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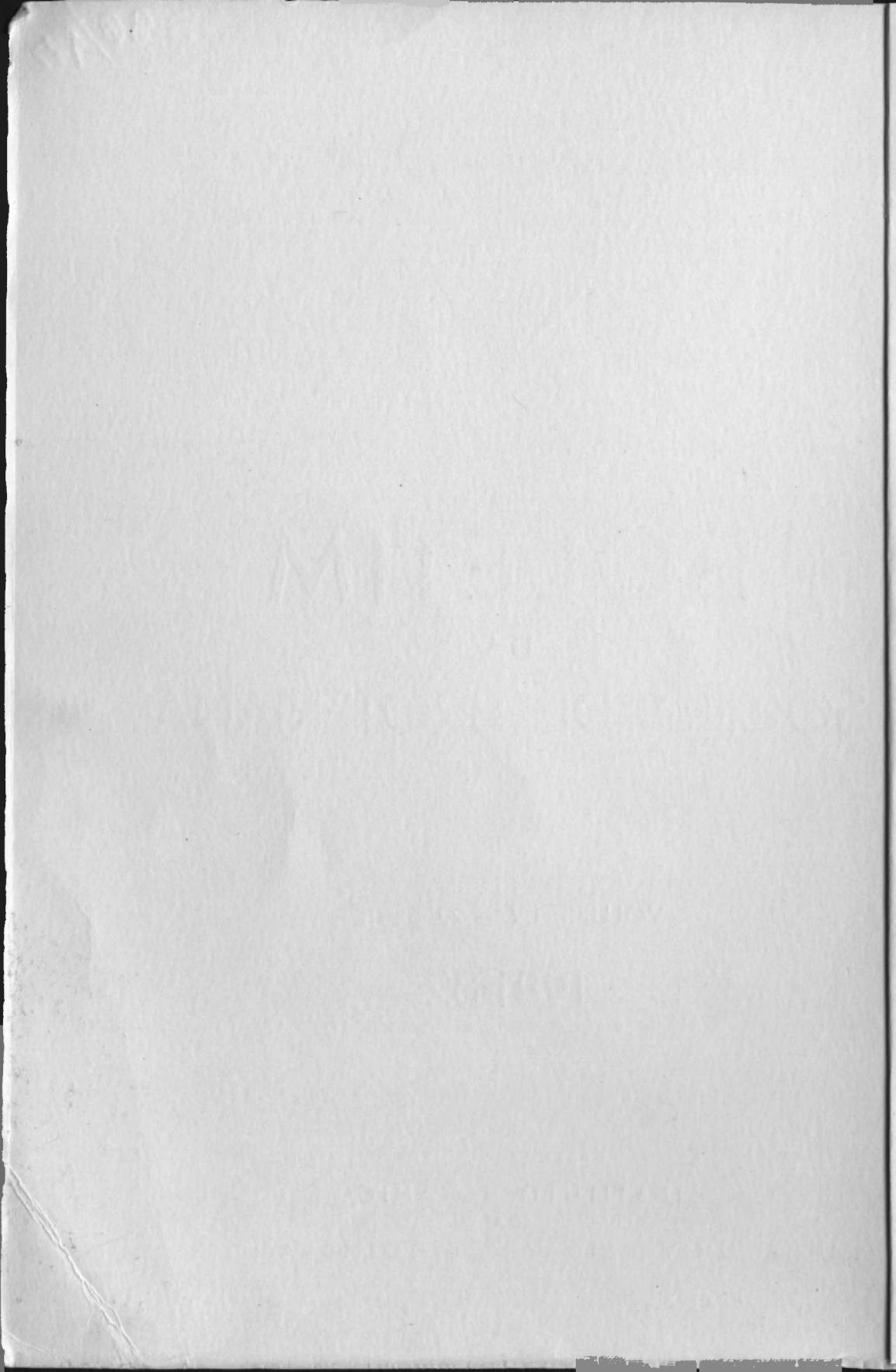
DA

SOCIEDADE BROTERIANA

VOLUME LV — 2.^a SÉRIE

1981-82

INSTITUTO BOTÂNICO
DA
UNIVERSIDADE DE COIMBRA



BOLETIM DA
SOCIEDADE BROTERIANA
VOL. LV (2.^a SÉRIE)
1981-1982



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1884-1885

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Vol. IV, 1914
1914-1915

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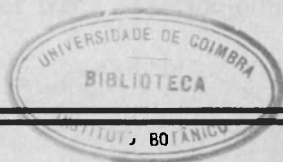
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*Subsidiado pela Junta Nacional de Investigação Científica e Tecnológica,
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e pela Fundação Gulbenkian*

COIMBRA
1981-1982



MUSEU BOTÂNICO DA UNIVERSIDADE DE COIMBRA
BOLETIM
SOCIEDADE BROTERIANA

DATAS DE PUBLICAÇÃO

Págs. 1-94	1981
Págs. 95-352	1982



Composição e impressão das Oficinas da
Tipografia Alcobacense, Lda. — Alcobaca

NOVA ESPÉCIE DE *MANOSTACHYA* (RUBIACEAE) DE ANGOLA

E. SAMPAIO MARTINS

Centro de Botânica da Junta de Investigações Científicas
do Ultramar

BREMEKAMP (1952) criou o género *Manostachya* com apenas duas espécies, *M. staelioides* e *M. juncoides*. E. J. MENDES, em 1960, herborizou por três vezes no Sul de Angola diversos materiais de *Rubiaceae* que nos intrigavam, e mais recentemente, em 1973, BAMPS e o autor herborizaram materiais idênticos no planalto central de Angola. A espécie que a seguir se descreve, baseada naquelas quatro colheitas, eleva para 3 o número de espécies de *Manostachya* conhecidas.

Manostachya ternifolia, sp. nov., a *M. juncoide* praecipue habitu erecto et foliis plerumque ternatis differt; a *M. staelioides* praecipue, quod validior est, foliis plerumque ternatis, brachyblastis in axillis foliorum et internodiis multo minoribus differt.

Herba perennis, 40-65 cm alta, 1- vel paucicaulis (7-caulis). Caules erecti, hornotini, plerumque tricostati, subteretes tamen in internodiis inferioribus, scabridi vel subglabri, 1-4 mm in diam. ad basin, simplices vel ramosi, plerumque cum brachyblastis in axillis foliorum easdem plus minus aequantibus vel brevioribus; internodia inferiora 2-3.5(4) cm longa, in parte florifera gradatim minora. Folia plerumque ternata, sed in brachyblastis et ramis saepe opposita, sessilia, subulata, 5-25 mm longa, 0.4-1.0 mm lata, ea in parte florifera breviora, rigida, in marginibus et costa scabrido-ciliata; vagina stipularis c. 1 mm alta, margine breviter et sparse ciliata vel haud ciliata. Dichasia contracta, bracteata, axillaria, 3-7-flora, breviter pedunculata; bracteae similes foliis, 2-5 mm longae; pedicelli c. 1 mm longi, in fructu maturo paulo longiores. Calyx tubo glabro; lobi anguste triangulares, 1.3-1.4 mm longi, in marginibus et costa scabrido-ciliati. Corolla alba, extus

[4]

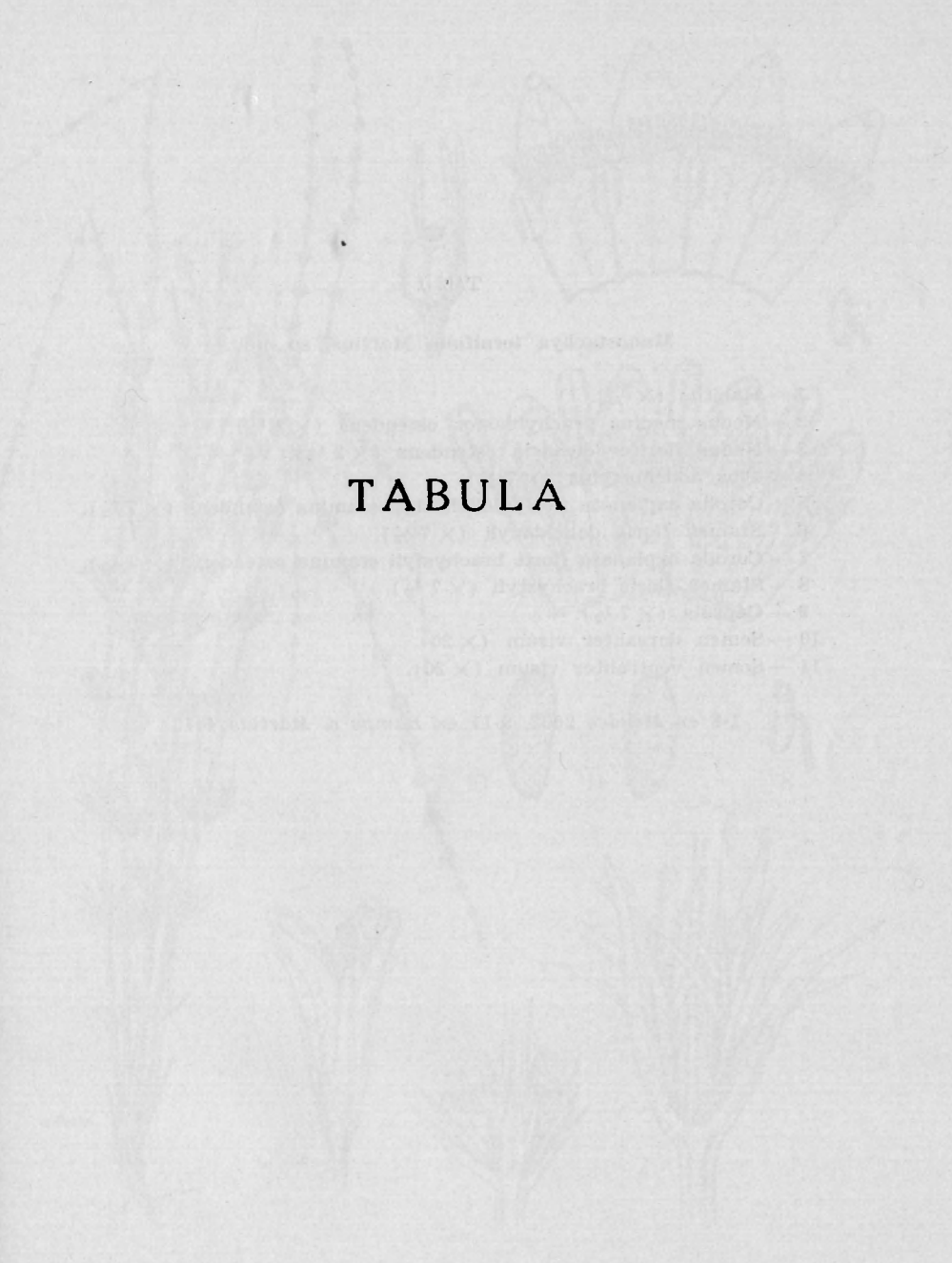


glabra; tubus cylindrico-infundibuliformis, 1.0-1.3 mm altus et 0.8 mm latus in parte media, in floribus dolichostylis ad faucem sparse barbatus, in floribus brachystylis intus in $\frac{1}{3}$ inferiore glaber et in $\frac{2}{3}$ superioribus pilis obtusis comparate longis et comparate densis obsitus; lobi ovati, 1.1-1.7 mm longi et 0.7-1.0 mm lati, intus papilloso, apice inflexo. Stamina in floribus dolichostylis c. 0.6 mm a basi tubi corollae inserta, in floribus brachystylis ad incisuras corollae inserta; filamenta glabra, in floribus dolichostylis 0.2 mm, in brachystylis 0.8 mm longa; antherae 0.6-0.7 mm longae, dorsifixae, obtusae utroque extremo. Granula pollinis ellipsoidea, 3-colporata, 32μ alta et 29μ diam. Stylus glaber, in floribus dolichostylis 1.8 mm longus, in brachystylis 0.5 mm; stigmata obovoidea, 0.5 mm longa, recurvata in floribus dolichostylis, erecta in brachystylis. Capsula ellipsoidea, c. 1.7 mm longa et 1.3 mm lata, per c. $\frac{1}{4}$ libera. Semina 1-2(3) per loculum, brunnea, dorsiventraliter applanata, ambitu oblonga; paries externus cellularum testae reticulatus.

Icon. nostr.: tab. I.

Specimina nota:

ANGOLA: Huambo, Vila Flor, Chavaca, alt. 1570 m, fr. 6.IV.1973, *Bamps & Martins* 4410 (LISC); Huila, Ganguelas, a 15 km pelo caminho de ferro de Ganguelas (Artur de Paiva) para Cutato, alt. 1450 m, fl. & fr. 21.I.1960, *Mendes* 2143 (BR; c; LISC; PRE; WAG); Cuando-Cubango, Menongue (Serpa Pinto), pr. confluência dos rios Cambumbé e Cuebe, alt. c. 1420 m, fl. & fr. 11.II.1960, *Mendes* 2446 (LD; LISC; LUA; M; SRGH), e a c. 17 km de Menongue (Serpa Pinto) para Caiundo, rio Candondo, alt. c. 1400 m, fl. & fr. 17.II.1960, *Mendes* 2662 (BM; COI; LISC, *holotypus*; LUAI; MO).



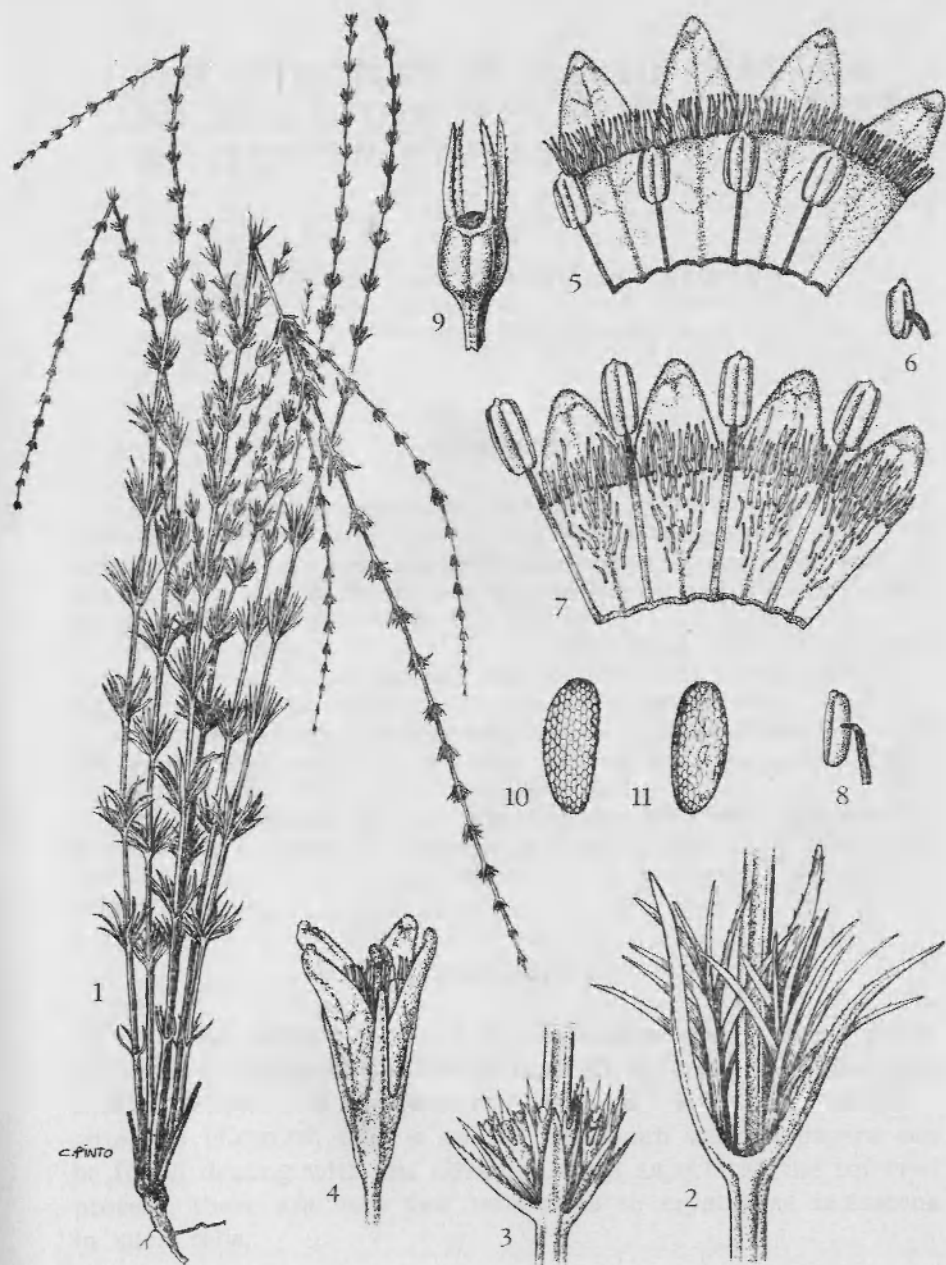
TABULA

TAB. I

Manostachya ternifolia Martins, sp. nov.

- 1 — Habitus ($\times \frac{1}{2}$).
- 3 — Nodus medius brachyblastos ostendens ($\times 2 \frac{1}{2}$).
- 3 — Nodus florifer dichasia ostendens ($\times 2 \frac{1}{2}$).
- 4 — Flos dolichostylus ($\times 7 \frac{1}{2}$).
- 5 — Corolla explanata floris dolichostyli stamina ostendens ($\times 7 \frac{1}{2}$).
- 6 — Stamen floris dolichostyli ($\times 7 \frac{1}{2}$).
- 7 — Corolla explanata floris brachystyli stamina ostendens ($\times 7 \frac{1}{2}$).
- 8 — Stamen floris brachystyli ($\times 7 \frac{1}{2}$).
- 9 — Capsula ($\times 7 \frac{1}{2}$).
- 10 — Semen dorsaliter visum ($\times 20$).
- 11 — Semen ventraliter visum ($\times 20$).

1-8 ex *Mendes* 2662, 9-11 ex *Bamps & Martins* 4410.



Manostachya ternifolia Martins, sp. nov.



Stenactis scabra (L.) DC.

FINE STRUCTURE OF PROTEIN CRYSTALS AND BACILLIFORM-TYPE VIRUS IN ANTHERS OF *LYCOPERSICUM ESCULENTUM* MILL.

by

ILDA ABREU, ARLETE SANTOS and R. SALEMA *

Experimental Cytology Centre and Institute of Botany,
University of Porto — Portugal

SUMMARY

During microsporogenesis, in some plants of *L. esculentum* Mill., a crystalline inclusion was observed in degenerating tapetal cells. The structure which is almost completely digested by protease, is made up from spherical particles under hexagonal arrangement with a centre-to-centre spacing of 22 nm, connected by thin filaments.

Virus particles, with a U-shaped nucleocapsid, were concomitantly found in both tapetal and parietal cells, located in the nucleus, perinuclear cisternae, endoplasmic reticulum cisternae and plasmodesmata.

The process of microsporogenesis seems to be unaffected by either the proteinaceous crystals or the virus infection and even at the level of cell organelles no abnormalities were detected.

Since the referred crystalline inclusions were not found in other tomato plants, either virus-free specimens or in cases of infection by other virus, they are very likely somehow related to the presence of the observed rod-shaped virus.

INTRODUCTION

TAPETAL cells, which line up the anther cavity where pollen grains are developed, went through a phase of active synthesis, followed by degenerescence and, later on, complete autolysis (ECHLIN, 1971 *a* and *b*). Although various papers can be found dealing with the ultrastructural aspects of the referred process, there are very few references to crystalline inclusions in such cells.

* Adress: Experimental Cytology Centre, R. Campo Alegre, 1021, 4100 Porto-Portugal.

