada. Present in the Pyrenees and along the Cordillera Cantabrica, in N. Portugal, Zamora, and E. Central Portugal. Extending Eastwards into the Western Cordillera Central and the Montes de Toledo. Absent from Macaronesia.

**RANGE:** The commonest plant throughout the range of the species except for the area under consideration where it is less common and becomes gradually replaced by subsp. *affinis*.

**NOTES:** The cytology of this subspecies requires further study. At least some plants of triploid *D. affinis* show equal numbers of bivalents and univalents in the 16-celled sporangia at meiosis (with bivalents only in the 8-celled sporangia) which suggests the presence of two sets of one type of genome and one of another, probably those of *D. oreades* and *D. wallichiana* respectively, but the identity of the genomes has never been demonstrated and the presence of other genomes cannot be excluded. Furthermore the subspecific identity of these plants is not known to the present author and it is quite possible that the reports referred to subsp. *stilluppensis*. It is also possible that some of the plants which have been found to show complete failure of pairing may belong to subsp. *borreri*, though one such plant has been reported to be *D. affinis* subsp. *robusta* Oberholzer & von Tavel ex Fraser-Jenkins (see FRASER-JENKINS, 1980a). However, on morphological grounds it seems likely that subsp. *borreri* could have been derived from *D. affinis* subsp. *affinis* and *D. caucasica*, and if so would presumably contain three different genomes and show considerable failure of bivalent formation in the 16-celled sporangia at meiosis. At present it is not clear and indeed seems somewhat unlikely that subsp. *robusta* is really genomically different from subsp. *borreri*, rather than merely representing large and luxuriant plants of the latter. Thus it seems likely that the plants identified by FRASER-JENKINS (1980a) as subsp. *robusta* and usually mistaken for *D. × tavelli* really belong under subsp. *borreri* and should be treated under that subspecies as belonging to a variety *robusta*, if necessary. However much further study is needed to decide the status of subsp. *robusta*. Plants





MAP 2.

corresponding more closely with subsp. *robusta*, as outlined by FRASER-JENKINS (1980a), are listed separately below.

RIVAS-MARTÍNEZ, COSTA, IZCO & SÁENZ (1981) have recently published without acknowledgement, as a new record for Spain, the author's tentative determination made at MAF in 1980 (which was in fact erroneous) of subsp. *robusta* from Navalvillar de Ibor, Cáceres. The plant was actually subsp. *borreri*.

They also report the author's determination of subsp. *borreri* from Baños de Montemayor, Salamanca.

MAP: 2.

VOUCHER SPECIMENS (literature records have been referred to subsp. *affinis*).

- PJ2. ½ km. N.E. of Gontan, S.W. of Mondoñedo, N. of Lugo, Lugo, Spain. *C. R. Fraser-Jenkins* 4902 and 4903, 5/June/1976. BM! P!
- PJ4. 2 km. W. of and below Las Rozadas, c. 1 km. above Vega do Ouria, Between Boal and Vegadeo, Sierra de La Bobia, S.E. of Castropol, Oviedo, Spain. *C. R. Fraser-Jenkins* 10665, 27/Sept/1981. BM!
- QJ2. c. 200 m., roadside c. 1 km. E. of El Pito, 5 km. S.E. of Cudillero, Aviles to Luearca, Oviedo, Spain. *C. R. Fraser-Jenkins* 10642, 26/Sept/1981. BM!
- TP4. Rioseco de Deva (Gijón), 2-300 m., Spain. *J. M. Argüelles Sáez*, 8/Aug/1971. Herb. Gijón! (with subsp. *affinis*).
- UP2. c. 150 m., c. 4 km. E. of Ribadasella, on Oviedo to Santander road, E. of Oviedo, Oviedo, Spain, *C. R. Fraser-Jenkins* 10823-10824, 4/Oct/1981. BM!
- UP4. c. 50 m., W. side of Pendueles village, c. 2 km. E. of Vidiago, E. of Llanes, Gijón to Santander, Oviedo, Spain. *C. R. Fraser-Jenkins* 10812, 3/Oct/1981. BM!
- PH1. c. 2 km. N. of Millares, N. of Fontão, Baleira to Meira, Sierra de Meira, N.E. of Lugo, Lugo, Spain. *C. R. Fraser-Jenkins* 10689-10690, 27/Sept/1981. BM!
- PH3. c. ½ km. N. of Millardos, 1½ km. N. of Sta. Eulália de Oscos on road to Vegadeo, S. side of Sierra de La Bobia, c. 650 m., Spain. *C. R. Fraser-Jenkins* 10677, 27/Sept/1981. BM!
- QH1. Puerto Ventana, 1225 m., Spain. *Lainz*, 3/Sept/1972. Herb. Gijón! (with subsp. *affinis*).
- UN1. Lago de Enol, Covadonga, Picos de Europa, Oviedo, Spain. *C. R. Fraser-Jenkins* 3765, 16/July/1972. BM!

- VN1. Calc., c. 1100 m., S. side of Portilla de La Luna, between Villacarriedo and Espinosa de Los Monteros, Spain. *C. R. Fraser-Jenkins* 10594, 17/Sept/1981. BM!
- WN1. Olaeta, Otxandiano, Spain. *J. A. Alejandro* 1355, 15/Dec/1979. Herb. AEPNA, Vitoria!
- WN3. Urquilla (Aratz), 900-1000 m., Spain. *P. Uribe-Echebarria* 949, 21/July/1976. Herb. AEPNA, Vitoria!
- XN1. Roncesvalles, Navarra, 900 m., Spain. *B. Molesworth-Allen* 5933, 14/June/1972. MGC!
- XN3. N.N.W. of Belagua, Isaba, Navarra, 1300-1500 m., Spain. *L. Villar* 4117, 17/Aug/1979. JACA!
- YN1.  $\frac{1}{2}$  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*, 10560, 10562 and 10563-10565, 15/Sept/1981. BM!
- BH3. Bois de Culousque, env. 1 km. N.E. de Barèges, 1490 m., France. *F. Badré* 1646, 22/July/1975. P!
- QH2. 3  $\frac{1}{2}$  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* 10748, 30/Sept/1981. BM!
- WN2. Umbria de la Sierra de Cantabria, Lagran, Alava, 1100-1250 m., Spain. *P. Montserrat & L. Villar* 4422, 17/Aug/1973. JACA!
- BH4. Valle Anisclo, Spain. *J. Fernández-Casas*, 1/Sept/1969. Herb. Fac. Cienc., Univ. Auton. Madrid!
- CH2. nr. Viella, Valle de Aran, N. of Lerida, Lerida, Spain. *C. R. Fraser-Jenkins* 3580, 15/Jan/1972. BM!
- DH2. L'entrée de la village de la Llagonne, vers Montlouis, 1690 m., Pyrénées Orientales, France. *F. Badré* 668c, Aug/1973. P!
- DH4. Taurinya, entrée de la vallée de Balatg, France. *L. Ocnill*, 6/July/1929. TL!
- NG3.  $\frac{1}{2}$  km. N. of Vilanova, c. 2 km. N. of Celanova, S.S.E. of Orense, Orense, Spain. *C. R. Fraser-Jenkins* 10693, 29/Sept/1981. BM!
- PG1. c. 800 m., 2 km. E. of Baldrey, W. side of Alto de Rodicio, W. of Laboreiro, S.W. of Castro Caldelas, Orense to Ponferrada, Orense, Spain. *C. R. Fraser-Jenkins* 10715, 29/Sept/1981. BM!
- PG3. W. end of Lago de Sanabria, Zamora, Spain. *R. K. Brummit & A. O. Chater* 205, 19/May/1972. K! LTR!
- VM3. San Millán, Sierra de la Demanda, Burgos, Spain. *A. E. Salvo-Tierra* 5913, 23/June/1979. MGC!
- WM1. Sierra de la Demanda, Logroño, Spain. *A. E. Salvo-Tierra*, 30/June/1979. MGC! and *J. A. Gil, J. Varo & Guerra*, 26/June/1979. Herb. Fac. Ciencias, Univ. Granada (7120-7123)!

- DG3. La Garrotxa, El Sallent de Sta. Pau, Bac d'Esparragueres, pr. Font Suriola, 600 m., Spain. *A. & O. de Bolós*, 24/Aug/1957. BC (115763)!
- NG2. Bank of rio Minho, W. side of São Pedro da Torre, N. Portugal. *C. R. Fraser-Jenkins* 10141, 6/Aug/1980. BM!
- NG4. E. side of Picos de Fonte Fria, N. of Pitões (Portugal), S. of Muíños (Spain), Trás-os-Montes e Alto Douro, Portugal. *C. R. Fraser-Jenkins* 10705, 29/Sept/1981. BM!
- DG4. Maresme, Orsavinya, L. Canyamars, Spain. *P. Montserrat*, 29/Sept/1946. BC (622157)!
- QF1. El Rostro, Corporario, Arroyo de Valdihuerto, Salamanca, Spain. *F. Amich*, 16/June/1978. SA (no. 15585)!
- VL3. c. 1300 m., reserve «Hayedo de Montejo», N.E. of Montejo de La Sierra, on road to El Cardoso de La Sierra, S.E. of Puerto de Somosierra, Guadalajara, Spain. *C. R. Fraser-Jenkins* 10763-10766, 2/Oct/1981. BM! (following the indication of *D. affinis* made without voucher specimens, by I. BARRERA-MARTINEZ, pers. comm., 1981).
- PF4. Puerto Seguro, Salamanca, Spain. *E. Rico*, 5/June/1977. SA (no. 14072)!
- PE1. Beira Baixa, Serra de Estrela, ad Cântaros, 2500', Portugal. *M. Ganderoger*, 29/May/1904. LY!
- PE3. El Payo, Salamanca, Spain. *E. Rico*, 17/June/1976. SA (9461)! MA!
- QE1. Cepeda, Salamanca, Spain. *F. J. Fernández Díez*, 8/July/1974. SA (6268)!
- TK3. Helechadas, por debajo del Puerto de Tornavacas, Avila, Spain. *Rivas-Martinez & J. Izco*, 25/July/1967. LTR! SEV (30125)! (mixed with *D. filix-mas*).
- UK1. nr. Mombeltrán, 50 km. S.S.W. of Avila, Spain. *D. W. Adshead & P. R. Scott* 379, 4/Aug/1962. CGE! LTR!
- UK3. La Adrada, Valle del Fiétar, Avila, 750-800 m., Spain. *P. Montserrat & J. Fernández-Casas* 6103, 30/Nov/1975. JACA!
- TK4. Sierra de Gredos, Base du versant sud, près du Monastère de Yuste, Spain. *P. Berthet* 280, 17/July/1965. LY!
- TJ3. Bordes de Cauces de Agua, Garganta Loriosa, Los Chapatales, Navavillar de Ibor, Cáceres, Spain. *M. Ladero*, 8/April/1971. MAF (80587)!
- UJ1. Arroyo de la Pedriza, Sierra Carbonera, Navatrasierra, Cáceres, Spain. *M. Ladero*. 13/Aug/1966. MAF (80574)!
- UJ3. Toledo, Montes de Toledo, Puerto de Los Canchales, Spain. *S. Rivas & E. F. Galiano*, 11/June/1961. MA (17794)! MAF (60650)! SEV!