BUSS and LERSTEN (1972) reported calcium oxalate crystals in tapetal cells of some Leguminosae and referred earlier papers mentioning crystals in Commelinaceae and Labiatae.

This paper reports observations made during the study of microsporogenesis in *Lycopersicum esculentum* Mill. referring crystalline structures which were observed in tapetal cells. Simultaneously, in these degenerating cells, and also on the parietal ones, aggregates of rod-shaped particles, morphologically similar to others considered as virus were found (ABREU and SANTOS, 1975) and are here also described.

MATERIAL AND METHODS

Anthers of *Lycopersicum esculentum* Mill. were processed for electron microscopic observation. Samples were fixed in 2.5 % glutaraldehyde in 0.1 M phosphate buffer at pH 7.2 (SABATINI, BENSCH and BARNETT, 1963) for 3 hrs., thoroughly washed in the same buffer overnight and post-fixed in 2 % osmium tetroxide in veronal buffer (PALADE, 1952) for 2 hrs. The fixed anthers, were treated «en bloc» with 1 % uranyl acetate in veronal buffer for 30 minutes. Dehydration with acetone and embedding in Epon 812 through propylene oxide (LUFT, 1961) followed. Thin sections were made with a LKB ultratome III fitted with diamond knife and stained with a saturated solution of uranyl acetate in 50 % ethanol with 1 % acetic acid (VALENTINE, 1966) and lead citrate (REYNOLDS, 1963). Sections were examined with a Siemens Elmiskop 1A at 80 Kv using 200 μ m condensor aperture and 50 μ m objective aperture. Agfa Gevaert 23 D 56 cut film was used for photographic recording.

Commercial protease (Sigma Type I) at 2 mg/ml in phosphate buffer pH 7.5 was used for enzymatic treatment of ultrathin sections. The enzymatic digestions were carried out at 37° C in sections previously treated with 3 % (v/w) hydrogen peroxide (Perhydrol, Merck) for 15 minutes at room temperature (MARI-NOZZI and GAUTIER, 1961). As a control, sections were incubated at 37° C in phosphate buffer pH 7.5.

RESULTS

Crystalline structures were observed in degenerating tapetal cells of some anthers of *L. esculentum*. These crystals (Pl. I, fig. 1a), with variable shape, are made up from spherical particles with diameter of 18-20 nm, in which an electron-translucent core of 4-5 nm and dark ring of 7-7.5 nm could be seen. The particles assume an hexagonal organization (each one is surrounded by other six) and display a centre-to-centre spacing of 22 nm. The particles in the aggregate are connected by thin fibrils, making an angle of 60° between them.

To assess the nature of the particles under consideration, enzymatic digestions with protease were carried out on thin-sections; 17 hrs incubation lead to the almost complete disappearance of the crystal inclusion (Pl. I, fig. 1b).

Bacilliform virus particles were encountered not only in the crystal-containing tapetal cells (Pl. I, fig. 2), but also on the parietal cells of the anther (Pl. II, fig. 1). Groups of viral particles were seen in the perinuclear cisternae or in the nucleus, inside a membrane bounded space (Pl. II, fig. 2) possibly resulting from the invagination of the inner membrane of the nuclear envelope during a process of enlargement of the perinuclear cisternae. When located in the cytoplasm, either in tapetal cells or in parietal ones, the virus particles were always seen inside rough endoplasmic reticulum cisternae (Pl. I, fig. 2; Pl. II, fig. 1a, b). In addition to that, they were also often found along plasmodesmata (Pl. II, fig. 1b).

Most of the virus particles had a length of 270-320 nm, although few of them measured 500-600 nm. They had a 9 nm thick envelope surrounding a U-shaped nucleocapsid with 50-60 nm in diameter (Pl. I, fig. 2; Pl. II, fig. 2). A grooved aspect of the nucleocapsid, with a periodicity of 4 nm, could be distinguished in some images (Pl. II, fig. 1a, double arrow). A 10 nm thick central axial core could be seen in transection of the virus particles (Pl. II, fig. 2).

Pollen grains, at all developmental stages, showed no virus particles and no crystal inclusions. Also, the presence of virus particles and crystal inclusions seem to have no effect on the microsporogenesis process, even on what concerns the ultrastructure of the pollen grain organelles.

DISCUSSION

The crystalline structures which were observed in tapetal cells of the anther of *L. esculentum* are different from other crystals reported in this type of cells, as far as both morphology and nature are concerned. Thus, BUSS and LERSTEN (1972), described calcium oxalate crystals, which attained maximum development during meiosis, diminishing somewhat later on, ascribing no functions nor presenting relationships between them and developmental stages. In our material the crystalline structures, due to their protease sensitivity, seem to be mostly, if not entirely, made up of protein. The inclusions, which had no perceptible effect on microsporogenesis, were found only in degenerating tapetal cells.

Morphologically similar crystalline inclusions were described in virus-infected leaves of *Vicia faba*, *Phaseolus vulgaris* L. var. Bountiful and *Vigna sinensis* Endl. var. *Blackeye* (WEINTRAUB and RAGETLI, 1968, 1970), *Avena sativa* L. var. Clintland and *Hordeum vulgare* L. var. Vantage (PALIWAL, 1970) and *Vigna unguiculata* L. (Walp) var. Early Romshorn (LANGENBERG and SCHRODER, 1975), which were interpreted as virus-aggregates, although WEINTRAUB and RAGETLI stated that only the identification of proteins and nucleic acids in the elements of the crystalline structure would be a reliable mean for relating them to virus.

Besides the crystalline inclusion, also particles morphologically similar to bacilliform virus were observed in the anthers of *L. esculentum*. In the literature there are reports of various cases of infection with this type of virus and, in plant cells, they are reported namely in leaves of 2 species of *Melilotus* (KITAJIMA *et al.*, 1969), wheat derived from seeds infected through leafhoppers (LEE, 1970), naturally diseased eggplants, and experimentally graft-inoculated seedlings of eggplants and tomato (MARTELLI and CASTELLANO, 1970), *Dendrobium* (LAWSON and ALI, 1975), *Laelia* (PETERS, 1977), phloem cells of *Sonchus* (STEINKAMP and HOEFERT, 1977) and callus tissue obtained from wheat leaf (FARMER and LEE, 1978). The fact that no crystalline structures were found in tapetal cells of tomato plants devoided of the referred rod-shaped virus and the fact that they were also absent in

tomato plants infected with a different virus (SANTOS and ABREU, 1975) seems to point to a direct or indirect relationship between them and the here described bacilliform virus.

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PLATES

KEY TO ABBREVIATIONS

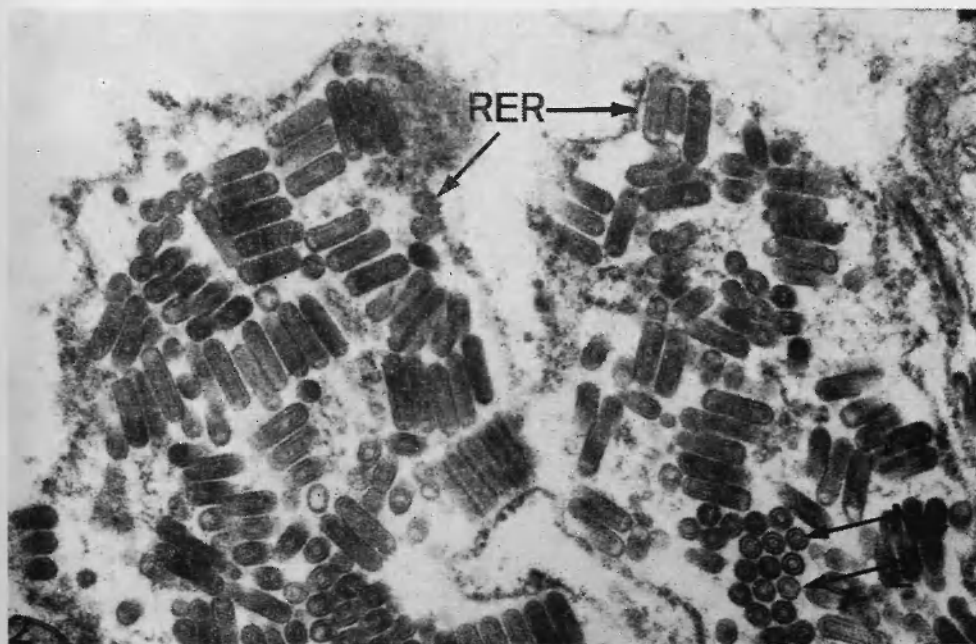
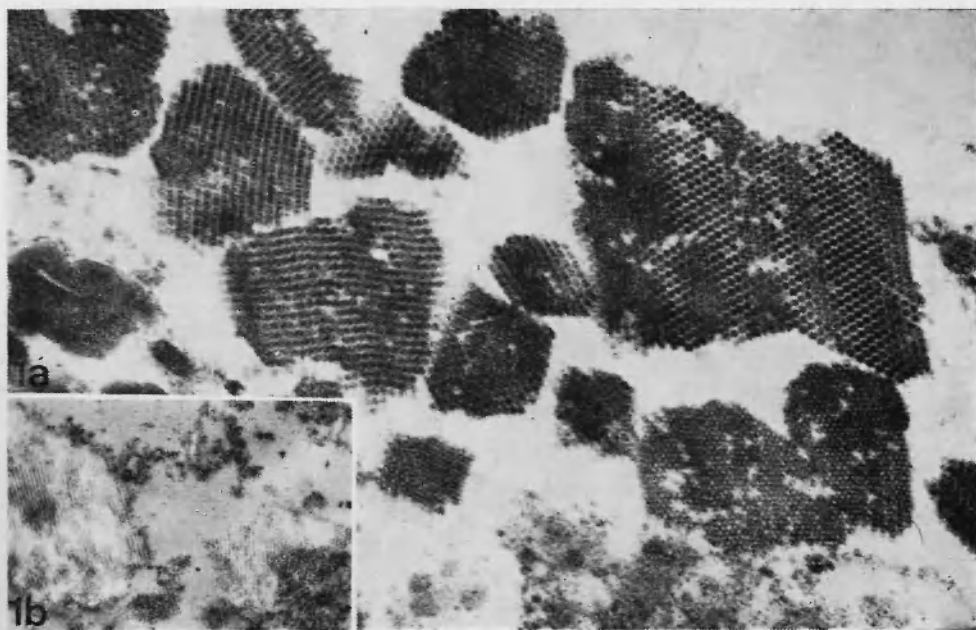
- AC — axial core
- CW — cell wall
- E — envelope
- N — nucleus
- NC — nucleocapsid
- NM — nuclear membrane
- RER — rough endoplasmic reticulum
- Va — vacuole

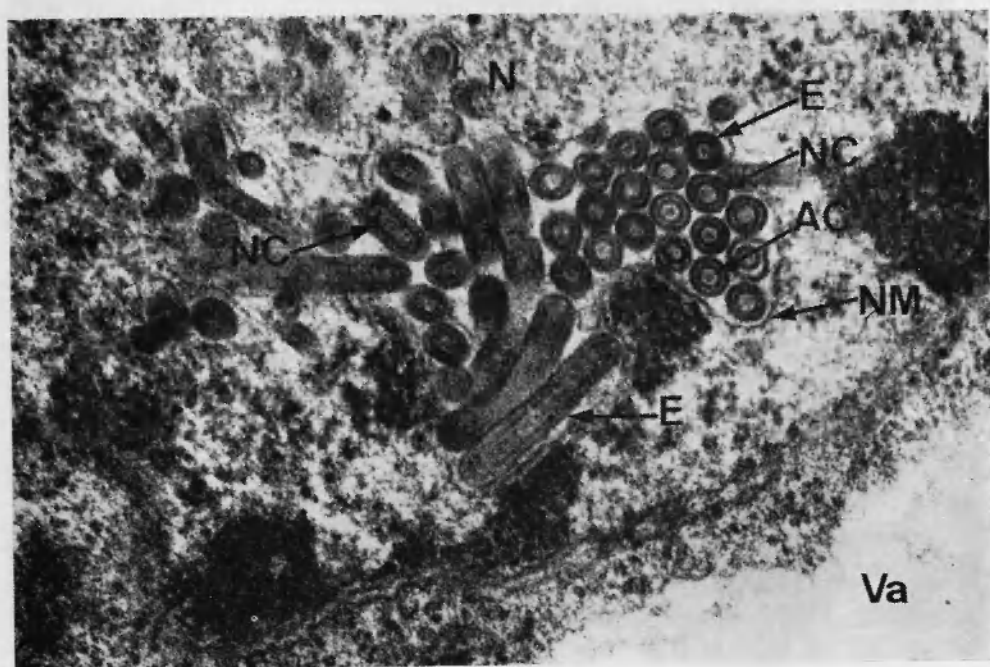
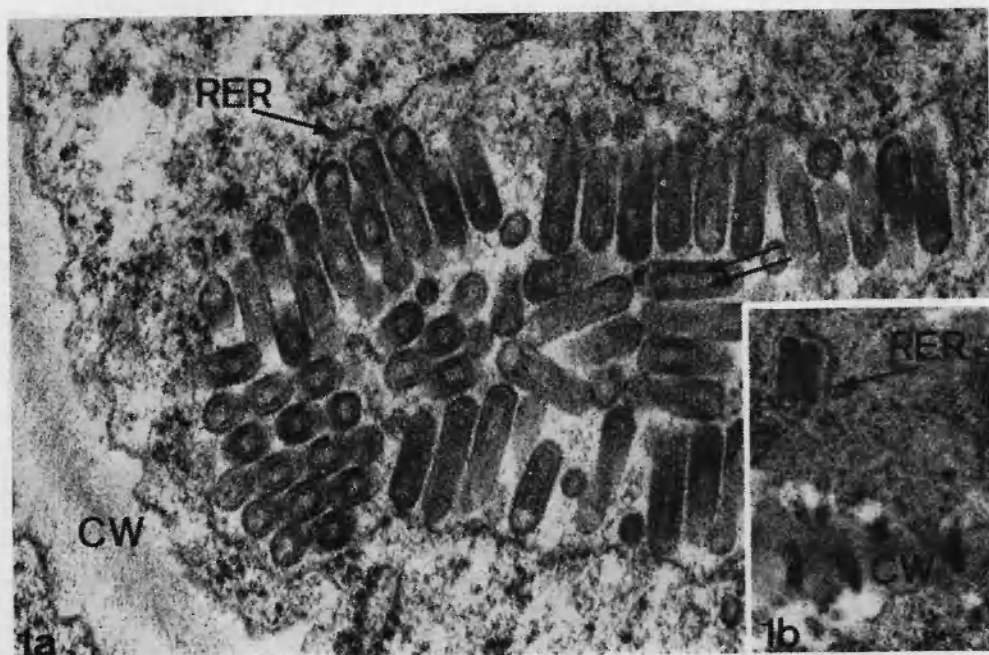
PLATE I

Fig. 1-a) — Degenerating tapetal cell showing crystalline structures. $\times 50\ 000$.

b) — Crystal almost completely digested away by protease incubation. $\times 25\ 000$.

Fig. 2. — Tapetal cell. Longitudinal and transections of bacilliform virus contained within dilated cisterna of the endoplasmic reticulum. $\times 33\ 000$.





VIRAL INFECTION DURING MICROSPOROGENESIS
OF *DYOSCOREA ESCULENTUM* MILL.
AND *CUCURBITA POLYCARPA* DUCH.

ADRIANO DE VITO, ROSA ANTONI, & SALEM

PLATE II

- Fig. 1.-a) — Cytoplasm of a parietal cell. Note striations in the nucleocapsid (double arrow). $\times 56\ 000$.
b) — Bacilliform particles along plasmodesmata. $\times 35\ 000$.
- Fig. 2. — Nucleus of a parietal cell. Bacilliform virus inside a membrane bounded space. $\times 63\ 000$.

II STATE

The State of New York, in and for the County of ...
do hereby certify that the following is a true and correct copy of the ...
as the same appears from the records of the ...
at the City of New York, this ... day of ... 19...

VIRAL INFECTION DURING MICROSPOROGENESIS OF *LYCOPERSICUM ESCULENTUM* MILL AND *CUCURBITA POLYMORPHA* DUCH.

by

ARLETE SANTOS, ILDA ABREU and R. SALEMA *

Experimental Cytology Centre and Institute of Botany,
University of Porto — Portugal

SUMMARY

Virus particles were observed during all stages of microsporogenesis of *L. esculentum* and *C. polymorpha*. Such virus particles are isodiametric, averaging 250 Å, arranged in a single row inside a tubular structure of 500 Å diameter.

Virus particles were observed in the cytoplasm, nucleus and plasmodesmata of parietal cells, and in plasmodesmata and in the cisternae of the typical elaborated endoplasmic reticulum system of tapetal cells.

In pollen mother cells the tubular virus-containing structures were observed in the cytoplasm. After meiosis, however, they appeared located in the callosic cell walls. Uninucleated microspores showed virus particles in the cytoplasm, intine and germinative pores. After mitosis (binucleated microspore) they appeared in the intine and in the generative cell wall, in this latter case both inside tubular structures or as aggregates of particles.

No further alterations were noticed, even in what concerns cell organelles and ontogenic processes, in comparison with non-infected, healthy anthers of the same species.

INTRODUCTION

DURING the study of microsporogenesis in *Lycopersicum esculentum* Mill. and *Cucurbita polymorpha* Duch. the occasional occurrence of isodiametric, virus-like particles was observed (SANTOS and ABREU, 1975).

Ultrastructural aspects of viral infection of anthers were reported in *Glycine max* cv. Harosoy (YANG and HAMILTON, 1974), *Hordeum vulgare* var. «Atlas» (CARROL, 1974; CARROL and MAYHEW, 1976) and *Olea europaea* L. (PACINI and CRESTI, 1977).

* Address: Rua do Campo Alegre, 1021, 4100 Porto-Portugal.

Both the occurrence of the referred particles and their possible influence on the development of pollen grains were considered worth to study, and are reported in the present paper.

MATERIALS AND METHODS

For electron microscopic observations, anthers of *Cucurbita polymorpha* Duch. and *Lycopersicum esculentum* Mill. were collected at different development stages. Samples were fixed in 2.5% glutaraldehyde in 0.1 M phosphate buffer at pH 7.2 (SABATINI, BENSCH and BARNETT, 1963) for 3 hrs., thoroughly washed in the same buffer overnight and post-fixed in 2% osmium tetroxide in veronal buffer (PALADE, 1952) for 2 hrs. The fixed anthers were treated «en bloc» with 1% uranyl acetate in veronal buffer for 30 minutes. Dehydration with acetone and embedding in Epon 812 through propylene oxide (LUFT, 1961) followed. Thin sections were made with a LKB ultratome III fitted with diamond knife and stained with a saturated solution of uranyl acetate in 50% ethanol with 1% acetic acid (VALENTINE, 1966) and lead citrate (REYNOLDS, 1963).

Sections mounted on uncoated grids were examined with a Siemens Elmiskop 1A at 80 Kv using 200 μ m condensor aperture and 50 μ m objective aperture. Agfa-Gevaert 23 D 56 cut film was used for photographic recording.

RESULTS

Virus particles were found in the cell layers which surround the anther locus (parietal and tapetal cells) and at all stages of pollen development.

The isodiametric particles, averaging 200-300 Å, form one single row inside tubular structures of 450 to 650 Å in diameter. These tubular structures, when located in the cytoplasm, always appear inside rough endoplasmic reticulum cisternae (Pl. I, fig. 1a, b).

In parietal cells, tubular structures containing virus particles were observed in the cytoplasm (Pl. I, fig. 1a, b), in the nucleus (Pl. I, fig. 2), and also in the cell wall, located in plasmodesmata (Pl. I, fig. 1c). In tapetum (Pl. II, fig. 1), tubular structures were found in cell walls and also in the elaborate system of rough

endoplasmic reticulum cisternae, during development of these cells (SANTOS, ABREU and SALEMA, 1979).