- VG4. El barranco del Río de San Juan, Sierra Nevada, Granada, Spain. A. E. Salvo-Tierra, March/1978. MGC!
- VF3. Alpujarra Mts, Río Bermejo, Granada Prov., 1200 m., Spain. B. Molesworth-Allen 6356. 5/Aug/1969. K! BM!

Plants corresponding with *D. affinis* subsp. *robusta* (these have not been mapped):

- WN3. Aitzgorri, 900 m., Spain. J. A. Alejandre, P. Uribe-Echebarria, Carmen & Bapha 2116, 20/July/1980. Herb. AEPNA, Vitoria!
- YN1. Vallon d'Artigase, Bilhères, 1200 m., France. P. Montserrat & L. Villar 1702, 9/July/1979. JACA!
- BH4. Ruisseau de la Houradade, près de la vallée de Lys, S. S. W. de Bagnères de Luchon, 1400 m., Haute Garonne, France. F. Badré 1561, 17/July/1975. P!
- CH4. El Serrat, 15-1600 m., Andorra. M. Losa & P. Montserrat, 4/Aug/1948. BCF (4914)!
- DG4. Catalonia, St. Hilari, Spain. E. Vayreda. BC (no. 374566)!

3) Subsp. *stilluppensis* (Sabr.) Fraser-Jenkins, Willdenowia 10: 112 (1980).

BASIONYM: *Aspidium filix-mas* var. *stilluppense* Sabransky, Österreich. Bot. Zeit. 52: 144, 287 (1902).

IMPORTANT SYNONYMS: *Aspidium distans* Viviani (1825), non *Dryopteris distans* (Hook.) O. Ktze. (1851). *Dryopteris borrieri* var. *insubrica* Oberholzer & von Tavel (1937), nom. nud.

TYPE (holotype): from Austria in W!

DESCRIPTION: Similar to subsp. *affinis* in its rounded pinnule apices, thick indusia and somewhat obtuse teeth, but the lamina is markedly narrower and often smaller in all its parts and the frond appears intermediate between it and *D. oreades*. Stipe  $\pm$  short, stipe scales dense, somewhat glossy, lanceolate, russet- or yellowish-brown, usually almost without a darker base, becoming narrower further up but not as narrow as in subsp. *affinis*. Lamina often somewhat crispaceous-coriaceous, glandular on the axes, at least when young. Pinnæ  $\pm$  short, well spaced below, symmetrical, and the lower ones not or only slightly basiscopically developed.

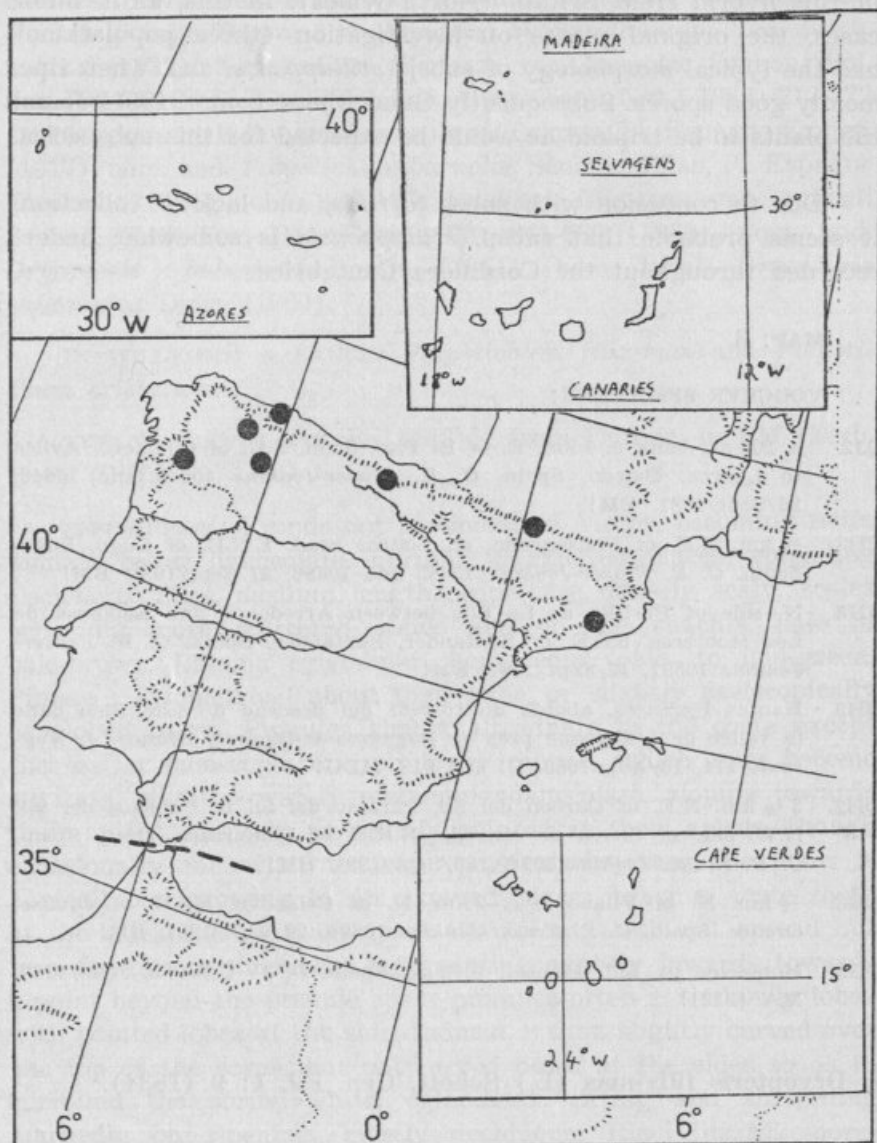
Pinna-lobes or pinnules narrow, becoming long at the bases of the pinnae, usually with indentations above the sori and often above the veins, their apices rounded-truncate and bearing  $\pm$  short, regular, somewhat narrow, but often obtuse-tipped teeth spread out in a fan-like arrangement; pinna-lobe or pinnule margins unlobed towards the apices, but lobed with rounded lobes towards the bases, often with marked rounded basal auricles. Indusia tall, thick pale-brown, curved around the sorus and inflected, shrinking slightly and becoming reddish-brown but not or only slightly lifting on ripening, mostly persistent, usually bearing glands at their margins. Triploid apomictic. Differs from *D. oreades* in its more coriaceous and darker green frond, much more parallel-sided pinnules with slightly more truncate apices and more acute teeth, and by its thicker indusia. It can also be confirmed and distinguished microscopically from that species by its larger spores with more abortive material present, similar to those of subsp. *borreri*.

**HABITAT:** Rocky mountain slopes and banks, on acidic rocks. From c. 200 m. (sometimes less) to c. 1000 m. altitude or more.

**RANGE IN THE AREA:** Scattered. The Pyrenees and Montseny and scattered throughout the Cordillera Cantabrica to Orense. Absent from Macaronesia.

**RANGE:** A subalpine, South Central European species. From South Central France and N.E. Spain to the Black Forest in Germany and Western parts of Britain (in Wales, Scotland and N.W. England), S. W. Ireland, throughout Switzerland, the subalpine regions and Northern Appennines of Northern Italy and Southern and Western Austria. Also Corsica and Sardinia. ?The Caucasus.

**NOTES:** The morphology of this subspecies strongly suggests the presence of genomes of *D. oreades* (combined with *D. wallichiana*) and the presence of equal numbers of bivalents and univalents at meiosis in the 16-celled sporangia is compatible with there being two genomes of *D. oreades* and one of *D. wallichiana*. Subsp. *stilluppensis* is often mistaken for *D. affinis*  $\times$  *D. oreades*, as for example the tentative report of ROBERTS (1967)



MAP 3.

of this hybrid from Britain (North Wales). In this, as in other cases, the original plants on investigation (three populations) had the typical morphology of subsp. *stilluppensis* and, when ripe, mostly good spores. Subsequently GIBBY (pers. comm. 1981) found the plants to be triploid as would be expected for this subspecies.

Due to confusion with subsp. *affinis*, and lack of collection, it seems probable that subsp. *stilluppensis* is somewhat under-recorded throughout the Cordillera Cantabrica.

MAP: 3.

VOUCHER SPECIMENS:

- QJ2. c. 200 m., bank c. 1 km. E. of El Pito, 5 km. S.E. of Cudillero, Aviles to Luearca, Oviedo, Spain. *C. R. Fraser-Jenkins* 10645 and 10648, 26/Sept/1981. BM!
- PH3. ½ km. N.E. of Fonsagrada, on Luearca road, E.N.E. of Lugo, Lugo, Spain. *C. R. Fraser-Jenkins* 10685 and 10686, 27/Sept/1981. BM!
- VN3. N. side of Portilla de La Sia, between Arredondo and Espinosa de Los Monteros, S.S.E. of Santander, Santander, Spain. *C. R. Fraser-Jenkins* 10591, 17/Sept/1981. BM!
- BH3. Hautes Pyrénées, abords du torrent qui descend du Lac Bleu dans la vallée de L'Esponne près de Bagnères-de-Bigorre, France. *J. Neyrault* 114, 10/Aug/1980. P! and 918. MPU!
- QH2. 3 ½ km. N.E. of Carbon del Sil, Paramo del Sil to Palacios del Sil, N.W. side of Sierra de Jistredo, N.N.E. of Ponferrada, Léon, Spain. *C. R. Fraser-Jenkins* 10749, 30/Sept/1981. BM!
- NG3. ½ km. N. of Vilanova, c. 2 km. N. of Celanova, S.S.E. of Orense, Orense, Spain. *C. R. Fraser-Jenkins* 10694, 29/Sept/1981. BM!
- DG2. Montseny, pr. Snt. Mansal, 1000 m., Spain. *D. F. Trémols*, June/1883. MA (212)!

2. *Dryopteris filix-mas* (L.) Schott, Gen. Fil. 1: 9 (1834).

BASIONYM: *Polypodium filix-mas* L., Sp. Plant. 2: 1090 (1753).

IMPORTANT SYNONYM: *Polypodium heleopteris* Borckh. (1798). *Polystichum filix-mas* (L.) Roth. (1799). *Tectaria filix-mas* (L.) Cav. (1801). *Nephrodium filix-mas* (L.) Rich. (1801). *Polypodium umbilicatum* Poir. (1804) (stated to have come from the Mas-



carenes in error for a European plant). *Aspidium filix-mas* var. *blackwellianum* Tenore (= «*Aspidium blackwellianum*» Ten. comb. inval.) (1832). *Nephrodium filix-mas* var. *barnolae* Sennen, Bol. Soc. Iber. de Cienc. Nat. (Bol. Soc. Arag. Cienc. Nat.) 1916: 217-272 (1916), nom. nud. *Polystichum rolandi* Sennen, Pl. Espagne Exsicc. (1917), nom. nud. *Polystichum barnolae* Senn. et Elias, Pl. Espagne Exsicc. (1918), nom. nud. *Nephrodium filix-mas* var. *rolandi* Sennen, Bull. Soc. Bot. France 73: 641-680 (1929), nom. nud. *Dryopteris* × *bohémica* Domin (1941), nom. inval. *Dryopteris patagonica* Diem (1960).