Virus particles were present during all stages of pollen grain development. They were found in the cytoplasm of microspore mother cells and, after meiosis, tubular structures were observed at various depths in the thick callosic wall which surrounds the tetrads formed and in the anther loculus (Pl. II, fig. 2). In the uninucleated microspore (Pl. III, fig. 1), when the exine is already structured, virus particles were seen in the cytoplasm, in the intine and in the germinative pores. Later on, at the binucleated pollen grain (Pl. III, fig. 2), virus particles appeared preferentially in the intine and in the generative cell wall; in this latter case, besides tubular structures containing virus particles, also aggregates of particles were observed.

DISCUSSION

Virus particles, morphologically similar to the ones reported here, were described in leaves of *Phaseolus vulgaris* L. cv. Cherokee Wax, after mechanical inoculation (KIM and FULTON, 1973). These virus particles moved to the cell wall, and appeared located in invaginations of the plasmalemma, admittedly responsible for the formation of paramural bodies and subsequent development of abnormal cell wall protusions. In our material no such modifications of the plasmalemma nor such cell wall outgrowths were observed.

Among the papers referred to under Introduction (YANG and HAMILTON, 1974; CARROL and MAYHEW, 1976; PACINI and CRESTI, 1977) only in the case of the anthers of *Olea europaea* virus particles similar to the ones described in the present paper were studied. However, the situation in that arboreous dicotyledon is a different one because immediately before mitotic division of the microspore the virus particles are confined to germinative pores, and they were no longer seen in the binucleated pollen grain or in the germinated one. This markedly contrasts with the here reported, since we found virus particles in the binucleated stage, mostly located at the generative cell wall, and also at the intine. As no further developmental stages were studied, nothing can be said about probable transmission to seeds.

The observations made showed virus particles in the cell layers which surround the loculus of the anther, and also on the various stages of pollen grain development. It seems reasonable to admit that virus particles observed in the callosic wall of tetrads are penetrating those cells, rather than leaving them, since they appear in higher numbers in the following stages and, on the other hand, in previous developmental stages, they were seen in the tapetum and, after degenerescence of such cells, freely located in the loculus, surrounding the tetrads; in addition to that they were seen either in the callosic wall and in plasmodesmata, suggesting an intracellular movement.

Comparison of microsporogenesis in the infected anthers with healthy ones showed no alteration, as far as cell organelles and ontogenetic process of pollen grain formation were concerned.

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PLATES

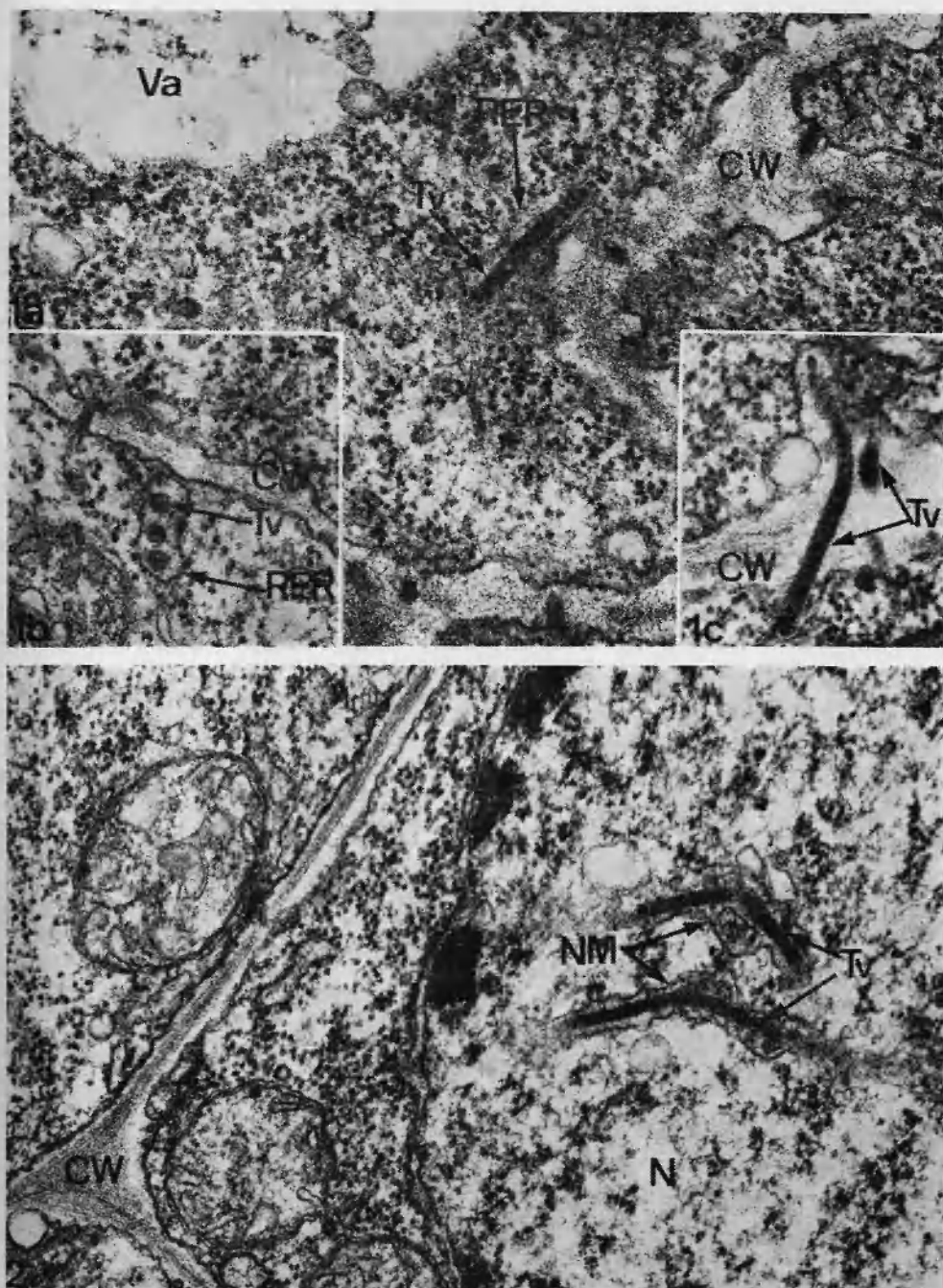
KEY TO ABBREVIATIONS

AL	—	Anther loculus
AV	—	Aggregates of virus
C	—	Callose
CW	—	Cell wall
E	—	Exine
gcw	—	Generative cell wall
GN	—	Generative nucleus
I	—	Intine
N	--	Nucleus
NM	—	Nuclear membrane
RER	—	Rough endoplasmic reticulum
Tv	—	Tubules with virus
Va	—	Vacuole

PLATES

PLATE I

- Fig. 1.-a) — Detail of a parietal cell showing virus particles, contained in tubular structures and located inside one endoplasmic reticulum cisterna. $\times 48\ 000$.
- b) — Transections of tubular structures containing virus and surrounded by endoplasmic reticulum membrane. $\times 47\ 000$.
- c) — Tubular structures with virus in plasmodesmata. $\times 48\ 600$.
- Fig. 2. — Parietal cell showing tubular structures containing virus and surrounded by invaginations of the inner nuclear membrane. $\times 35\ 000$.



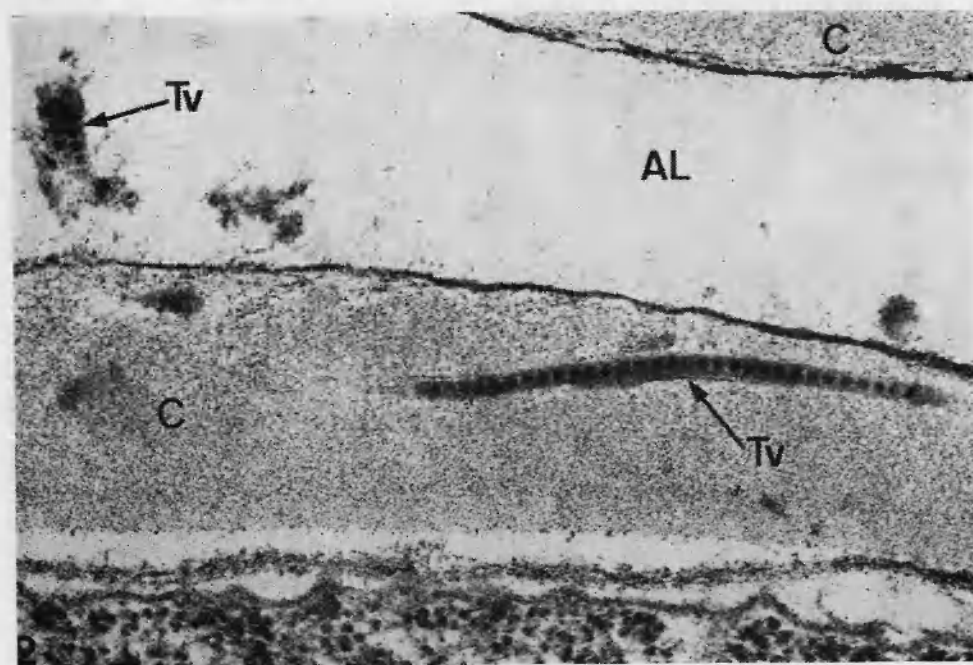
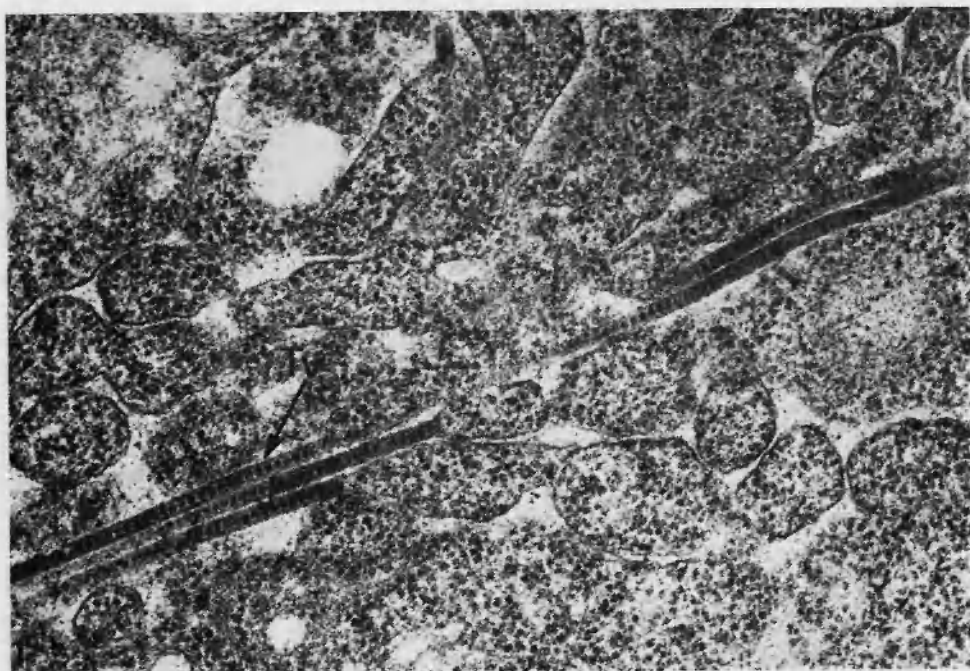


PLATE II

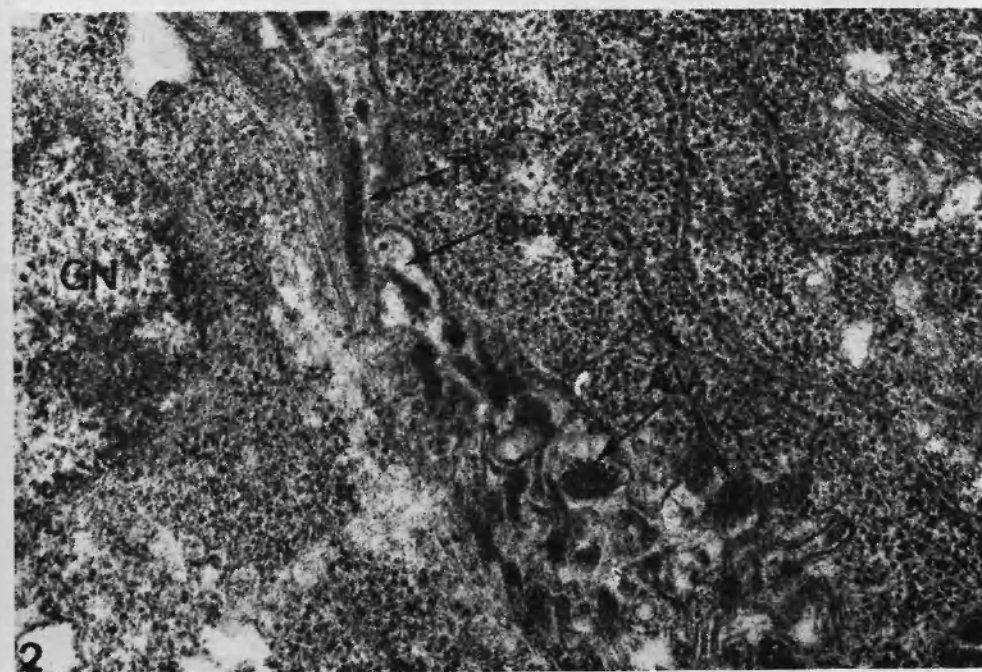
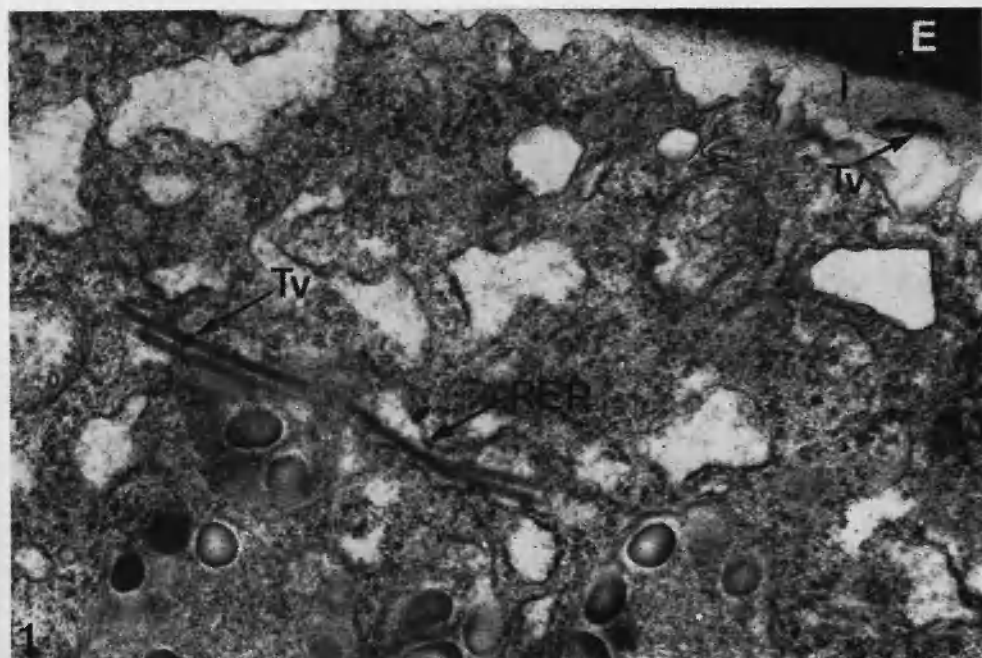
Fig. 1. — Viral tubules located in rough endoplasmic reticulum cisternae, which at this developmental stage form an elaborate system. $\times 43\ 000$.

Fig. 2. — Microspore in tetrad stage enclosed by callose wall in which viral tubules can be seen, as well as in the anther loculus. $\times 60\ 000$.

PLATE III

Fig. 1. — Microspore with well developed exine. Viral particles are present in the intine and in the cytoplasm. $\times 22\ 000$.

Fig. 2. — Binucleated pollen grain. Viral tubules and aggregates of virus located in the generative cell wall. $\times 38\ 700$.





CONTRIBUTION À LA CONNAISSANCE
DES LOTIERS DU GROUPE *CORNICULATUS*
DE LA PÉNINSULE IBÉRIQUE ET DES ÎLES BALÉARES

par

ABÍLIO FERNANDES *

Institut Botanique de l'Université de Coimbra

RÉSUMÉ

L'examen des spécimens existant à COI, ELVE, LISE, LISU, MA, MAF et PO a montré que les Lotiers du groupe *corniculatus* se trouvent représentés à la Péninsule Ibérique et aux îles Baléares par les taxa suivants: *Lotus tenuis* Waldst. & Kit. ex Willd., avec les vars. *tenuis* et *macrodon* Borsos; *L. preslii* Ten.; *L. alpinus* (Ser.) Schleicher ex Ramond; *L. corniculatus* L., avec les vars. *corniculatus*, *crassifolius* (Pers.) Ser., *ciliatus* Koch, *hirsutus* Koch et *sennenii* A. Fernandes; *L. pedunculatus* Cav. (syn. *L. uliginosus* Schkuhr), avec les vars. *pedunculatus* et *villosus* (Ser.) Lawalrée; *L. boissieri* A. Fernandes; *L. glareosus* Boiss. & Reuter, avec les vars. *glareosus* et *villosus* Boiss. & Reuter; et *L. delortii* Timb.-Lagr. ex F. W. Schultz, avec les vars. *delortii* et *rivasii* A. Fernandes.

Les noms considérés corrects, la bibliographie respective, la synonymie concernant particulièrement l'aire étudiée, une description et l'énumération des spécimens observés sont donnés pour chacun des taxa. Des clefs pour la détermination des espèces et de leurs variétés, ainsi que des cartes montrant la distribution géographique dans la région étudiée sont aussi ajoutées.

En tenant compte des données caryologiques connues, soit pour des plantes croissant dans la Péninsule Ibérique, soit dans d'autres régions, et en prenant en considération aussi les données de la morphologie externe, on fait des remarques sur les rapports phylogénétiques et l'évolution probable chez les taxa énumérés.

RESUMO

O estudo de espécimes existentes em COI, ELVE, LISE, LISU, MA, MAF e PO mostrou que os *Lotus* do grupo *corniculatus* se encontram representados na Península Ibérica e nas ilhas Baleares pelos seguintes taxa: *Lotus*

* Bolseiro do Instituto Nacional de Investigação Científica (I. N. I. C.).
Centro de Fito-sistemática e Fito-ecologia (Ec C2) da Universidade de Coimbra.

tenuis Waldst. & Kit. ex Willd., com as vars. *tenuis* e *macrodon* Borsos; *L. preslii* Ten.; *L. alpinus* (Ser.) Schleicher ex Ramond; *L. corniculatus* L., com as vars. *corniculatus*, *crassifolius* (Pers.) Ser., *ciliatus* Koch, *hirsutus* Koch et *sennenii* A. Fernandes; *L. pedunculatus* Cav. (sinón. *L. uliginosus* Schkuhr), com as vars. *pedunculatus* e *villosus* (Ser.) Lawalrée; *L. boissieri* A. Fernandes; *L. glareosus* Boiss. & Reuter, com as vars. *glareosus* e *villosus* Boiss. & Reuter; e *L. delortii* Timb.-Lagr. ex F. W. Schultz, com as vars. *delortii* e *rivasii* A. Fernandes.

Aos nomes considerados correctos de cada um dos taxa seguem-se a bibliografia, a sinonímia respeitante particularmente à área considerada, uma descrição e a enumeração dos espécimes observados. Juntam-se também chaves para a determinação dos taxa, bem como mapas mostrando a sua distribuição na Península e nas ilhas Baleares.