IN WILLKOMM & LANGE: *Polystichum filix-mas* and *Polystichum cristatum*.

TYPE [lectotype, Parris (1982)]: from Europe, in BM (herb. Hort. Cliff.)!

DESCRIPTION: Fronds not persistent in winter, becoming twice pinnate below, lanceolate, upright in exposed places, spreading elsewhere. Stipe medium length, stipe-base densely scaly, scales becoming more scattered above and on the rhachis, pale to pale-brown. Lamina eglandular, herbaceous, pale- to mid-green. Pinnae ± symmetrical about their axes, or slightly basiscopically developed below. Pinnules almost all adnate to the costa except the lowest basiscopic one on lower pinnae, which may become stipitate, slightly ovately rectangular-lanceolate, sloping towards their apices, obtusely or acutely pointed at their apices, though occasionally somewhat truncate, particularly when the plant is a small one growing in an exposed place; bearing acute teeth at the sides and particularly at the apices, teeth not spread out in a fan-like arrangement but pointing slightly inwards towards a point beyond the pinnule-apex; pinnules often ± shallowly lobed with pointed lobes at the side. Indusia ± thin, slightly curved over the top of the sorus, but not turned down at the sides so as to surround the sorus, white, eglandular, lifting and shrivelling markedly on ripening, mostly deciduous. Ripe (dark) spore-samples contain regular spores. Tetraploid sexual.

HABITAT: Banks and slopes, in woods, or among rocks, bushes or walls in mountain areas, on calcareous or acidic rock. Rarely at sea-level (in Southern Europe), but more usually from c. 500-2000 m. altitude, or more (e. g. the Sierra Nevada).

**RANGE IN THE AREA:** The most widespread fern in Iberia, occurring further inland than *D. affinis*, though not as common as that species, at least in N. and W. Iberia. Throughout the Pyrenees and North and West Spain, and South to the 40° line of latitude in Portugal. Throughout the Cordillera Central and connecting to the Eastern part of the Cordillera Cantabrica. Also down the East coastal regions of Spain nearly to the 40° line and in Teruel and Cuenca. Scattered populations occur in the mountains of Andalucia (N. Andalucia, Algeciras, Sierra Nevada, Sierra de Segura, Western Almeria). Probably introduced at Sintra, Portugal. Absent from Macaronesia (from where it has been reported in error for *D. affinis*).

**RANGE:** Throughout Europe and present in every country there, but absent from North-Eastern Russia and Spitzbergen in the North and the Balearic Islands and Crete in the South. Becoming scattered in Southern Europe. Extending Eastwards in Asia through Turkey, the Caucasus and N. Iran (rare) and through Soviet Central Asia and West Siberia to the Pamirs and the North-West Himalaya, Tien Shan (just reaching N.W. China), Dzhungaria, Altai and Irkutsk. Absent from the Far-East and most of the Himalaya, where it has been confused with other species (sometimes markedly different ones). Present in N.W. Africa and apparently also in Ethiopia (specimen labelled by CHRIST in herb. P as var. *abyssinicum!*). In North America from South Greenland to Canada and the North-Eastern states of the U. S. A. and in the West down the Rockies to California and probably Mexico (*Arsene* no. 2181, in MPU!, though this needs re-examination). In South America present in the Andes in Argentina.

**NOTES:** The morphology is exactly intermediate between that of *D. oreades* and the Caucasian species *D. caucasica* (A. Br.) Fraser-Jenkins & Corley (which also occurs in N. Turkey, the Crimea and Iran). The cytological studies of MANTON (1950), FRASER-JENKINS & CORLEY (1973) and FRASER-JENKINS (1976) show that *D. filix-mas* is almost certainly derived from these two species, but as a segmental allopolyploid rather than an allopolyploid as might be expected, the two ancestral species, though clearly distinct, having at least part of their genome in common.