Utilizando os dados cariológicos obtidos a partir de plantas provenientes da Península Ibérica e de outras regiões e tendo em consideração os caracteres da morfologia externa, fazem-se algumas considerações sobre as relações filogenéticas e a evolução nos taxa enumerados.

INTRODUCTION

LE *Lotus corniculatus* a été établi par LINNÉ (Sp. Pl. 2: 775, 1753) et dans cette espèce il a distinguée deux variétés: β ., non nommée, et γ ., désignée sous le nom *tenuifolia*. En ce qui concerne l'habitat, il indique l'Europe pour l'ensemble.

BROTERO (Fl. Lusit. 2: 121, 1804) mentionne pour le Portugal *L. corniculatus* L. var. *arvensis* et var. *sylvaticus*, en donnant une description soignée de la dernière, laquelle correspond au *L. pedunculatus* Cav., comme il a été généralement reconnu.

BOISSIER (Voy. Bot. Esp. 2: 175, 1840) reconnaît dans l'espèce une autre variété, croissant «in lapidosis regionis nivalis summae Sierra Nevada», qui, d'accord avec son habitat, il nomme *L. corniculatus* var. *glacialis*. Plus tard, BOISSIER & REUTER (Pugilus: 36, 1852) décrivent le *L. glareosus*, espèce dans laquelle ils distinguent les vars. *glabrescens* et *villosus*, en même temps qu'ils transfèrent le var. *glacialis* Boiss. du *L. corniculatus* dans l'espèce qu'ils venaient de créer. La combinaison devient donc *L. glareosus* Boiss. & Reuter var. *glacialis* (Boiss.) Boiss. & Reuter. Ces auteurs ajoutent à la description de leur espèce et des variétés les différences au moyen desquelles on peut distinguer le *L. glareosus* du *L. corniculatus*.

WILLKOMM (in Willk. & Lange, Prodr. Fl. Hisp. 3: 342-345, 1877) cite pour l'Espagne, dans ce groupe, le *L. glareosus* Boiss.

& Reuter, avec les variétés indiquées par BOISSIER & REUTER, le *L. corniculatus*, le *L. tenuifolius* (L.) Reinchenb. (= *L. tenuis* Waldst. & Kit. ex Willd.) et le *L. uliginosus* Schkuhr.

Chez le *L. corniculatus* L., WILLKOMM considère les taxa infraspécifiques suivants¹:

- | | |
|--|---|
| a. vulgaris | d. pilosus |
| α . genuinus | α . ciliatus (L. ciliatus Ten.) |
| β . pedunculatus (L. pedunculatus Cav.?) | β . villosus (L. corniculatus γ . hirsutus Koch, L. villosus Thuill., L. stenodon Boiss. & Heldr., L. corniculatus γ . stenodon Boiss.) |
| b. gracilis (L. delortii Timb.-Lagr.) | γ . alpinus Boiss. |
| c. crassifolius Pers. | |

En ce qui concerne le var. *pedunculatus*, l'auteur ajoute qu'il est très distinct et qu'il appartient probablement au *L. uliginosus* Schkuhr.

HENRIQUES (Rel. Exped. Sci. Serra Estrella, Bot.: 101, 1883) rapporte l'existence à la Serra da Estrela, croissant sur les terrains pierreux à Lagoa Comprida et à S. Romão, du *L. glareosus* var. *villosus* Boiss. & Reuter, taxon pour lequel il indique, outre la Serra da Estrela, la distribution géographique suivante: Espagne, dans la région montagneuse et alpine de la Sierra Nevada. Dans cet ouvrage, il mentionne aussi pour le Portugal (Serra da Estrela et d'autres régions) les taxa du *L. corniculatus* a. *vulgaris* (Manteigas, Covilhã et S. Romão), d. *pilosus* β *villosus* (Bragança, Arrábida, Azeitão) et γ *alpinus* (Covão do Boi et Penha do Gato), ainsi que le *L. uliginosus* Schkuhr (Senhora do Desterro, Manteigas, Valezim, Sintra et Caparide).

En dehors du *L. glareosus* var. *glacialis* et du *L. uliginosus*, MARYZ (in Bol. Soc. Brot. 2: 83, 1884) cite pour le Portugal le *L. corniculatus* L., espèce dans laquelle il distingue les mêmes taxa infraspécifiques mentionnés par WILLKOMM et réfère les spécimens existant dans l'herbier de Coimbra.

COLMEIRO (Enum. Pl. Penins. Hisp.-Lusit. 2: 188, 1886) énumère les spécimens de la Péninsule Ibérique et des îles Baléares dont il avait connaissance, soit par l'observation des échantillons, soit par les citations d'autres auteurs. Ce procédé

¹ La synonymie citée est celle référée par WILLKOMM (op. cit.: 343-344).

l'a amené à inclure dans les divers taxa du matériel assez hétérogène, de telle façon qu'il est impossible de prendre en considération cet ouvrage pour les citations dans beaucoup de cas.

Pour la Galice, MERINO (Fl. Galicia 1: 347-350, 1905) indique le *L. uliginosus* Schkuhr, le *L. pilosus* Jord. (= *L. delortii* Timb.-Lagr. ex F. W. Schultz), le *L. corniculatus* L., avec les taxa infraspécifiques correspondant à peu près à ceux énumérés par WILLKOMM (loc. cit.) mais réduits à la catégorie de formes et, d'une façon douteuse, le *L. tenuifolius* Reichenb. (*L. tenuis* Waldst. & Kit. ex Willd.).

LÁZARD é IBIZA (Comp. Fl. Esp. 2: 259, 1907) cite les *L. glareosus* Boiss. & Reuter, *L. tenuifolius* Reichenb., *L. pilosus* Jord. et *L. uliginosus* Schkuhr.

HENRIQUES (Esb. Fl. Bac. Mondego: 204, 1913) suit les points de vue de WILLKOMM (loc. cit.) et de MARIZ (loc. cit.).

SAMPAIO (Man. Fl. Portug.: 244, 1911) ne cite que le *L. corniculatus* L. avec les vars. *pedunculatus* (Cav.), *alpinus* (Schleicher) et la raça (= subsp.) *longipes* Samp. Plus tard (Fl. Portug.: 295, 1947), il exclue de l'espèce le var. *pedunculatus* (Cav.), qui est alors considéré comme une espèce indépendante, dans laquelle il range le *L. uliginosus* Schkuhr comme synonyme.

COUTINHO (Fl. Port.: 349, 1913; ed. 2: 417, 1939) ne réfère aussi que le *L. corniculatus* L., espèce dans laquelle il distingue le var. *arvensis* Ser. — avec les formes *typicus*, *ciliatus* (Koch) et *hirsutus* (Koch) —, le var. *alpinus* (Schleicher) Ser. et le var. *decumbens* (Poiret) Coutinho. Pour cet auteur, le *L. glareosus*, indiqué par HENRIQUES (op. cit.: 101, 1833) et MARIZ (loc. cit.), ne serait que le *L. corniculatus* var. *alpinus* (Schleicher) Ser.

PAU [in Mem. Mus. Cienc. Nat. Barcelona, 1 (1): 37, 1922] range le *L. corniculatus* var. *glacialis* Boiss. dans la catégorie d'espèce [*L. glacialis* (Boiss.) Pau], en mentionnant qu'il l'a récolté à la Sierra Nevada. En même temps, il réduit l'espèce *L. glareosus* Boiss. & Reuter à la catégorie de variété — *L. glacialis* (Boiss.) Pau var. *glareosus* (Boiss. & Reuter) Pau — en lui attribuant comme synonyme *L. glareosus* var. *glabrescens* Boiss. & Reuter.

CABALLERO (Fl. Anal. Esp.: 260, 1940) ne réfère que le *L. uliginosus* Schkuhr et le *L. corniculatus* L.

P. W. BALL & A. CHRTKOVÁ-ZERTOVIÁ (in Fl. Eur. 2: 174, 1968) reconnaissent le groupe du *L. corniculatus* L. dans lequel

ils rangent les espèces suivantes: *L. tenuis* Waldst. & Kit. ex Willd., *L. krylovii* Schischkin & Serg., *L. borbasii* Ujhelyi, *L. delortii* Timb.-Lagr. ex F. W. Schultz, *L. stenodon* (Boiss. & Heldr.) Heldr., *L. glareosus* Boiss. & Reut., *L. corniculatus* L., *L. alpinus* (DC.) Schleicher ex Ramond, *L. uliginosus* Schkuhr, *L. pedunculatus* Cav., *L. granadensis* Zertová, *L. prestlii* Ten. et *L. palustris* Willd. D'après les mêmes auteurs (loc. cit.), les *L. krylovii*, *L. borbasii*, *L. stenodon* et *L. palustris* n'existent pas dans la Péninsule Ibérique.

Finalement, selon FRANCO (Nova Fl. Port.: 378, 1971), les espèces de ce groupe représentées au Portugal sont: *L. tenuis* Waldst. & Kit. ex Willd., *L. corniculatus* L., *L. uliginosus* Schkuhr et *L. pedunculatus* Cav.

En nous semblant que quelques problèmes concernant la taxonomie et la distribution géographique dans la Péninsule Ibérique et dans les îles Baléares de certains éléments de ce groupe restent encore à être éclaircis, nous avons entrepris la revision des taxa existant dans cette région et nous présentons ici les résultats des études menées à bout.

MATÉRIAUX

Les matériaux que nous avons employés dans nos recherches sont les suivants:

- 1) Les types et d'autres échantillons du *L. glareosus* Boiss. & Reuter (incl. les vars. *glabrescens*, *villosus* et *glacialis*) existant à l'herbier du Conservatoire Botanique de Genève (G);
- 2) Le type du *L. alpinus* (Ser.) Schleicher ex Ramond appartenant aussi à l'herbier ci-dessus mentionné;
- 3) Les spécimens existant à COI (Herbiers Général, Portugais et de Willkomm), LISE, LISU, MA, MAF et PO;
- 4) Des échantillons d'herbier de plantes récoltées à «Granada: Sierra Nevada, Hoya de la Mora, 2400 m, in pratis humidis, solo silicio», 25-VIII-1978, par M. le Dr. JAVIER FERNÁNDEZ CASAS.

CLEF POUR LA DÉTERMINATION DES ESPÈCES

Les espèces du groupe *corniculatus* qui, à notre avis, existent dans la Péninsule Ibérique et dans les îles Baléares pourront être identifiées au moyen des clefs suivantes:

Calice campanulé, à dents égales ou presque égales et à base triangulaire:
Folioles des feuilles supérieures linéaires ou linéaires-lancéolées, (3)4 fois plus longues que larges 1. **L. tenuis**

Folioles lancéolées à obovées ou subrhombiques, généralement à longueur inférieure à 3 fois la largeur:

Dents du calice généralement une fois et demi plus longues que le tube 2. **L. preslii**

Dents du calice n'atteignant pas une fois et demi la longueur du tube:

Racine pivotante; tiges pleines, quelquefois avec une fissure étroite à la base (voir cependant le var. *sennenii*); folioles à nervures latérales indistinctes ou peu saillantes sur la page inférieure; ombelles (1)2-7-flores; dents du calice convergentes avant l'anthèse:

Plantes généralement naines, à forte souche et à tiges florifères 10(15) cm de long; ombelles 1-3(5)-flores; fleurs jusqu'à 18 cm de long; folioles 2-6 × 1,5-4 mm 3. **L. alpinus**

Plantes à tiges florifères 5-35 cm de long; ombelles (1)2-7-flores; fleurs plus petites; folioles 4-18 × 1-10 mm 4. **L. corniculatus**

Rhizome rampant, stolonifère; tiges fistuleuses au-dessus de la base; folioles à nervures secondaires saillantes sur la page inférieure; ombelles 5-12(15)-flores; dents du calice divergentes avant l'anthèse 5. **L. pedunculatus**

Calice zygomorphe, à dents supérieures et latérales courbées, généralement plus longues que le tube:

Plantes naines, à tiges courtes couchées sur le sol; folioles 1,5-7 × 0,5-3,5 mm, suborbiculaires ou lancéolées et à indument de poils ± appliqués et argentés; pédoncule jusqu'à 12 mm de long; ombelles 1-2-flores 6. **L. boissieri**

Plantes à tiges florifères couchées ou ascendantes, jusqu'à 40 cm de long; folioles 4-15 × 2-7 mm, glabres, glabrescentes ou à poils denses ± étalés; pédoncule plus long; ombelles (1)2-7-flores:

Fleurs 10-13(15) mm de long, rougeâtres, l'étendard ne verdissant pas en général par dessiccation; ailes subtronquées au sommet; carène dépassant les ailes; folioles 4-15 × 2-7 mm, généralement obovées, quelquefois lancéolées ou ovées, apiculées, dépourvues de marge blanchâtre; légume 15-25 × 2-2,5 mm 7. **L. glareosus**

Fleurs longues de 12-15(18) mm, jaunes, l'étendard verdissant par dessiccation; étendard dépassant nettement les autres pétales; ailes obovées-oblongues; carène ne dépassant pas les ailes; folioles 4-9 × 1,5-3 mm, généralement obovées-oblongues, aiguës ou subaiguës, à marge souvent blanchâtre; légume 20-35 × 2,5-3 mm
 8. *L. delortii*

ENUMERATION DES TAXA ET DISTRIBUTION GÉOGRAPHIQUE

1. *Lotus tenuis* Waldst. & Kit. ex Willd., Enum. Pl. Hort. Berol.: 797 (1809). — Sowerby & Sm., Engl. Bot., Suppl. 1: t. 2615 (1831). — Nyman, Consp. Fl. Eur.: 183 (1878) pro parte excl. subsp. *decumbens* Poiret. — Cadevall & Sallent, Fl. Catalunya 2: 138 (1916). — Ross-Craig., Draw. Brit. Pl. 7: t. 44 (1954). — Ujhelyi in Annal. Hist.-Nat. Mus. Nation. Hung. 52: 185 (1960). — Lawalrée in Robyns, Fl. Génér. Belg. 4 (2): 139 (1963). — Borsos in Acta Bot. Acad. Hung. 12 (3-4): 264 (1966). — P. W. Ball & Chrtková-Zertová in Fl. Eur. 2: 174 (1968). — Franco, Nova Fl. Port. 1: 378 (1971). — Chrtková-Zertová in Preslia 44 (2): 131-139 (1972); in Fragm. Fl. Geobot. 20 (1): 21, fig. 8 (1974).

Lotus corniculatus var. *tenuifolius* L., Sp. Pl.: 776 (1753). — Ser. in DC., Prodr. 2: 214 (1825). — Brand in Bot. Jahrb. 25: 212 (1898).

Lotus tenuifolius (L.) Reichenb., Fl. Germ. Excurs.: 506 (1832). — Willk. in Willk. & Lange, Prodr. Fl. Hisp. 3: 344 (1877); Suppl. Fl. Hisp.: 243 (1892). — Merino, Fl. Galicia 1: 350 (1905). — Láz.-Ibiza, Comp. Fl. Esp. 2: 259 (1907). Non Burm. fil.

Lotus corniculatus subsp. *tenuifolius* (L.) Hartman in Svensk Norsk. Excurs.-Fl.: 103 (1846). — Montserrat in Collect. Bot. 5 (1): 69 (1956). — Chrtková-Zertová in Preslia 33: 17-35 (1961).

Lotus campestris Schur in Verh. Naturf. Ver. Brünn 15: 181 (1877).

Lotus campestris subsp. *tenuis* (Kit.) Briquet, Prodr. Fl. Corse 2: 335 (1913). — A. & O. de Bolòs, Veg. Fl. Comarc. Barcelon.: 364 (1950). — Masclans & Batalla in Collect. Bot. 6 (4): 678 (1966).

Lotus decumbens Forst. in Sm., Engl. Fl. 3: 314 (1825) non Poiret (1814).

Plante de (5)8-90 cm, glabre ou glabrescente ou rarement à poils denses et apprimés. Tiges nombreuses, diffuses, rameuses, à rameaux ascendants ou dressés. Folioles et stipules (3)5-20 × (0,8)1-5 mm, linéaires ou linéaires-lancéolées, aiguës, souvent ténues, les supérieures plus étroites. Pédoncule grêle, allongé, jusqu'à 13 cm de longueur. Ombelles 1-4(6)-flores. Fleurs 6-12 mm

de long; dents du calice égales, triangulaires à la base et brusquement subulées, moins longues, aussi longues ou quelquefois plus longues que le tube; étendard suborbiculaire, légèrement émarginé au sommet; ailes obovées-oblongues, plus longues que la carène. Légume $15-30 \times 2-2,5$ mm. $2n = 12$.

Nous distinguons dans cette espèce les deux variétés suivantes:

Dents du calice plus courtes ou aussi longues que le tube, le plus souvent
2-3 mm de long var. **tenuis**
Dents du calice plus longues que le tube, le plus souvent 3-3,5 mm de long.
... .. var. **macrodon**

Var. **tenuis** — Borsos in Acta Bot. Acad. Sci. Hung. 12 (3-4): 264 (1966).

Lotus tenuis var. *serpentinicus* P. Silva in Agron. Lusit. 30 (3-4): 209 (1968).

SPÉCIMENS OBSERVÉS¹

Espagne: LUGO: riberas de Lea, 25-VII-1956, *E. Carreira* (MA 202811). SANTANDER: Requejada, prairies maritimes, 16-VI-1926, *Ed. Leroy* 6020 (MA 65966 sub *L. corniculatus* L. subsp. *cantabricus* Sennen et Leroy). VIZCAYA: Ria de Lequeitio, explanada arcillosa inundable debajo de una aliseda, 31-VII-1947, *E. Guinea* 3552 (MA 165240); Isla de San Nicolás, Lequeitio, calizas compostas del cretácico, terra negra, 30-VII-1947, *E. Guinea* (MA 165241). GUIPÚZCOA: S. Sebastian, VI-1895, *Gandoger* 268 (MA 66052); S. Sebastian, VI-1899, *Gandoger* (MA 66051). VALLADOLID: Olmedo, s. d., *Gutierrez* (MA 65900, sub *L. ulmeticus* Pau); Olmedo, s. d., *Gutierrez* 52 (MA 65960, forme à poils appliqués très denses). LOGROÑO: Corera,

¹ En ce qui concerne l'énumération des spécimens, nous considérons tout d'abord l'Espagne, ensuite le Portugal et après les îles Baléares. Les localités sont indiquées pour chaque province (Espagne) ou district (Portugal) et l'ordre des ces aires géographiques est celui établi dans l'«Official Standard Names Gazetteers», préparées par l'Office of Geography, Department of the Interior et publiées par le Central Intelligence Agency, Washington, DC. Au dedans de chaque province ou district, la citation des spécimens est faite, tant que possible, de l'ouest vers l'est et du nord vers le sud. Le plus souvent, la position des localités sur les cartes de distribution est approximative. Quelquefois, nous n'avons pas réussi à trouver dans les «Gazetteers» les localités mentionnées sur les étiquettes. Les noms des collecteurs sont quelquefois abrégés, mais nous croyons que, malgré cela, ils sont aisément identifiés. La transcription des étiquettes est faite d'après la langue dans laquelle elles sont écrites.

prados, 9-VIII-1929, *F. Cámara* (MA 66047); Corera, coteaux humides, alt. 500 m, VIII-1935, *F. Cámara* (MA 66048). Logrono, 4-VII, *Zubia* (MA 66049); sitios húmedos y salinos, VII-VIII, *Zubia* (MA 66050). ZARAGOZA: Calatayud, ad margines agrorum et in pratis locisque herbosis, 19-VII-1910, *C. Vicioso* (MA 66020); Calatayud, orillas de las acequias, abundante en el prado de Sr. Ramon, VI-1893, *B. Vicioso* 169 (MA 66045). ARAGONIA australis, s. d., *Loscos* (COI-Willk.); Aragon, s. d., *Iniguez* (MA 152226). BARCELONA: Llobregat, in pratis prope flumem, VI-1870, *F. Tremols* (MA 66055); Castelldefels, prairies maritimes, VII-1910, *Sennen* (MA 66053); Prat dei Llobregat, sables maritimes herbeux, 13-VIII-1925, *Sennen* 5277 (MA 66015, sub *L. Bertrandi* Sennen avec description en français sur l'étiquette). GERONA: praderas maritimas de la desembocadura del Ridaura, cerca de Sant Feliu de Guixols, 14-VIII-1944, s. coll. (MA 66054). MADRID: Cerro Negro, in pratis, VI-1843, *J. Rodriguez* (MA 66010); Sierra de Guadarrama, El Paular, in pascuis, VII-1914, *C. Vicioso* (MA 66064); rivas de Jarama, in pratis humidis, VII-1790, *Cavanilles* (MA 66009); rivas de Jarama, 1818, s. coll. (MA 66011); rivas de Jarama, in pratis, 9-VI-1918, *C. Vicioso* (MA 66008). GUADALAJARA: km 19 de la carretera de Brihuega a Nosegoso de Tajuna, 26-VI-1970, *Bellot & Ron* (MA 193304). TERUEL: Camarena, alt. 1900 m, 10-VII-1881, *Pau* (MA 66017). TARRAGONA: entre Arbós y Castellet (Panaolès), 16-VI-1929, *Cuatrecasas* (MAF 39661).

Portugal: PORTO: arredores do Porto, VIII-1914, *G. Sampaio* (MA 66024). BRAGANÇA: Samil, in novalibus solo fortasse serpentinoso, 27-VII-1964, *P. Silva & B. Rainha* 7335 (COI, isotypus var. *serpentinicus* P. Silva); arredores de Miranda do Douro, Paradela, VI-1888, *Mariz* (COI, LISU, P 21515)¹. GUARDA: Serra da Estrela, in subhumidis de Valle da Candieira infra Cantarum Crassum (Cântaro Gordo), in fluminis rarior, VIII-1848, *Wehwitsch* (LISU, P 21519).

Iles Baléares: MALLORCA: inter *Juncus acutus* in solo madido etque ad fossas ditone La Albufereta pr. Pollenza abund., 25-VIII-1873, *Willkomm* 341 (COI-Willk.); Soller, V-1899, *Gandoger* (MA 66013); Soller on coll, 29-III-1909, *Bianor* (MA 66058); Palma, 1907, *Mas Guindal* (MA 66056); Torrente Vergeles, *A. Pons y Guerau* (MA 65924); Cau Pastilla, 11-VIII-1946, *P. Ferrer* 482 (MA 65926); Torrenteras en los montes de Santa Maria, terrenos salobres de Cau Pastilla asociado con el *L. creticus*, 12-VI-1947, *P. Ferrer* 2127 (MA 65928); terrenos salobres de Cau Pastilla, asociado con el *L. creticus*, 15-VII-1949 (MA 65929); Lluc, in herbosis humidis vel aestivis, 20-VIII-1947, *P. Ferrer* (MA 65930); Santa Pousa, sitios uliginosos, 29-VI-1954, *P. Ferrer* 625 (COI; MA 162862). MENORCA: Rambos (Mayor), sitios húmedos, 29-V-1900, *A. Pons y Guerau* (MA 66014); Mesquita, 26-V-1900, *A. Pons y Guerau* (MA 66057); Camino Albufera, orilla torrente, V-1898, *A. Pons y Guerau* (MA 65927).

¹ P signifie Herbar du Portugal de LISU.

Var. **macrodon** Borsos in Acta Bot. Acad. Sci. Hung. 12 (3-4): 266 (1966).

Espagne: LUGO: Picos de Ancares, s. d., *Merino* (MA 198519); Ancares y outros montes de Galicia, s. d., *Merino* (MA 198520). BURGOS: Valle de Mena, s. d., *Salcedo* 856 (MA 66046). VALLADOLID: Laguna de Duero, VI, *F. de las Barras* (MA 66012). ZARAGOZA: Calatayud, in pascuis et ad vias, 20-VIII-1909, *B. Vicioso* (MA 66044). GUADALAJARA: Penalena, alt. 1950 m, 17-VIII-1934, *Cuatrecasas* 4570 (MA 66007).

En ce qui concerne la «Cordillera litoral catalana», MONTSERRAT (loc. cit.) réfère pour l'espèce les plages de Malgrat-Blanes et Mataró, ainsi que, d'après les données d'autres auteurs, de Barcelona à Badalona et Estang Vancells.

Par rapport aux Monts de Prades dans la province de Tarragona, MASCLANS & BATALLA [in Collect. Bot. 6 (4): 678, 1966] réfèrent que l'espèce abonde sur les rives du Francolí, entre Vallclara et Vimbodí, et depuis L'Espluga jusqu'à Vilaverd.

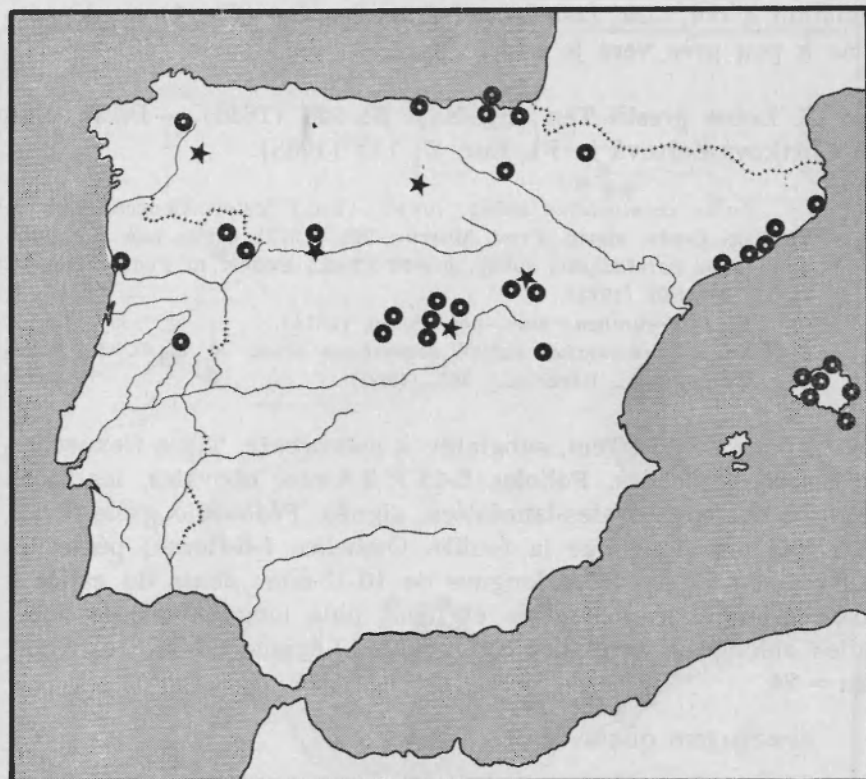
Les plantes de la Tchécoslovaquie de cette espèce ont été soigneusement étudiées par CHRTKOVÁ-ZERTOVÁ [in Preslia 44 (2): 131-139, 1972] en ce qui concerne leurs variabilité et respective valeur taxonomique des variations, écologie et répartition géographique. Nos observations s'accordent avec celles de cette auteur, de sorte que nous nous bornerons ici à signaler seulement quelques références générales concernant la distribution dans la Péninsule Ibérique et les îles Baléares, d'autant plus que nous n'avons pas fait des observations sur le terrain et que les étiquettes des spécimens observés contiennent peu de renseignements écologiques.

Relativement à la taille des plantes, nous avons constaté qu'elle est très variable et que les plantes les plus petites correspondent à celles décrites par P. SILVA [in Agron. Lusit. 30 (3-4): 209, 1968] comme var. *serpentinicus*, taxon qui s'accorde assez bien avec la forma *parvifolius* Borsos du var. *tenuis*.

Quant à la pubescence, nous avons trouvé des plantes glabres, d'autres glabrescentes et d'autres assez densément poilues, à poils apprimés (*Gutierrez* 52 — MA 65980).

La longueur des dents du calice est aussi un peu variable, parfois même chez des fleurs d'une même plante. Quelquefois on trouve des populations situées dans des localités voisines qui appartiennent aux deux variétés, comme il arrive par exemple à Valladolid et à Calatayud.

Au point de vue écologique, deux types de populations se décèlent (fig. 1) : des halophytes littorales (endroits du littoral



- - *Lotus tenuis* var. *tenuis*
- ★ - *Lotus tenuis* var. *macrodon*

Fig. 1. — Carte de distribution du *L. tenuis* Waldst. & Kit. ex Willd. dans la Péninsule Ibérique et les îles Baléares.

de Santander, Viscaya, Guipúzcoa, Catalogne, Mallorca, Cabrera et Menorca) et des plantes de l'intérieur qui devront correspondre, soit à des aires serpenticoles (P. SILVA, loc. cit.), soit à des endroits où s'accumulent des sels. En tout cas, il semble que l'espèce est une halophyte facultative.

En ce qui concerne la distribution géographique, CHRŤKOVÁ-ZERTOVÁ (loc. cit.) définit rigoureusement le *L. tenuis* comme une espèce euroatlantique-centroeuropéenne-méditerranéenne. Ce-

pendant, l'auteur (carte 1, pag. 135) inclut toute la Péninsule Ibérique dans son aire. Nos observations ne s'accordent pas entièrement avec l'aire indiquée, puisque, d'après les échantillons existant à COI, LISE, LISU, MA et MAF, l'espèce (fig. 1) ne dépasse pas à peu près vers le sud le parallèle de Madrid (40° 24' N).

2. *Lotus preslii* Ten., Fl. Nap. 5: 160 (1836). — P. W. Ball & Chrtková-Zertová in Fl. Eur. 2: 175 (1968).

Lotus corniculatus subsp. *preslii* (Ten.) Esteve-Chueca, Veg. & Fl. Reg. Centr. Merid. Prov. Murcia: 291 (1972) comb. non rite publ.

Lotus corniculatus subsp. *preslii* (Ten.) Ponert in Feddes Repert. 83 (9-10): 640 (1973).

Lotus decumbens auct. non Poiret (1814).

Lotus corniculatus subsp. *decumbens* sensu A. & O. de Bolòs, Veg. Fl. Comarc. Barcelon.: 363 (1950).

Plante de 15-80 cm, subglabre à pubescente. Tiges flexueuses, rameuses, couchées. Folioles 6-15 × 3-8 mm, obovales, les supérieures ovales à ovales-lancéolées, aiguës. Pédoncule grêle, étalé, 3-5 fois plus long que la feuille. Ombelles 1-6-flores; pédicelles 1,5 mm de long. Fleurs longues de 10-15 mm; dents du calice à base triangulaire, une fois et demi plus longues que le tube; ailes oblongues, arrondies au sommet. Légume 20-30 × c. 2 mm. 2n = 24.

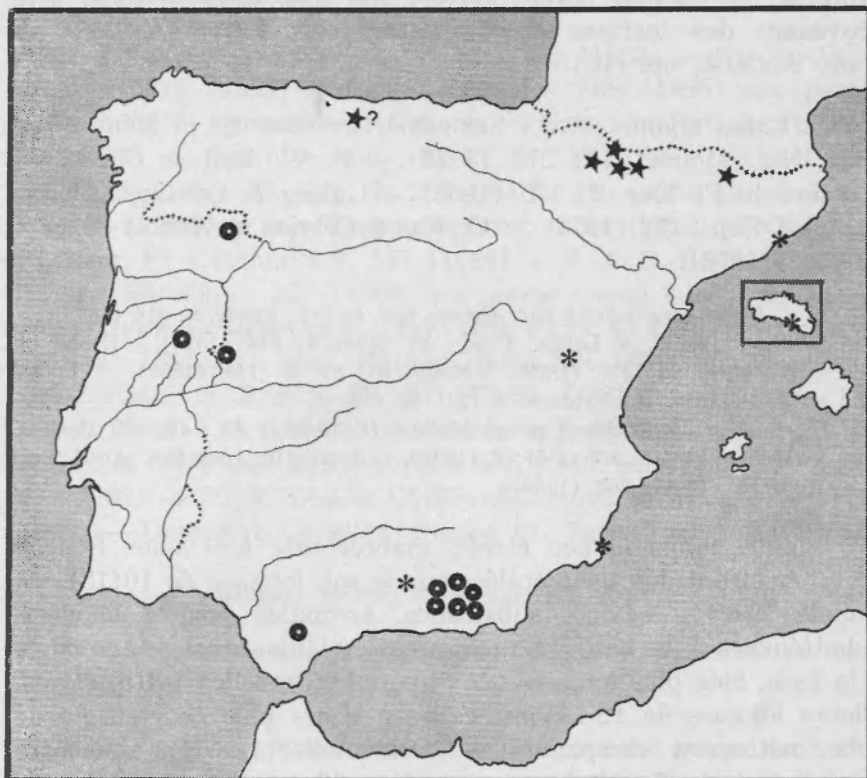
SPÉCIMENS OBSERVÉS

Espagne: CATALOGNE. Cabanas, marécages, 18-VIII-1901, *Sennen* (MA 65919); Cabanas, herbages, 6-VIII-1908, *Sennen* (MA 65976). TERUEL: Mocondon?, Valle del Mareza, Sierra de Albarracin, s. d., *B. Zagrates?* (MA 66018).

Iles Baléares: MENORCA?, Fafal-Fort, 9-V-1900, *Pons & Guerau* 216 (MA 65925).

Cette espèce semble n'être pas fréquente dans la Péninsule Ibérique, puisque nous n'avons rencontré que peu de spécimens pouvant lui être référés sans hésitation provenant des régions côtières de la Catalogne et de Minorque et un seul de la Sierra de Albarracin (fig. 2). A. & O. DE BOLÒS (loc. cit.) la signalent, d'après une récolte de SENNEN, pour les prairies maritimes de Castelldefels et ESTEVE-CHUECA (loc. cit.) la rapporte des «Saladares y suellos arcillosos sub-salinos de la costa del Mar Menor o sus proximi-

dades». Cet auteur ajoute: «No abundante. Característica de la al. Plantaginion crassifoliae. En la localidad mencionada participa de las comunidades del ord. Juncetalia maritimi».



- - *Lotus boissieri*
- ★ - *Lotus alpinus*
- * - *Lotus preslii*

Fig. 2. — Carte montrant les aires de distribution de *L. preslii* Ten., *L. alpinus* (Ser.) Schleicher ex Ramond et *L. boissieri* A. Fernandes dans la Péninsule Ibérique. Les localités indiquées par ESTEVE-CHUECA et ESTEVE CHUECA & VARO ALCALÁ pour la première espèce sont aussi signalées.

ESTEVE-CHUECA & VARO ALCALÁ [in Anal. Inst. Bot. Cavanilles 32 (2): 1369, 1975] indiquent aussi l'existence de cette espèce dans les Salinas de Malá, situées au SW de Grénade, comme caractéristique territoriale de l'Association *Centaureo-Dorycnietum gracilis*. Il pourra-t-arriver que la plante de la Sierra de

Albarracin, qui à notre avis doit se référer plutôt à cette espèce qu'au *L. tenuis*, se trouve dans cette localité dans des conditions écologiques comparables, c'est-à-dire, occupant la partie plus profonde de quelque saline, formée par l'accumulation des sels provenant des terrains environnants (voir ESTEVE-CHUECA & VARO ALCALÁ, op. cit.).

3. *Lotus alpinus* (Ser.) Schleicher ex Ramond in Mém. Mus. Hist. Nat. (Paris) 13: 275 (1825). — P. W. Ball & Chrtková-Zertová in Fl. Eur. 2: 175 (1968). — Guinea & Ceballos, Elenco Fl. Vasc. Esp.: 110 (1974). — Corrias & Corrias in Webbia 30 (2): 299-302 (1976).

Lotus corniculatus var. *alpinus* Ser. in DC., Prodr. 2: 214 (1825). — Willk. in Willk. & Lange, Prodr. Fl. Hisp. 3: 344 (1877). — Brand in Bot. Jahrb. 25: 211 (1898). — Rouy, Fl. Fr. 5: 148 (1899). — Vicioso in Anal. Jard. Bot. Madrid 6 (2): 48 (1946).

Lotus corniculatus subsp. *alpinus* (Schleicher ex Ramond) Rothm. in Feddes Repert. 67 (1-3): 6 (1963). — Borsos in Acta Bot. Acad. Sci. Hung. 12 (3-4): 263 (1966).

Plante naine ou peu élevée, glabrescente à ± velue. Souche forte, émettant des tiges étalées sur le sol, longues de 10(15) cm. Foliolles 2-6 × 1,5-4 mm, subsessiles, arrondies jusqu'à obovées, subatténuées à la base et au sommet; stipules ovales, arrondies à la base, bien plus longues que le pétiole. Ombelles 1-3(5)-flores. Fleurs longues de 12-18 mm; calice à dents plus courtes que le tube, nettement campanulé; ailes arrondies; carène rougeâtre jusqu'à marron foncé au sommet. 2n = 12.

SPECIMENS OBSERVED

Espagne. SANTANDER: Picos de Europa, Pena Vieja, in saxosis, 4-IX-1944, C. Vicioso (MA 65983). HUESCA: Panticosa, s. d., s. coll. (MA 65984); Banos de Panticosa, VII, Zubia (MA 65985); Panticosa, s. d., s. coll. (MA 152220); Panticosa, VIII-1918, L. Aterido (MA 147869); Valle de Ordesa, «Lana de Cotatuero», 9-VIII-1953, Ceballos (MA 65986); in Pyren. Aragon. in jugo Puerto de Confranc, 24-VI-1850, Willkomm (COI-Willk.). GERONA: Camprodón, Font dei Boix, prados, 19-VII-1926, Cuatrecasas (MAF 39658); Bacibé, prados-rupestr., alt. 2200 m, 18-VII-1924, Cuatrecasas (MAF 39681).

Dans la Péninsule Ibérique cette espèce se trouve aux Pyrénées et aux Picos de Europa (fig. 2), la deuxième région étant signalée la première fois par VICIOSO (loc. cit.). La citation de cette plante

pour le Portugal (Henriques, Rel. Exped. Sci. Serra Estrela, Bot.: 101, 1883; Coutinho, Fl. Port.: 349, 1913; ed. 2: 418, 1939; Sampaio, Fl. Portug.: 295, 1947) a résulté d'une confusion avec le *L. boissieri* (voir pag. 60).

4. *Lotus corniculatus* L., Sp. Pl.: 775 (1753). — Ser. in DC., Prodr. 2: 214 (1825). — Lange, Pugillus: 368 (1865) pro parte quoad distr. in Cantabria et Gallecia. — Brand in Bot. Jahrb. 25: 210 (1898) pro parte. — Rouy, Fl. Fr. 5: 146 (1899) pro parte. — Láz.-Ibiza, Comp. Fl. Esp. 2: 259 (1907) pro parte quoad distr. geogr. — Correvon, Fl. Champs & Bois: t. 54 (1911). — Cadevall & Sallent, Fl. Catalunya 2: 137 (1916). — A. & O. Bolòs, Veg. Fl. Comarc. Barcelon.: 363 (1950) pro parte quoad subsp. *eu-corniculatus* Syme. — Ross-Craig, Draw. Brit. Pl.: t. 43 (1954). — Ujhelyi in Annal. Hist.-Nat. Mus. Nation. Hung. 52: 186 (1960). — Chrtková-Zertová in Preslia 33 (1): 17-35 (1961); in Fragm. Fl. Geobot. 20 (1): 21 (1974). — Lawalrée in Robyns, Fl. Génér. Belg. 4 (2): 136 (1963). — Borsos in Acta Bot. Acad. Sci. Hung. 12 (3-4): 258 (1966). — P. W. Ball & Chrtková-Zertová in Fl. Eur. 2: 174 (1968). — Guinea & Ceballos, Elenco Fl. Vasc. Esp. 110 (1974).