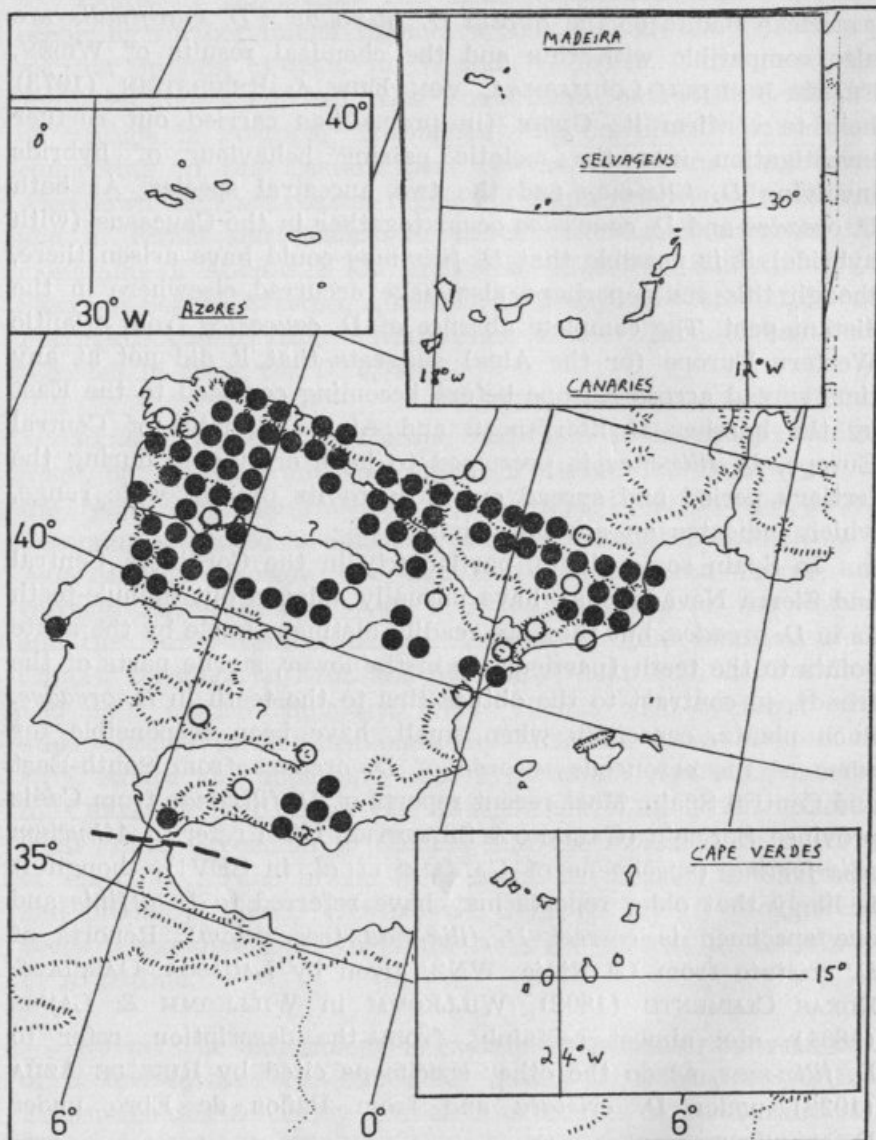
The cytological results of WAGNER (1971) on Eastern North American plants of the hybrid *D. filix-mas* × *D. marginalis* are also compatible with this and the chemical results of WIDÉN, FRASER-JENKINS, LOUNASMAA, VON EUW & REICHSTEIN (1973) help to confirm it; GIBBY (in prep.) has carried out further investigation into the meiotic pairing behaviour of hybrids involving *D. filix-mas* and the two ancestral species. As both *D. oreades* and *D. caucasica* occur together in the Caucasus (with hybrids) it is possible that *D. filix-mas* could have arisen there, though this could perhaps also have occurred elsewhere in the distant past. The complete absence of *D. caucasica* from Atlantic Western Europe (or the Alps) suggests that it did not at any time spread across Europe before becoming confined to the East by the harsher Mediterranean and Alpine climates of Central Europe. *D. filix-mas* is presumed to have originated during the tertiary period and spread outwards to its present wide range, which indicates an ancient origin.

In Spain some plants, particularly in the Cordillera Central and Sierra Nevada, may have unusually splayed out pinnule-teeth as in *D. oreades*, but they are readily distinguishable by the acute points to the teeth (particularly in the lower, sterile parts of the frond), in contrast to the obtuse tips to the teeth in *D. oreades*. Such plants, especially when small, have been responsible for some of the erroneous records of *D. oreades* from South-East and Central Spain. Most recent reports of *D. filix-mas* from Cadiz province, S. Spain (GALIANO & SILVESTRE, 1974) refer to *Athyrium filix-femina* (specimens of GALIANO *et al.* in SEV!), though it is likely that older reports may have referred to *D. affinis* and one specimen is correct *D. filix-mas* (see below). Reports of *D. cristata* from La Rioja, WN2, given by LAGASCA, GARCIA & ROXAS CLEMENTE (1802), WILLKOMM in WILLKOMM & LANGE (1861), etc. almost certainly, from the description, refer to *D. filix-mas*, as do the other specimens cited by RUIZ DE AZÚA (1928) under *D. cristata* and from Baños de Ebro under *D. spinulosa*.

MAP: 4.

VOUCHER SPECIMENS:

- PJ2. Gontan, S.W. of Mondoñedo, N. of Lugo, Lugo, Spain. C. R. Fraser-Jenkins 4904, 5/June/1976. BM!



MAP 4.

Correction: convert the open circle in Portugal, immediately North of the river Douro, into a full spot.