Lotus ambiguus Besser ex Sprengel, Syst. Veg. ed. 16, 3: 282 (1828).

Lotus caucasicus Kuprian in Fl. URSS, ed. Komarov, 11: 291 (1945).

Plante glabre, glabrescente ou velue, à souche non stolonifère. Tiges 5-60 cm de long, couchées ou ascendantes, pleines (parfois avec une étroite fissure), rameuses. Folioles 4-18 × 1-10 mm, lancéolées ou oblancéolées jusqu'à suborbiculaires; stipules plus longues que le pétiole. Pédoncule beaucoup plus long que la feuille, pourvu au sommet de 1-3 folioles de grandeur variable. Ombelles (1) 2-7-flores; pédicelles 1-1,25 mm de long. Fleurs longues de 10-16 mm, généralement jaunes; dents du calice aussi longues, moins longues ou plus longues que le tube, triangulaires à la base et devenant subitement subulées, aiguës, conniventes avant l'anthèse. Étendard suborbiculaire ou largement ovale, entier ou légèrement émarginé au sommet, verdissant fortement par la dessiccation; ailes élargies au milieu et courbées au bord inférieur, plus courtes que l'étendard; carène longuement rostrée. Légume 15-30 × 2-2,5 mm. $2n = 24$.

Tiges pleines ou avec une étroite fissure seulement à la base; nervures secondaires indistinctes sur la page inférieure des folioles:

Folioles charnues, très glauques; plantes petites, à fleurs 9-12 mm de long var. *crassifolius*

Folioles non charnues; plantes plus robustes, à fleurs 10-16 mm de long:

Tiges et folioles glabres ou subglabres var. *corniculatus*

Tiges et folioles ciliées ou velues:

Plantes ciliées var. *ciliatus*

Plantes velues var. *hirsutus*

Tiges fistuleuses; nervures secondaires, tout au moins celles de premier ordre, distinctes sur la page inférieure des folioles var. *sennenii*

Var. *corniculatus* — Ujhelyi in *Annal. Hist.-Nat. Mus. Nation. Hung.* 52: 186 (1960). — Borsos in *Acta Bot. Acad. Sci. Hung.* 12 (3-4): 258 (1966). — Chrtková-Zertová in *Fragm. Fl. Geobot.* 20 (1): 21, fig. 1 (1974).

Lotus arvensis Pers. in Usteri, *Ann. Bot.* 14: 39 (1795).

Lotus corniculatus var. *arvensis* (Pers.) Ser. in DC., *Prodr.* 2: 214 (1825) comb. illegit., non Brot. (1804).

Lotus corniculatus var. *vulgaris* Koch, *Synops. Fl. Germ.* 1: 154 (1835).

Lotus corniculatus var. *genuinus* Willk. in Willk. & Lange, *Prodr. Fl. Hisp.* 3: 343-344 (1877).

Lotus corniculatus var. *gracilis* Willk. op. cit.: 343 pro parte quoad specim. ca. Alhama et Totana lecta et excl. synon.

Lotus corniculatus var. *vulgaris* forma *genuinus* (Willk.) Merino, *Fl. Galicia* 1: 349 (1905).

SPÉCIMENS OBSERVÉS

Espagne: LUGO: Galdo, s. d., *Merino* (MA 65957). GUIPÚZCOA: Escoriaza, s. d., *Gredilla* (MA 65961). HUESCA: Valle de Ordesa, in fagetis, 3-VIII-1935, *Ceballos* (MA 65914). ZARAGOZA: Paniza, Puerto de Paniza, 25-VI-1955, *J. Borja* (MA 202799); in Aragonia australis, in pratis, 1860, *Loscos* (COI-Willk.). BARCELONA: S. Cugat, lieux subhumides, 6-VIII-1921, *Sennen* (COI, sub *Lotus poiiretii* Sennen); in colle Monjay prope Barcinonem, 4-IV-1846, *Willkomm* (COI-Willk.); Massif du Tibidado, sur le schiste et l'argile, 21-V-1928, *Sennen* 6559 (MA 65923); Castelldefels, arenales, 2-V-1926, *Cuatrecasas* (MAF 39655); Castelldefels, arenales, 29-V-1930, *Cuatrecasas* (MAF 39656); Sant Celoni-Olzinelles, 17-X-1926, *Cuatrecasas* (MAF 39663). CASTELLON: Sagunto, VII-1882, *Pau* (MA 66091). ALBACETE: El Vallejo, 8-VII-1935, *G. Albo* (MA 66023). VALENCIA: in graminosis ad lacum Albufera pr. Valencia, VIII-1850, *Willkomm* (COI-Willk.); Bicorp, in pratis humidis, X-1914, *C. Vicioso* (MA 65962). MURCIA: Riachuelos de Alhama, VI-1857, *Willkomm* 13 (COI-Willk.) et Zarzadilla de Totana, junto los riachuelos, V, *Willkomm* 17 (COI-Willk.); La Flota, 16-VI-

-1978, A. M. Hernandez (MA 209650). MALAGA: in ruderatis prope pagum Frigiliana in prov. Malacitana, alt. 2-250 m, 11-VI-1845, *Willkomm* (COI-Willk.); S. LOC.: habitat passim in humidis per totam Hispaniam, V-1971, *Cavanilles* (MA 65953).

Var. *crassifolius* (Pers.) Ser. in DC., Prodr. 2: 214 (1825). — Lange, Pugillus: 368 (1865). — Willk. in Willk. & Lange, Prodr. Fl. Hisp. 3: 344 (1877). — Rouy, Fl. Fr. 5: 147 (1899). — Merino, Fl. Galicia 1: 349 (1905). — Chrtková-Zertová in Fragm. Fl. Geobot. 20 (1): 21, fig. 4 (1974).

Lotus crassifolius Pers., Synops. Pl.: 2: 354 (1807).

SPECIMENS OBSERVÉS

Espagne: LA CORUÑA: in rupibus maritimis, 10-VIII-1851, *Lange* (COI-Willk.). OVIEDO: Serin, 3-V-1914, *C. Martinez* 171 (MA 65951); Asturias, La Bobia, 17-VII-1956, *E. Carreira* (MA 202803). SANTANDER: S. Vicente de la Barquera, VII-1919, *E. J. de la Espada* (MA 65972). GUIPÜZCOA: Passages, V-1895, *Gandoger* 146 (MA 65973); Pasages, V-1895, *Gandoger* 174 (MA 65974). VALENCIA: Penescola, pelouses maritimes, 24-VI-1909, *Sennen* (MA 65959).

Var. *ciliatus* Koch, Synops. Fl. Germ. 1: 154 (1835). — Reichenb., Ic. Fl. Germ. 22: t. 130 (1867-89). — Ascherson & Graebner, Synops. Mitteleur. Fl.: 678 (1908). — Borsos in Acta Bot. Acad. Sci. Hung. 12 (3-4): 261 (1966).

Lotus corniculatus subvar. *ciliatus* Gams in Hegi, Ill. Fl. Mitteleur. 4: 1368 (1923).

Lotus corniculatus var. *kochii* Chrtková-Zertová in Fragm. Fl. Geobot. 20 (1): 22, fig. 2 (1974).

Lotus barcinonensis Sennen in Bol. Soc. Ibér. Cienc. Nat. 26 (6-8): 114 (1927) pro max. parte.

Lotus catalaunicus Sennen, loc. cit. pro parte quoad specim. *Sennen* 3009 (COI).

SPECIMENS OBSERVÉS

Espagne: LUGO: Villardiaz, Fonsagrada, s. d., *E. Carreira* (MA 170283). BARCELONA: Massif du Tibidabo vers la Meca, IV-1916, *Sennen* 3348 (MA 65968, sub *L. barcinonensis* Sennen); Massif du Tibidabo, sur le schiste et l'argile, 21-V-1928, *Sennen* 6558 (MA 65967, sub *L. barcinonensis* Sennen); collines granitiques du littoral, à Montalegre, Argenton, etc., IV et V-1917, *Sennen* 3009 (COI, sub *L. catalaunicus* Sennen). TERUEL: desierto de Calanda, 20-VI-1900, *Reyes* (MA 66098).

Var. *hirsutus* Koch, Synops. Fl. Germ. 1: 154 (1835). — Reichenb., Ic. Fl. Germ. 22: t. 129 (MMCLXXX) 1867-89). — Chrtková-Zertová in Fragm. Fl. Geobot. 20 (1): 22, Fig. 3 (1974).

Lotus corniculatus subsp. *hirsutus* (Koch) Rothm. in Feddes Repert. 67 (1-3): 6 (1963). — Borsos in Acta Bot. Acad. Sci. Hung. 12 (3-4): 259 (1966).

Lotus corniculatus var. *arvensis* (Pers.) Ser. forma *hirsutus* (Koch) Flori, Nuov. Fl. Anal. Ital. 1: 877 (1925). — Montserrat, Fl. Cordill. Litor. Catal.: 69 (1968).

SPÉCIMENS OBSERVÉS

Espagne: SANTANDER: Guariza, Reinos, prados-hayedos, 7-VII-1948, Borja (MAF 39632); Molledo, s. d., *D. Culto?* vel *Cueto?* (MAF 39634). HUESCA: inter Jaca et S. Juan de la Pena, 2-VII-1850, *Willkomm* (COI-Willk.). BARCELONA: Martorelles, montanas de Mollet, 2-V-1927, *Cuatrecasas* (MAF 39657).

ROTHMALER (loc. cit.) élève le var. *hirsutus* Koch à la catégorie de sousespèce, point de vue suivi par BORSOS (loc. cit.). Nous croyons que ce critère est exagéré car des formes glabres, ciliées ou velues peuvent exister dans une même population. D'autre part, la distinction entre les vars. *ciliatus* et *hirsutus* est parfois très difficile, puisqu'il y a des formes de transition entre elles.

Var. *sennenii* A. Fernandes, nom. nov. Lectotypus: *Sennen* 3009 (MA 65922).

Lotus catalaunicus Sennen var. *grandifolius* Sennen in Bol. Soc. Ibér. Cienc. Nat. 26 (6-8): 115 (1927).

En dehors du spécimen indiqué, on ne connaît de ce taxon qu'une branche se trouvant sur la partie médiane de la feuille MA 65968, qui possède aussi des échantillons de *L. corniculatus* var. *ciliatus* Koch.

SENNEN a publié le *L. barcinonensis* dans le Bol. Soc. Ibér. Cienc. Nat. 26 (6-8): 114 (1927), en mentionnant le spécimen *Sennen* 3348 et en ajoutant que ce taxon a son habitat à « Barcelone, massif du Tibidabo, surtout vers les Planas, Can Casas et dans la direction de S. Cugat; se retrouve aussi abondant par les collines du littoral à Badalona, Montalegre, etc. ».

En se basant sur le n.º 3009 de sa collection, le même auteur décrit ensuite à la même page le *L. catalaunicus* qu'il indique aussi pour Barcelone: «Collines granitiques et schisteuses du littoral, à Montalegre, Argentona, le Tibidabo vers les hauteurs de la Meca, Vista Rica, etc.».

A. & O. DE BOLÒS (Vegetación y flora de las Comarcas Barcelonesas, 1950) expriment l'opinion que ces deux espèces de SENNEN doivent être attribuées au *L. corniculatus*.

MONTSERRAT [in Collect. Bot. 5 (1): 69, 1956] est de l'avis que le *L. barcinonensis* de la Coscoiada-Montalegre doit être référé au *L. corniculatus* L. var. *arvensis* (Pers.) Fiori. UJHELYI (in Ann. Hist.-Nat. Mus. Nation. Hung. 52: 186, 1960) considère le *L. barcinonensis* comme un synonyme du *L. corniculatus* L. CHRTKOVÁ-ZERTOVÁ [in Folia Geobot. Phytotax. (Praha) 1: 83, 1966] dit que les espèces de SENNEN *L. barcinonensis*, *L. catalaunicus* et *L. fortunii* correspondent à des formes du *L. corniculatus* L.

Dans l'herbier de Madrid, 3 feuilles de montage existent, étiquetées comme *L. barcinonensis* Sennen. La première, portant le n.º *Sennen* 3348 (MA 65968) — Massif du Tibidabo vers la Meca —, est un mélange comportant le suivant:

- 1) Deux plantes, avec des fleurs et des fruits jeunes, occupant, respectivement, le côté gauche et la partie supérieure droite de la feuille; une plante, à fruits déjà ouverts, placée sur le côté de la droite; et une branche et un pédoncule fructifère à la partie inférieure. Tout ce matériel s'accorde très bien avec les caractères du *L. corniculatus* L. var. *ciliatus* Koch;
- 2) La partie supérieure d'une tige florifère entièrement glabre, fistuleuse, à stipules et folioles plus grandes, à nervation secondaire nettement visible sur la page inférieure et à fleurs plus grandes occupe la partie centrale de la même feuille. Étant donnés ces caractères, nous avons pensé tout d'abord à une tige du *L. pedunculatus* Cav. Cependant, par le fait que la fistule de la tige était étroite et que les extrémités des dents du calice étaient convergentes et non divergentes avant l'anthèse, nous avons été forcé à abandonner cette interprétation, d'autant plus que la présence du *L. pedunculatus* Cav. (incl. *L. uliginosus*

Schkuhr) à la Catalogne n'est pas certaine [vide A. & O. DE BOLÒS, op. cit.: 363 (1950) et MONTSERRAT in Collect. Bot. 5 (1): 69 (1967)].

Les autres deux feuilles portent le même numéro de la collection, c'est-à-dire *Sennen* 6558 (MA 65967) — Massif du Tibidabo, sur le schiste et l'argile — et les échantillons qu'y se trouvent appartiennent, comme la plupart des éléments de la première feuille, au *L. corniculatus* var. *ciliatus* Koch.

Comme nous l'avons remarqué, SENNEN (loc. cit.) indique pour le *L. catalaunicus* le n.º 3009 de sa collection, dont nous avons examiné deux feuilles de montage, une de l'herbier du Jardin Botanique de Madrid et l'autre de l'herbier général de Coimbra. La première (MA 65922) — Catalogne, collines granitiques du littoral, à Montalegre, Argentona, etc. — porte deux tiges florifères semblables à celle située sur la partie centrale de la feuille MA 65968, mais avec les stipules et les folioles pouvant atteindre jusqu'à 16 × 10 mm et les fleurs jusqu'à 15 mm.

La feuille de Coimbra, par contre, montre une plante à racine pivotante et à tiges étalées, les autres caractères correspondant aussi à ceux du *L. corniculatus* var. *ciliatus* Koch.

SENNEN (op. cit.: 115) ajoute le suivant dans une note concernant le *L. catalaunicus*: «Entre Vista Rica et la Meca nous recueillîmes, sur le bord du chemin, une forme entièrement glabre et à folioles beaucoup plus grandes, var. *grandifolius* Sennen». D'après l'observation des matériaux mentionnés et de cette note, nous concluons que le *L. barcinonensis* Sennen pro max. parte et le *L. catalaunicus* Sennen ne sont que le *L. corniculatus* L. var. *ciliatus* Koch et que la tige florifère de la feuille MA 65968 dont nous avons parlé plus haut, ainsi que les deux autres qui constituent la feuille MA 65922, appartiennent au *L. catalaunicus* var. *grandifolius* Sennen. Cependant, il faut discuter ce qui est ce dernier taxon.

ZERTOVÁ [in *Preslia* 33 (1): 23, 1961], se référant à la nervation du *L. corniculatus*, dit: «die Nervatur versenkt, mit schwach hervorragenden Hauptnerv und den Nerven des 2. Ranges, bei einigen Formen auf der Unterseite der Blätchen hervorragend». Le dernier type de nervation de quelques formes mentionné par cette auteur correspond très bien à celui de la plupart des folioles de *L. catalaunicus* var. *grandifolius*, mais nous avons constaté



Lotus corniculatus L.

- var. *corniculatus*
- * var. *crassifolius*
- var. *ciliatus*
- * var. *hirsutus*
- * var. *sennenii*

Fig. 3. — Carte de distribution du *L. corniculatus* L. (vars. *corniculatus*, *crassifolius*, *ciliatus*, *hirsutus* et *sennenii*) dans la Péninsule Ibérique, d'après les spécimens examinés.

qu'il y avait quelques folioles dans lesquelles les nervures tertiaires étaient aussi visibles.

En suivant les clefs de ČHRTKOVÁ-ZERTOVÁ [in *Fragm. Fl. Geobot.* 20 (1): 21, 1974] pour les variétés du *L. corniculatus* de la Pologne, nous avons constaté que le *L. catalaunicus* var. *grandifolius* Sennen s'accorde avec le var. *sativus* Hyl. en ce

qui concerne la tige fistuleuse, la nervation et la glabricité. Cependant, il s'en écarte par le fait qu'il s'agit d'une plante couchée sur le sol, à folioles surtout obovées et non lancéolées et à dents du calice plus longues que le tube.

Étant donné ces derniers caractères, nous proposons maintenir cette variété, laquelle doit, cependant, être rangée dans le *L. corniculatus* L. Dans cette nouvelle position, nous sommes, obligé de créer un nom nouveau — *L. corniculatus* var. *sennenii* A. Fernandes —, puisque l'épithète *grandifolius* ne peut pas s'appliquer par suite de l'existence de *L. corniculatus* subsp. *hirsutus* (Koch) Rothm. var. *pilosus* (Jord.) Posp. forma *grandifolius* Borsos [in Acta Bot. Acad. Sci. Hung. 12 (3-4): 260, 1966].

Il faut remarquer que la feuille MA 65922 porte une étiquette mentionnant Montalegre, Argentona, etc. (voir ci-dessus), tandis que nous devrions attendre comme localité de récolte «entre Vista Rica et la Meca». Cependant, sur la feuille MA 65968, qui, comme nous l'avons montré, possède une branche du var. *grandifolius* Sennen, on peut lire «Massif du Tibidabo vers la Meca». Nous croyons qu'on a fait un mélange des récoltes de SENNEN, mais, comme la feuille MA 65922 est celle qui porte des éléments homogènes correspondant à la description du var. *grandifolius*, nous l'avons désignée comme lectotype du var. *sennenii* A. Fernandes.

Nous avons examiné un autre spécimen catalain — Castelldefels, arenales, 2-V-1926, *Cuatrecasas* (MA 39655) — montrant aussi des tiges fistuleuses et des folioles à nervures secondaires visibles sur la page inférieure. Nous nous demandons donc s'il n'y aura pas eu dans la Catalogne des essais de culture du *L. corniculatus* qui s'est révélé une plante fourragère de grande importance. S'il en est ainsi, les échantillons ayant des ressemblances avec le var. *sativus* pourraient correspondre à des plantes échappées de la culture.

Si le *L. corniculatus* n'a jamais été cultivé en Catalogne, nous pourrions admettre que cette région est un centre où des plantes ayant certaines ressemblances avec le var. *sativus* se sont engendrées. Par le fait que le var. *sennenii* possède des folioles plus larges que le var. *sativus*, elle pourrait se révéler plus avantageuse que la dernière variété lorsque des formes dressées puissent être obtenues.

À MA, une autre feuille (MA 65923) existe portant l'étiquette:

1928 — Plantes d'Espagne. — F. Sennen
N.º 6559

Lotus catalaunicus Sennen

Bol. Soc. Ibér. C. N. (1927) p. 114-115

Barcelone: Massif du Tibidabo, sur le schiste et l'argile.

À notre avis, cet échantillon doit être référée au *L. delortii* Timb.-Lagr. ex Schultz var. *rivasii* A. Fernandes, puisque, bien que possédant les caractères de l'espèce, il est entièrement glabre (voir pag. 73).