- PJ4. 2 km. W. of and below Las Rozadas, c. 1 km. above Vega do Ouria, between Boal and Vegadeo, Sierra de La Bobia, S.E. of Castropol, Oviedo, Spain. *C. R. Fraser-Jenkins* 10666-10667, 27/Sept/1981. BM!
- QJ2. Canero, E. of Luarca, N.W. of Oviedo, Oviedo, Spain. *C. R. Fraser-Jenkins* 4896, 5/June/1976. BM!
- TP4. Avilés. Spain. Chermезon (1919).
- UP2. c. 200 m., c. ½ km. below Riaseco village, S.W. of Posada on road to La Robellada and Onís, Ribadasella to Llanes, Oviedo to Santander, Oviedo, Spain. *C. R. Fraser-Jenkins* 10816, 4/Oct/1981. BM!
- UP4. c. 150 m., c. 1 km., N.W. of La Borbolla, c. 5 km. S. of Vidiago, S.E. of Llanes, Cordal de Cuera, Oviedo to Santander, Oviedo, Spain. *C. R. Fraser-Jenkins* 1071, 3/Oct/1981. BM!
- XP2. Jalas & Suominen (1972).
- PH1. c. 2 km. N. of Millares, N. of Fontão, Baleira to Meira, Sierra de Meira, N.E. of Lugo, Spain. *C. R. Fraser-Jenkins* 10688, 27/Sept/1981. BM!
- PH3. c. ½ km. N. of Millardos, 1 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* 10675, 27/Sept/1981. BM!
- QH1. Bosque ribereño en Pigüeces, Somiedo, Asturias, Spain. *J. A. Fernández-Prieto* 1541, 7/June/1975. FCO!
- TN3. Pajares, Spain. *A. Lawalrée* 5439, 9/July/1953. BR!
- UN1. Puerto del Pontón, Cangas de Onís to Riaño, León, Spain. *C. R. Fraser-Jenkins* 3760, 14/July/1972. BM!
- UN3. Puerto de Piedras Luengas, Spain. *A. Lawalrée* 5307, 5/July/1953. BR!
- VN3. Villareal, Alava, Spain. *Ruiz de Azúa*, 6/June/1925. MA (271)!
- WN1. Ochandiano, Vizcaya, Spain. *Ruiz de Azúa*, 4/Sept/1925. MA (195)!
- WN3. Aratz, 1400 m., Spain. *J. A. Alexandre & P. Uribe-Echebarria* 2570, 23/Aug/1980. Herb. AEPNA, Vitoria!
- XN1. Navarra, cuenca del Río Irati, bosques, Spain. *M. Losa*, July/1965. PAMP (01736)!
- XN3. Refugia Labéroutat, Lescun, 1550 m., France. *P. Montserrat & L. Villar* 2975, 3/July/1975. JACA!
- YN1. Lac d'Isabe, Gorges de Bitet, Vallée d'Ossau, 1100 m., France. *P. Montserrat* 5222, 3/Aug/1972. JACA!
- BH3. Bagnères de Bigorre, France. *G. Blanchet* 36, Aug/1922. MPU!
- CH1. Haute-Garonne, environs de Fos, France. *Joustau*, Sept/1915. MPU!
- CH3. Jalas & Suominen (1972).

- NH2. Fornás; Casal; Sta. Lucia and Rocha, all near Santiago de Compostela, Spain. Casaseca-Mena (1960).
- NH4. Palas de Rey, Carteira. *E. Seijas-Vasquez*, 20/May/1951. Seijas-Vasquez (1952). This specimen was at one time at SANT (given in the card index as no. 06186), but along with a number of other specimens, the author was unable to locate it there with the help of Prof. J. Izco in 1981.
- PH2. Carretera Chantada-Monforte, km. 133, Spain. *I. Barrera*, 22/July/1977. Herb. Fac. Cienc. Biol., Univ. Complutense, Madrid (4779)!
- PH4. Hayedo de Fonte Ferosa, Piedrafita del Cebrero, Lugo, Spain. *Losa-Quintana*, 21/June/1975. MAF (100555)!
- 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* 10747, 30/Sept/1981. BM!
- UN4. Peña Redonda, Cumbre, Spain. *M. Losa*, 27/July/1949. BCF (253)!
- VN4. Burgos, Sa. de Obarenes, Spain. *Elias, Sennen* no. 4557, 14/Oct/1922. PO! BM! K! BCF (262)! Herb. Gijón! and 3281. P! MPU! PO! MA (413)! Herb. Gijón!
- WN2. Sierra de Cantabria, Refugio Lagran, Alava, 9-1100 m., Spain. *P. Montserrat & L. Villar* 4379, 17/Aug/1973. JACA!
- WN4. San Dornato, Huarte Araquil, 1200 m., Spain. *P. Montserrat* 3738, 27/June/1972. JACA!
- XN4. Barranco del Aguerri, 1100 m., Spain. *L. Villar* 507, 18/June/1972, JACA!
- YN2. Inicio subida Lana Caballo, Ordesa, Huesca, 1380 m., Spain. *P. Montserrat* 4149, 18/Sept/1978. JACA!
- BH4. Salida, tunel sobre Hospital de Parzan, Bielsa, Huesca, 1450 m., Spain. *P. & G. Montserrat* 1834, 10/July/1978. JACA!
- CH2. Lerida, Puerto de La Bonaigua [E. of Viella], 2100 m., Spain. *B. Cabezudo, T. Luque & J. Ubera*, 12/July/1979. SEV (41958)!
- CH4. Vallferra, Terbeu, cases del rui, 900 m., Spain. *J. E. Farreny*, 17/Aug/1975. BC (620319)! Also: 2 km., Prut de Xuvall, Os de Cives, Andorra. *G. Duss*, 28/July/1976. JACA!
- DH2. Cerdagne, Llivia, 1350 m., Spain. *Sennen*, 26/Aug/1917. P!
- DH4. Gastepa, Forêt de Boucheville, 1050-1100 m., France. *P. & J. M. Montserrat & L. Villar* 1535, 3/July/1978. JACA!
- EH2. Près Font de Couloumates, La Massane, Pyrénées Orientales, France. *Oliver*, 24/June/1882. MPU!
- NG1. Marin, Pontevedra, Spain. *Gz. Albo*, Spring 1934. MA (260)!

- NG3. ½ km. N. of Vilanova, c. 2 km. N. of Celanova, S.S.E. of Orense, Orense, Spain. *C. R. Fraser-Jenkins* 10692, 29/Sept/1981. BM!
- PG1. Non longe a Puebla de Trives (Orense), 600 m. *Lainz*, 3/July/1971. Herb. Gijón!
- PG3. In nemoribus ad Millaroso (Orense) [S.E. of El Barco de Valdeorras], Spain. *Lainz*, 28/June/1956. Herb. Gijón!
- QG1. Molinaferrera [N. of Teleno], León, Spain. *M. F. Bernis*, July/1946. MA (259)!
- VM3. Sierra de la Demanda, Burgos, Spain. *M. Losa*, July/1926. MA (269)!
- WM1. Collado Sta. Inês, Urbion, Cebollera, Spain. *P. Montserrat* 361, 2/July/1958. JACA!
- WM3. Las Ruedas de Ocón [S.W. of Calahorra], Spain. *L. M. Medrano*, 13/June/1980. PAMP!
- CG1. Montes de Surroca [Pont de Suert], Spain. Herb. *Costa*, 8/Aug/1856. BC!
- CG3. *Jalas & Suominen* (1972).
- DG1. Ribas de Freser, 1000 m., Spain. *J. Fernández-Casas* 973, 8/June/1969. Herb. *Fernández-Casas*, Fac. Cienc., Univ. Auton., Madrid!
- DG3. Col de Caselles, de Sta. Pau a Olot, Spain. *A. de Bolòs*, 30/Aug/1939. BC (91765)!
- EG1. Cadagues, Spain. *A. C. Costa* 2390. BC (no. 609473)!
- NG4. E. side of Picos de Fonte Fria, N. of Pitões (Portugal), S. of Muíños (Spain), Trás-os-Montes e Alto Douro, Portugal. *C. R. Fraser-Jenkins* 10697 and 10706-10708, 29/Sept/1981. BM!
- PG2. Chaves, Ervededo, Portugal. *J. de Vasconcellos* 68313A, 30/Aug/1968. LISI!
- PG4. Bragança, Rebordãos, Serra de Rebordãos, sopé da serra, Portugal. *A. Rozeira & G. Costa*, 9/Sept/1967. PO (27022)!
- QG2. Miranda do Douro, S. Martinho de Angueira, na beira do rio Angueira, Portugal. *A. Rozeira & G. Costa*, 10/Sept/1967. PO (27023 & 27024)!
- UM4. *Jalas & Suominen* (1972).
- WM4. Above Santuario de Sierra de Moncayo, S. of Tarazona, Zaragoza, Spain. *C. R. Fraser-Jenkins* 3184, 29/July/1972. BM!
- CG4. Montserrat, prov. Barcelone, Spain. *O. Méribaud*, April/1909. P!
- DG2. Montseny, ad pedem montes Les Agudes, lat. N.E. 1600 m., Spain. *O. de Bolòs*, 15/Aug/1951. BC (129278)!
- DG4. Maresme, Montnegre, Roureda a l'Obaga de la Miranda, 720 m., Spain. *P. Montserrat*, 23/July/1948. BC (622156)!

- NF1. Matosinhos, Guifões, talude da via férrea, Portugal. *A. Serra & J. Araújo*, 10/July/1971. PO (27109)!
- PF1. Carrazeda de Ansiães, Amedo, Portugal. *A. Rozeira & J. Castro*, 10/June/1942. PO (125)! MA (186786)!
- PF3. Vila Flor, elevação a sul de Samões [Serra de Candoso], Portugal. *G. Barbosa & J. Pedrógão* 7481, 22/Oct/1944. LISI!
- QF1. Miranda do Douro, Sendim, estrada para a barragem, pr. do cruzamento com a E. N., Portugal. *A. Rozeira & G. Costa*, 4/July/1969. PO (27026)!
- VL3. Hayedo del Puerto de La Quesera, Segovia, 1650 m., Spain. *S. Rivas-Martinez et al.*, 12/July/1979. MAF!
- XL1. Jalas & Suominen (1972)
- CF1. Montes de Prades, Taragona. *F. Masclans & E. Batalla*. Montserrat-Recorder (1964).
- DF1. Jalas & Suominen (1972).
- NF4. Beira Alta, Serra de Montemuro, Portugal. *M. F. R. Pinto*, 15/April/1954. COI!
- PF2. Meda, Qta. do Vale da Manta, Portugal. *G. Barbosa & F. Garcia* 7186, 22/June/1944. LISI!
- PF4. La Fregeneda, Salamanca, Spain. *F. Amich*, 6/March/1976. SA (15584)!
- VL2. c. 1700 m., Arroyo de La Peña. N. side of upper Rio Manzanares valley, Pedriza de Manzanares, N.W. of Manzanares El Real, between Colmenar Viejo and the Puerto de Navacerrada, Sierra de Guadarrama, Madrid, Spain. *C. R. Fraser-Jenkins* 10753 and 10757, 1/Oct/1981. BM!
- VL4. Jalas & Suominen (1972).
- WL4. Guadalajara, Corduente, pr. «Ermita de Ntra. Sra. de la Hoz», 1040 m., *Fernández-Casas & Muñoz-Garmendia* 1977, 7/Aug/1977. MA!
- BF4. Ports de Tortosa, a la vall de la Montrela, pr. d'Horta, Spain. *P. Font i Quer*. Rothmaler (1937) (sub. *P. rigidum*).
- NE3. Beira Alta, Santa Comba Dão, 200 m., Portugal. *P. Silva* 7178, Aug/1941. LISE!
- PE1. Serra da Estrela, Penhas Douradas, Portugal. *C. Romariz*, 4/Aug/1949. LISU!
- PE3. Salamanca, Sierra de Gata, Mont. Jalama, 4000', Spain. *M. Gandoger*, 10/June/1904. LY!
- QE1. La Alberca, Margenes del Río Francia, Salamanca, Spain. *F. J. Fernández-Diez*, 10/Sept/1974. SA (6279)!
- TK3. Cáceres, La Garganta [Bejar to Hervas], Castañares. *M. J. Díez, J. Pastor & S. Silvestre*, 4/June/1979. SEV (40909)!