Se rapportant aux Comarcas Barcelonesas, A. & O. DE BOLÒS (loc. cit.) indiquent l'écologie et la distribution du *L. corniculatus* (subsp. *eu-corniculatus* Syme): «Prados y matorrales de las umbrías y lugares húmedos. Común en el territorio climácico del *Quercion ilicis*, pero poco abundante. Sobre Ca y Si. — G.-O. No observado en los valles meridionales a baja altitud. Entre Campdàsens y Vallgrassa, umbría, 300 m.!: camino de Carxol, 350 m.!: sobre el Mas Prunera de Vallirana, 340 m.!: Corbera! — SM. B. No raro, especialment en la vertiente umbría. La Rierada, disperso por el bosque y lugares herbosos, 125 m.!: entre Vallvidrera y las Planas!: Tibidabo (Senn.); San Medir!: La Meca!: Valldaura!: Reixach, 125 m.!: La Roca!: Céllecs, 500 m.! — V. lugares herbosos (Cad.). — SS. Común. Obac!: San Llorenç del Munt (Cad.); San Miguel del Fay!, etc.».

Dans son étude sur la «Flora de la cordillera litoral catalana», MONTSERRAT (loc. cit.) cite le *L. corniculatus* L. s. str. pour les localités suivantes: Montnegre, Corredor-El Far, Montalt-Can Bruguera de Mataró, montes de Argentona-Òrrius y Sant-Mateu-La Conreria de Badalona et encore à La Coscoiada-Montalegre (*L. barcinonensis* Sennen). L'auteur réfère aussi que le forma *hirsutus* (Koch) Fiori est le plus fréquent.

Dans les Monts de Prades, province de Tarragona, MASCLANS & BATALLA (op. cit.: 677) signalent le var. *corniculatus* entre Vimbodí et Vallclara, L'Aleixar et Villaverd. Les mêmes auteurs remarquent que le var. *hirsutus* (var. *pilosus* Willk.) est plus fréquent, existant à Vimbodí, valle de El Titlar, entre Capafonts et la dépression de la Febró, La Pena, valle de Castellfolit, massif de Els Motllats vers Mont-ral, Plans de la Mussara, Plans de



Prades, Tossal de la Baltasana vers le Coll de Boc, entre le Puig Pelat et le Puig la Mussara et Bosc del Guerxet, dans le massif de Roquerola¹.

Parmi les échantillons examinés de cette espèce nous n'avons trouvé aucun récolté aux îles Baléares. Cependant, le *L. corniculatus* y se trouve représenté, puisqu'il est indiquée par COLMEIRO (Enum. Pl. Penins. Hisp. Lusit. 2: 189, 1886), KNOCHE (Fl. Bal. 2: 95, 1922) et Fl. Eur. (loc. cit.). Dans la Péninsule, l'espèce se rencontre particulièrement à la périphérie de l'Espagne (fig. 3), le var. *crassifolius* se distribuant particulièrement le long de la côte cantabrique et les vars. *corniculatus*, *ciliatus* et *hirsutus* un peu plus à l'intérieur. L'espèce est très rare dans le sud de l'Espagne et elle n'existe pas au Portugal.

5. *Lotus pedunculatus* Cav., Icon. Descr. 2: 52 (1793). — Ser. in DC., Prodr. 2: 214 (1825). — Vicioso in Anal. Inst. Bot. Cavanilles 6 (2): 49 (1946). — Samp., Fl. Portug.: 295 (1947). — A. & O. de Bolòs, Veg. Comarc. Barcel.: 363 (1950). — Lainz in Bull. Jard. Bot. Bruxelles 30: 35-36 (1960). — Lawalrée in Robyns, Fl. Génér. Belg. 4 (2): 140 (1963). — Chrtková, in Fol. Geobot. Phytotax. (Praha) 1 (1): 78-87, fig. 1, 4, 6 (1966). — P. W. Ball & Chrtková-Zertová in Fl. Eur. 2: 175 (1968). — Hearth in Proc. Indiana Acad. Sci. 79: 193 (1969). — Franco, Nova Fl. Port.: 378 (1971). — Magallon, Fl. Veg. Prov. Alicante: 304 (1972).

Lotus uliginosus Schkuhr, Handb. 2: 412 (1796). — Lange, Pugillus: 368 (1865). — Reichenb., Icon. Fl. Germ. 22: t. 131 (1867-89). — Willk. in Willk. & Lange, Prodr. Fl. Hisp. 3: 345 (1877). — Nyman, Consp. Fl. Eur.: 182 (1878). — Colmeiro, Enum. Pl. Penin. Hisp.-Lusit. 2: 191 (1886). — Brand in Bot. Jahrb. 25: 180 et 209 (1898). — Rouy, Fl. Fr. 5: 145 (1899). — Merino, Fl. Galicia 1: 347 (1905). — Láz.-Ibiza, Comp. Fl. Esp. ed. 2, 2: 259 (1907). — Samp., Man. Fl. Portug.: 244 (1911). — Henriq., Esb. Fl. Bac. Mondego: 204 (1913). — Coutinho, Fl. Port.: 349 (1913); ed. 2: 418 (1939). — Caballero, Fl. Anal. Esp.: 260 (1940). — Ross-Craig, Draw. Brit. Pl. 7: t. 45 (1954). — Zertová in Preslia 33 (1): 17-35 (1961). — Chrtková-Zertová in Folia Geobot. Phytotax. (Praha) 1: 78-87, fig. 3, 6 (1966); Chrtková-Zertová in Ann. Naturhist. Mus. Wien 75: 34, fig. 2 (1971). — P. W. Ball & Chrtková-Zertová in Fl. Eur. 2: 175 (1968). — Chrtková-Zertová in Fragm. Fl. Geobot.

¹ Étant donné que le *L. delortii* croit aussi dans les Monts de Prades, il pourra-t-arriver que parmi ces matériaux quelques échantillons appartiendront à cette espèce.

20 (1): 21, fig. 9 (1974).—Franco, *Nova Fl. Port.*: 378 (1971).—Galiano & Valdés in *Lagascalia* 6 (1): (1976).—Galiano & Cabezudo in *Lagascalia* 6 (1): 134 (1976).

Lotus major Sowerby & Smith, *Engl. Bot.* 30: t. 2091 (1810) non Scop.

Lotus corniculatus var. *major* Ser. in DC., *Prodr.* 2: 214 (1825).

Lotus pisifolius Lowe in *Trans. Phil. Soc.* 6: 24 (1838).

Lotus nummularius Reichenb. ex Steud., *Nom. Bot.* ed. 2, 2: 74 (1841).

Lotus corniculatus var. *pedunculatus* (Cav.) Willk. in Willk. & Lange, *Prodr. Fl. Hisp.* 3: 343 (1877).—Colmeiro, *Enum. Pl. Penin. Hisp.-Lusit.* 2: 189 (1886).—Henriq., *Esb. Fl. Bac. Mondego*: 204 (1913).

Lotus uliginosus var. *brachycarpus* Willk., *Suppl. Prodr. Fl. Hisp.*: 243 (1893).

Lotus corniculatus var. *uliginosus* (Schkuhr) Fiori, *Nuov. Fl. Anal. Ital.* 1: 878 (1925).

Lotus cantabricus Sennen, *Diagn. Nouv. Pl. Espagne & Maroc* 1928-35: 50 (1936).

Plante glabre, glabrescente ou ± ciliée, souvent velue, pourvue d'un rhizome rampant, stolonifère. Tiges longues de 30-120 cm, dressées ou ascendantes, fistuleuses, rameuses. Folioles 8-35 × 3-15 mm, obovées, obtuses et souvent mucronées au sommet ou lancéolées-rhomboidales ou ovées-lancéolées, aiguës, glauques et à nervation saillante sur la page inférieure. Stipules obliquement cordées ou subtronquées, largement ovales, aiguës et plus longues que le pétiole. Pédoncule épais, 3-4 fois plus long que la feuille. Ombelles (3)4-5-12(15)-flores; pédicelles 1-2 mm de long. Fleurs 10-18 mm de long; calice à dents linéaires-lancéolées, à peu près de la même longueur que le tube, réfléchies avant l'anthèse; étendard à limbe ovale, verdissant en général par la dessiccation; ailes obovées, arrondies au sommet; carène courbée, longuement rostrée, recouverte par les ailes. Légume de 15-40 mm de long. Graines petites, globuleuses-déprimées. 2n = 12.

Plantes complètement glabres ou à tiges, folioles et calices ± ciliés

... .. var. *pedunculatus*

Plantes à tiges, folioles et calices velus var. *villosus*

Var. *pedunculatus*

Lotus uliginosus var. *glabriusculus* Bab., *Man. Brit. Bot.* ed. 2: 80 (1847).—Rouy, *Fl. Fr.* 5: 146 (1899).

Lotus pedunculatus var. *glabriusculus* (Bab.) O. de Bolos & Vigo in *Butl. Inst. Cat. Hist. Nat.* 38 (Secc. Bot. 1): 71 (1974).

SPECIMENS OBSERVÉS

Espagne: LA CORUÑA: lugares húmedos, VIII-1909, *Herbario Bes-cansa* (MA 152222). SANTANDER: Barreda, prairies, 16-VI-1927, *E. Leroy* 6938 (MA 66114). VIZCAYA: Macizo del Gorbea, aquazales de la Campa de Anobra, alt. \pm 1050 m. s. m., tierra negra decalcificada, 22-VII-1946, *E. Guinea* 5601 (MA 165239). BURGOS: Arlanzón, 27-VIII, *Zubia* (MA 66124). ZARAGOZA: Calatayud, orilla del Jalon, IV-1897, *B. Vicioso* (MA 66019). MADRID: Sierra de Guadarrama, El Paular, VIII-1914, *C. Vicioso* (MA 66116); Sierra de Guadarrama, VIII-1841, *Reuter* (MA 66117); Sierra de Guadarrama, Cercedilla, VII-1914, *C. Vicioso* (MA 66118).

Portugal: VIANA DO CASTELO: arredores de Melgaço, S. Gregório, VI-1884, *A. Moller* (COI); Valadares, margem do rio Minho, VI-1885, *A. R. Cunha* 94 (COI; LISU, P 21563); Valença, Ínsua Grande, VI-1885, *A. R. Cunha* (LISU, P 21559); margem da ribeira de Ancora, VI-1886, *A. R. Cunha* (LISU, P 21558); Insalde, Padronelo, VII-1916, *Clemente Pereira* 8 (COI); Serra do Soajo, Senhora da Peneda, VII-1890, *A. Moller* (COI); Ponte de Lima, 1894, *Moraes* (COI). BRAGA: Gerês, 1-VII-1970, s. coll. (COI); Serra do Gerês, Ponte Feia, VIII-1883, *A. Moller* (COI); Serra do Gerês, VI-1918, *G. Felgueiras* 136 (COI); Serra do Gerês, Abelheirinha, 5-VII-1948, *Sobrinho & Romariz* (LISU, P 1044); Serra do Gerês, Pedra Bela, 7-VII-1948, *Sobrinho & Romariz* (LISU, P 1047); Serra do Gerês, entre Caldas e Pedra Bela, numa linha de água, 10-VII-1958, *Malato-Beliz, Raimundo & J. P. Guerra* 4446 (ELVE 9354); Serra do Gerês, Chão de Lamas, 8-VII-1948, *R. Fernandes & Sousa* 2598 (COI); Caldas do Gerês, IX-1882, *M. L. Henriques* (COI); Barcelos, Bouças do Marnota, VI-1886, *A. R. Cunha* (LISU, P 21540); arredores de Braga, Monte do Crasto, VIII-1883, *A. Sequeira* (COI); Britelo, junto ao moinho, no ribeiro, 9-VII-1972, *A. Fernandes, J. Matos & A. Matos* 11989 (COI); PORTO: arredores de Vizela, VII-1889, *A. Velloso* (COI); arredores do Porto, VI-1881, *E. Johnston* 249 (COI; LISU, P 21549, P 21568). AVEIRO: Eirol, Ribeiro da Calada, 7-VIII-1967, *Amadeu Rosa* 8 (COI); Ribeiro da Calada, 2-VIII-1966, *V. Teles* 17 (COI); Bussaco, VI-1904, *F. Mendes* (LISU, P 21557); Bussaco, VIII-1885, *F. Loureiro* (COI); Pampilhosa, VII-1883, *A. Moller* (COI). VISEU: Penalva do Castelo, Quinta da Ínsua, VII-1885, *M. Ferreira* (COI); S. Domingos, pr. Castro Daire junto à fonte, na estrada Viseu-Castro Daire, 1-VII-1967, *J. Paiva, J. Matos & M. C. Alves* 9951 (COI); Castro Daire, S. Domingos, 26-VI-1968, *A. Matos* 1458 (COI); Serra da Lapa, corgo do rio Coja, VII-1890, *M. Ferreira* (COI); Caldas de S. Pedro do Sul, VII-1884, *A. Moller* (COI); Caldas de S. Gemil, VII-1886, *A. Moller* (COI); arredores de Viseu, Vildemoinhos, VII-1886, *M. Ferreira* (COI); arredores de Viseu, VII-1886, *M. Ferreira* (COI); Caramulo, V-1892, *A. Moller* (COI); Tondela, VII-1886, *M. Ferreira* (COI); pr. rio Criz, antes de chegar à ponte de Mortágua, 22-VI-1955, *A. Fernandes, J. Matos & A. Matos* 5311 (COI); Oliveira do Conde, VI-1886, *A. Moller* (COI); Carregal do Sal, Póvoa, VI-1886, *A. Moller* (COI). GUARDA: Manteigas, VIII-1881, *J. Daveau* (LISU, P 21564); Manteigas, próximo dos Banhos, VI-1881, *A. R. Cunha* (LISU, P 21545); Vale do Zêzere, próx. da Fonte de Paulo Martins, 3-VI-1949, *Romariz* (LISU, P 1958); Serra da Estrela, X-1879, *Fonseca*

(LISU, P 21550); Serra da Estrela, X-1879, *Fonseca* (COI); Serra da Estrela, VII-1920, *Fernandes* (COI; LISU, P 21535); arredores de Gouveia, Vinhó, VII-1890, *M. Ferreira* (COI); Serra da Estrela, Seia, s. d., *Ficalho* (LISU, P 21562); Serra da Estrela, Sabugueiro, VIII-1914, *M. Ferreira* (COI); Serra da Estrela, Prados de Miranda, VII-1886, *A. Moller* (COI); Serra da Estrela, pr. Valezim, VIII-1881, *J. Henriques* (COI); Serra da Estrela, pr. Valezim, S. Romão, VIII-1881, *J. Henriques* (COI); Valezim, VIII-1881, *J. Daveau* (LISU, P 21565); Serra da Estrela, S. Romão, VI-1883, *Francisco Miranda* (COI); arredores de Gouveia, Melo, VII-1890, *M. Ferreira* (COI); Fornos de Algodres, VIII-1892, *M. Ferreira* (COI). COIMBRA: Moita da Serra, 28-VI-1955, *A. Fernandes, J. Matos & A. Matos* 5721 (COI); Ponte da Mucela, Moura Morta, V-1892, *M. Ferreira* (COI); Serra da Boa Viagem, miradouro, numa mata, 3-VI-1966, *A. Moura* 717 (COI); Matas de Foja, 16-VII-1967, *A. Matos* 223 (COI); entre Gatões e Foja, VII-1896, *M. Ferreira* (COI); Paúl de Foja, VII-1883, *A. Moller* (COI); Zouparria, VI-1883, *A. Moller* (COI); Baleia, V-1876, *M. Ferreira* (COI); Baleia, 19-VI-1967, *A. Matos* 222 (COI); arredores de Coimbra, Rol, VI-1911, *M. Ferreira* 1877 (COI); Quinta dos Maias, VI-1883, *A. Moller* (COI); Vila Franca, VI-1883, *A. Moller* (COI); Santo António dos Olivais, V-1896, *M. Ferreira* (COI); pr. Amieira, na estrada Amieira-Paião, terreno húmido junto a um arrozal, 16-VI-1961, *J. Paiva* 41 (COI); Soure, VII-1890, *A. Moller* (COI); Miranda do Corvo, VII-1883, *A. Leal G. Pinto* (COI); Lousã, VI-1883, *J. Henriques* (COI); Pampilhosa, VII-1886, s. coll. (COI); Serra da Pampilhosa, IX-1887, *J. Henriques* (COI). CASTELO BRANCO: Covilhã, rio Zêzere, VII-1881, *A. R. Cunha* (LISU, P 21566); Unhais da Serra, Ribeira da Estrela, 4-VIII-1940, *R. Palhinha* (LISU, P 21553); Alpedrinha, Bilvos, VI-1882, *A. R. Cunha* (LISU, P 21575); Idanha-a-Nova, VII-1883, *A. R. Cunha* (LISU, P 21573); Ocreza, 1901, *Zimmermann* (COI); arredores de Castelo Branco, VI-1881, *A. R. Cunha* (LISU, P 21567); arredores de Castelo Branco, V-VI-1882, *A. R. Cunha* (COI); Soalheira, S. Fiel, VI-1893, *Zimmermann* (COI); S. Fiel e arredores, 2-VI-1900, *Zimmermann* (COI); S. Cruz, 1899, *J. S. Tavares* (COI); S. Fiel, s. d., *Zimmermann* (COI). LEIRIA: Vermoil, VI-1890, *A. Moller* (COI); Albergaria, VII-1890, *A. Moller* (COI); Ribeira de Alge, estrada Pontão-Figueiró dos Vinhos, 25-VI-1974, *A. Fernandes, R. Fernandes & A. Matos* 12795 (COI). SANTARÉM: arredores de Ferreira do Zêzere, IX-1906, *R. Palhinha* (LISU, P 21556); Ferreira do Zêzere, Pias, IX-1914, *R. Palhinha* (LISU, P 21555); Alferrarede, lugares húmidos, pinhais, VI-1910, *Palhinha, Navel & F. Mendes* (LISU, P 21538); Torres Novas, margem do rio S. Gião, VIII-1880, *A. R. Cunha* (LISU, P 21548). PORTALEGRE: Belver, pr. Abrantes, 1882, *Pereira Coutinho* 1435 (LISU, P 21551); Póvoa e Meadas, Ribeira de Vide, VI-1882, *A. R. Cunha* (LISU, P 21576); arredores de Niza, VI-1914, *M. Ferreira* (COI); entrada de Niza, VI-1881, *A. R. Cunha* (LISU, P 21546); Estação do Vale do Pezo, VI-1881, *A. R. Cunha* (LISU, P 21544); Castelo de Vide, Arieiro, VI-1882, *A. R. Cunha* (LISU, P 21574); Castelo de Vide, Mato da Póvoa, vala com água, 11-VI-1949, *Malato-Beliz* 69 (ELVE 2260); Marvão, estrada da Quinta Nova, VI-1882, *A. R. Cunha* (LISU, P 21541); Vale de Cavalos, na estrada Portalegre-Arronches, 9-VI-1971, *A. Fernandes, R. Fernandes & J. Matos* 11664 (COI); Elvas, VI-1886, *Senna* (COI). LISBOA:

Lezíria da Azambuja, margem do Tejo, VII-1881, *A. R. Cunha* (LISU, P 21542); Vila Franca, Cevadeiro, VI-1879, *A. R. Cunha* (LISU, P 21561); Queluz, pr. de Lisboa, VI-1881, *J. Daveau* (LISU, P 21577); arredores de Lisboa, Ribeira da Cruz Quebrada, IX-1879, *A. R. Cunha* (LISU, P 21578); Cascais, margem do ribeiro de Caparide, VIII-1880, *Pereira Coutinho* 1433 (LISU, P 21552); Montargil, VI-1833, *Cortezão* (COI). SETÚBAL: Corroios, VII-1879, *J. Daveau* (COI); Corroios, VI-1879, *J. Daveau* 601 (LISU, P 21569); Sesimbra, Lagoa de Albufeira, VII-1954, *E. J. Mendes & Romariz* (LISU, P 65421); Arrentela, Rio do Jardim, V-1881, *A. R. Cunha* (LISU, P 21560). BEJA: Ribeira dos Frades, VI-1881, *A. R. Cunha* (LISU, P 21547); entre Garvão e Panoias, VI-VII-1885, *J. Daveau* (LISU, P 21571); Odemira, 1893, *Gonçalo Sampaio* 48 (COI). FARO: lieux humides de la Serra da Picota, près Monchique, Algarve, 14-VI-1853, *Bourgeau* 1841 (COI-Willk.; LISU, P 21543); Monchique, IX-1927, *Palhinha* (LISU, P 21536); Banhos de Monchique, 1-VII-1847, s. coll. (LISU, P 21579); Monchique, arredores das Caldas, 21-IX-1947, *Romariz & E. J. Mendes* 1540 (LISU, P 64980); arredores de Monchique, VIII-1882, *Guimarães* (LISU, P 56308); Monchique VI-1887, *A. Moller* (COI); arredores de Monchique, IX-1883, *A. Guimarães* (COI).

Var. *villosus* (Ser.) Lawalrée in Robyns, Fl. Génér. Belg. 4 (2): 142 (1963).

Lotus corniculatus var. *villosus* Ser. in DC., Prodr. 2: 214 (1825).

Lotus uliginosus var. *villosus* Lamotte, Prodr. Fl. Plat. Centr. Fr. 1: 208 (1877). — Rouy, Fl. Fr. 5: 146 (1899). — Franco, Nova Fl. Port. 1: 378 (1971).

Lotus villosus Thuill., Fl. Env. Par. ed. 2: 387 (1799) nom illegit., non Forsk. (1775).

Lotus corniculatus raç. *longipes* Samp., Man. Fl. Portug.: 244 (1911); Fl. Portug.: 295 (1947).

Lotus pedunculatus var. *villosus* (Thuill.) Samp., Fl. Portug.: 295 (1947) comb. illegit.

Lotus pedunculatus var. *villosus* (Lamotte) O. Bolós & Vigo in Butil. Inst. Cat. Hist. Nat. 38 (Secc. Bot. 1): 71 (1974).

SPÉCIMENS OBSERVÉS

Espagne: ZAMORA: cercanias del Lago de Sanabria, 24-VII-1953, *A. Rodriguez* (MA 199833). SORIA: Agreda, Sierra de Moncayo, 15-VII-1935, *C. Vicioso* (MA 66123). ZARAGOZA: Sierra de Vicort, 8-VII-1906, *C. Vicioso* (MA 66120); Calatayud, Sierra de Moncayo, 4-VIII-1898, *B. Vicioso* (MA 66121). MADRID: Sierra de Guadarrama, 16-VI-1967, *J. Borja* (MA 202806); Escorial, 28-VI-1923, *R. M.* (MAF 39647); Escorial, 7-VII-1852, *Isern* (MA 66115); Puerto de la Cabrera, granitos, suelos encharcados, alt. 1080 m, 15-VII-1968, *S. Silvestre* 2578 (COI); Canal, VII-1892, *J. Mas y Guindal* (MAF 64302). CACERES: bords de la rivièrre près Plasencia, 21-V-1863,

Bourgeau 2421 (COI-Willk.); cercanias del rio Guadarranque, Alia, 25-V-1949, A. Caballero (MA 65954). CUENCA: Uclés, campos húmedos, V-VI-1897, J. S. Tavares (COI). CÁDIZ: Grazalema, lieux humides, 15-VII, E. Reverchon 509 (MA 66143).

Portugal: VIANA DO CASTELO: Montedor, Lagoa, VI-1886, A. R. Cunha (LISU, P 21584). BRAGA: Esposende, IX-1883, A. Sequeira (COI); Cabeceiras de Basto, VI-1881, M. L. Henriques (COI). PORTO: arredores do Porto, Lavra, Bouças, V-1909, Aroso (COI); Matosinhos, entre Pampolide e Boa Nova, s. d., *Gonçalo Sampaio* (PO, 4035 G. S.). VILA REAL: Chaves, Serra do Brunheiro, VII-1890, A. Moller (COI). BRAGANÇA: arredores de Bragança, Vila Nova, VI-1879, M. Ferreira (COI); Bragança, lameiros, bordas dos rios, VII-1887, *Pereira Coutinho* 1434 (LISU, P 21580); Argoselo, V-1921, P.^e *Miranda Lopez* 342 (COI); Argoselo, 21-VI-1923, *Taborda de Moraes* (COI); Miranda do Douro, margens do rio Fresno, VI-1915, *Palhinha & F. Mendes* (LISU, P 21582). AVEIRO: Ílhavo, bordas dos caminhos, 30-VI-1901, *Gonçalo Sampaio* (PO, 4034 G. S.); Pateira de Fermentelos, 7-VIII-1969, J. Magalhães & Norberto 61 (COI). VISEU: arredores de Viseu, Vildemoinhos, VII-1886, M. Ferreira (COI); Viseu, à saída para Satão, 23-VII-1973, A. Matos 6912 (COI); Sernancelhe, s. d., M. Soveral (COI); Rio de Mel, estrada Viseu-Castro Daire, 15-VII-1974, A. Matos & Pimenta 12925 (COI); Santa Comba-Dão, VII-1883, A. Moller (COI). GUARDA: Pocinho, ribeiro pr. Estação, VI-1915, *Palhinha & F. Mendes* (LISU, P 21554); Almeida, pr. rio Coa, VI-1890, M. Ferreira (COI); Vilar Formoso, Folha da Raza, VI-1884, A. R. Cunha (LISU, P 21585); Trancoso, VI-1890, M. Ferreira (COI); Arrifana, ribeiro da Aldeia, 8-IX-1942, J. G. Garcia 45 (COI); arredores da Guarda, VIII-1881, J. Daveau 13 (COI); arredores da Guarda, VII-1885, M. Ferreira (COI); estrada Sabugal-Vilar Formoso, a 2 km de Sabugal, 16-VII-1975, Ormonde, A. Dinis & E. Santos 13439 (COI); Manteigas, no Zêzere, VIII-1881, J. Daveau (LISU, P 21588); Serra da Estrela, Vale do Zêzere, nas margens do rio, VIII-1954, J. Abreu 64 (ELVE, 2259); Serra da Estrela, em volta do Poço do Inferno, 24-VII-1952, *Malato-Beliz, Gonçalves & Ruivo* 1379 (ELVE 2262); Serra da Estrela, Poço do Inferno, 16-VII-1952, *Malato-Beliz, Gonçalves & Ruivo* 1253 (ELVE 2261); Serra da Estrela, Cocharil, 12-VIII-1940, R. Palhinha (LISU, P 21581); Linhares da Beira, VII-1890, M. Ferreira (COI); Gouveia, VII-1890, M. Ferreira (COI). COIMBRA: Buarcos, VII-1890, A. Goltz (COI); Figueira da Foz, Tavadede, VII-1894, M. Ferreira (COI); S. Fagundo, arrozais, s. d., A. Rozeira, D. Barreto, A. Serra & J. Araújo (PO 13965); Choupal, VII-1882, F. Miranda (COI). CASTELO BRANCO: Teixoso, VII-1881, A. R. Cunha (LISU, P 21589); Vila Velha de Rodão, nas margens do Tejo, terreno arenoso, 29-IX-1955, B. Rainha 3009 (LISE). LEIRIA: Pinhal do Urso, VI-1895, F. Loureiro (COI); Lourical, Gardunha, VI-1890, Vaz Serra (COI); Caldas da Rainha, s. d., M. Albuquerque (PO, 4044 G. S.); Peniche, Berlengas e Farihães, VI-1924, G. Sobrinho 1353 (ELVE 2263); Peniche, V-1924, *Palhinha & J. J. Barros* (LISU, P 546). SANTARÉM: Valado, Águas Belas, IX-1889, A. R. Cunha (LISU, P 21583); Lagoa de Óbidos, 18-VI-1880, M. Albuquerque (PO 4033 G. S.). PORTALEGRE: Serra de S. Mamede, pr. Reguengo, junto à fonte do Açude, nas margens de um regato, 30-IV-1957, *Malato-Beliz & al.* 4164

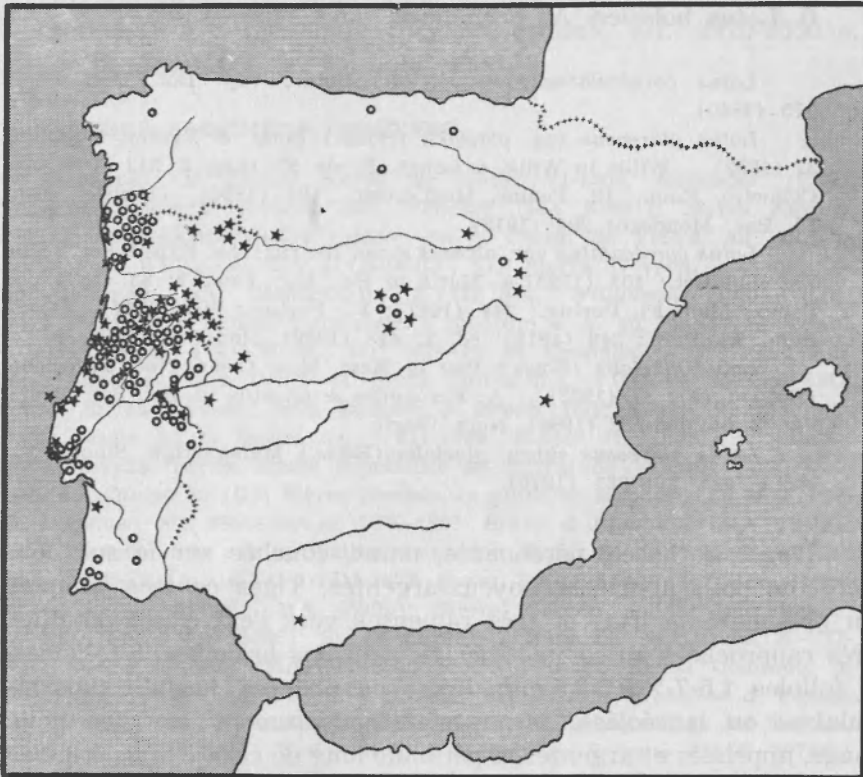
(ELVE 8737). LISBOA: entre Sintra e Colares, 16-VI-1961, *Malato-Beliz & J. A. Guerra* 5139 (ELVE 10717); arredores de Lisboa, Loures, VII-1880, *A. R. Cunha* (LISU, P 21590); Sintra, IV-1881, *H. de Mendia* (COI); margem do ribeiro de Caparica, VIII-1881, *Pereira Coutinho* (COI). SETÚBAL: Lagoa de Melides, beira da lagoa, 29-V-1968, *A. Rozeira & A. Serra* (PO 13966). S. L., s. d., s. coll. (LISU, P 21591); Pinhal do..., VII-1890, *A. Moller* (COI).

Quelques auteurs [VICIOSO (loc. cit.), SAMPAIO (loc. cit.), A. & O. DE BOLÒS (loc. cit.), LAÍNIZ (loc. cit.), LAWALRÉE (loc. cit.), HEATH (loc. cit.), MAGALLON (loc. cit.), BOLÒS & VIGO (loc. cit.), etc.] considèrent le *Lotus pedunculatus* Cav. et le *L. uliginosus* Schkuhr comme une seule espèce, le nom de la première ayant la priorité, tandis que d'autres, particulièrement CHRTKOVÁ-ZERTOVÁ (loc. cit.), P. W. BALL & CHRTKOVÁ-ZERTOVÁ (loc. cit.) et FRANCO (loc. cit.), admettent qu'il s'agit de deux espèces distinctes.

Dans le but de justifier son point de vue, CHRTKOVÁ-ZERTOVÁ [in *Folia Geobot. Phytotax. (Praha)* 1 (1): 78-87, 1966] discute le problème en détail, en présentant des figures (3-5) et un tableau mettant en contraste les différences entre le *L. uliginosus* Schkuhr et le *L. pedunculatus* Cav. À notre avis, aucune des différences indiquées ne se maintient lorsqu'on examine une abondante collection de plantes de la Péninsule Ibérique, puisqu'on constate qu'il y a toutes les formes de transition entre *L. pedunculatus* et *L. uliginosus*.

CHRTKOVÁ-ZERTOVÁ (loc. cit.) a identifié comme *L. pedunculatus* Cav. des plantes récoltées par BOURGEAU (n.º 1841 de COI et LISU) au Portugal, à la Serra da Picota, près Monchique, en Algarve. Cependant, il y a d'autres récoltes faites aussi à Monchique qui correspondent exactement aux plantes herborisées par BOURGEAU (voir notre liste des spécimens du var. *pedunculatus*). Malgré cela, quelques unes des ces plantes [LISU, P 21579, 21536, 56308, 64980, *A. Guimarães* (COI) et *A. Moller* (COI)] ont été identifiées par le même auteur comme *L. uliginosus* Schkuhr, ce qui confirme l'avis que nous partageons, qu'il n'existe qu'une seule espèce, c'est-à-dire, le *L. pedunculatus* Cav., nom qui, comme nous l'avons remarqué, a la priorité.

Nous n'avons pas observé le type du *L. granadensis* Zertová. P. W. BALL & CHRTKOVÁ-ZERTOVÁ (in *Fl. Eur.* 2: 175, 1968) admettent qu'il peut s'agir d'une sous-espèce du *L. pedunculatus* Cav. Nous croyons plutôt que, dans une espèce si variable en



- Lotus pedunculatus*
 ◦ var. *pedunculatus*
 * var. *villosus*

Fig. 4. — Carte montrant la distribution du *L. pedunculatus* (vars. *pedunculatus* et *villosus*) dans la Péninsule Ibérique d'après les spécimens examinés.

ce qui concerne la pubescence, la forme des folioles et le nombre des fleurs par inflorescence et à très large aire géographique, il y aura toutes les formes de transition entre le type du *L. pedunculatus* et le *L. granadensis*, qui pourra représenter seulement une forme sans valeur taxonomique du *L. pedunculatus* à folioles arrondies ou largement obovées et subitement acuminées.

La distribution dans la Péninsule Ibérique du *L. pedunculatus* est montrée sur la fig. 4.

6. *Lotus boissieri* A. Fernandes, nom. nov. — Tab. I.

Lotus corniculatus var. *glacialis* Boiss., Voy. Bot. Midi Esp.: 175 (1840).

Lotus glareosus var. *glacialis* (Boiss.) Boiss. & Reuter, Pugillus: 37 (1852). — Willk. in Willk. & Lange, Prodr. Fl. Hisp. 3: 343 (1877). — Colmeiro, Enum. Pl. Penins. Hisp.-Lusit.: 191 (1886). — Henriq., Esb. Fl. Bac. Mondego: 204 (1913).

Lotus corniculatus var. *alpinus* sensu Henriq., Rei. Exped. Sci. Serra Estrella, Bot.: 101 (1883). — Mariz in Bol. Soc. Brot. 2: 83 (1884). — Samp., Man. Fl. Portug.: 244 (1911); Fl. Portug.: 295 (1947). — Coutinho, Fl. Port.: 349 (1913); ed. 2: 418 (1939). Non Ser. (1825).

Lotus glacialis (Boiss.) Pau in Mem. Mus. Cienc. Nat. Barcelona (Bot.) 1 (1): 37 (1922). — A. Fernandes & Queirós in Bol. Soc. Brot., Sér. 2, 54: 133-152 (1980). Nom. illegit.

Lotus glareosus subsp. *glacialis* (Boiss.) Malagarriga, Sinops. Fl. Ibér., fasc. 39: 621 (1976).

Plante herbacée, pérennante, naine, couchée sur le sol, couverte de poils apprimés, soyeux-argentés. Tiges courtes, simples ou presque à la base et très rameuses vers l'extrémité. Feuilles très rapprochées au sommet des tiges et des branches, 3-foliolées, à folioles $1,5-7 \times 0,5-3,5$ mm, ovées ou obovées jusqu'à suborbiculaires ou lancéolées, recouvertes \pm densément par des poils longs, apprimés et argentés, à pétiole long de ca. 0,5 mm; stipules ressemblant les folioles; pétiole jusqu'à 2,5 mm de long, légèrement canaliculé à la face supérieure, poilu. Fleurs longues de 9-11 mm, solitaires, quelquefois en paires, jaunes-rougeâtres. Pédoncule jusqu'à 12 mm de long, à poils apprimés; pédicelles ca. 0,5 mm de long. Calice bilabié, à tube obconique, ca. 3 mm de long, à poils apprimés; dents supérieures à base triangulaire, aiguës, ca. 3 mm de long, courbées et conniventes vers l'extrémité, les laterales aussi courbées, mais divergentes et l'inférieure généralement un peu plus courte que les autres. Étendard rougeâtre, à limbe suborbiculaire, émarginé au sommet, subitement contracté en onglet largement canaliculé, ne verdissant pas par dessiccation; ailes obliquement subtronquées au sommet; carène courbée à angle presque droit, courtement rostrée, le sommet dépassant les ailes. Légume jusqu'à 20 mm de long, linéaire, à valves spiralées après la déhiscence. Graines ca. 1,5 mm de long, \pm ellipsoïdales, brunes, à hile latérale. $2n = 12$.

Fl. Jul.-Août; fr. Août-Sept.

Habitat: «in altissimis *Sierra Nevada*», alt. 2970-3300 m, VIII-1837, *Boissier* s. n. (G, holotypus).

AUTRES SPÉCIMENS OBSERVÉS

Espagne: CACERES: Sierra de Gata, VI-1904, *Gandoger* (COI). GRANADA: Sierra Nevada, 1801, *Thacker* (MA 65991); Sierra Nevada, in glareosis regionis nivalis copiose, en el Corral de Veleta, alt. 2900 m, 26-VII-1844, *Willkomm* 205 (COI-Willk.; G) Sierra Nevada, borrequil de San Geronimo, alt. 2640-2970 m, 3-VIII-1844, *Willkomm* (COI-Willk.); Sierra Nevada, in lapidosis summorum jugorum e. g. ad Piacho de Veleta, VIII-1848, *Funk* (COI-Willk.; G); Montes de Granada y Cádiz, in glareosis humidis fluvii Darro et prope Grazalema, VII-1849, *Reuter* (MA 65990); Sierra Nevada, 1849, *Boissier & Reuter* (G); Sierra Nevada, reg. nivalis prope de la Cueva de..., VII-1849, *Reuter* (G; LISU G 31568); Sierra Nevada, region alpine supérieure au Corral de Veleta, 21-VII-1852, *Pedro del Campo* 30 (G); Sierra Nevada, in glareosis m.^{tes} Piacho de Veleta, solo schistoso, alt. 2800-3000 m, VIII-1891, *Porta & Rigo* 513 (MA 65988); Sierra Nevada, loc. arenos. vallium superior. flum. Soril et Monachil sol. schist., 2300-2500 m, 16-VII-1-VIII-1879, *Huter, Porta & Rigo* 747 (G); Sierra Nevada, s. d., s. col. (MA 65992); Sierra Nevada, in lat. meridionali, 1-VI-1902, *Pau* (MA 65989); Sierra Nevada, Laguna de las Yeguas, 20-VII-1925, *Cortés Latorre* (MAF 85560); Sierra Nevada, Penon Colorado, in saxosis glareosisque ad 3000 m, loc. class., 5-VIII-1930, *Ceballos & Vicioso* (MA 65987); Sierra Nevada, prados inmediatos de la Laguna de las Yeguas, alt. 2970 m, 4-VIII-1947, *Muñoz Medina y Amparo Serrano* (MAF 39715); Sierra Nevada, prados inmediatos de la Laguna de las Yeguas, alt. 2970 m, 4-VIII-1947, *Muñoz Medina y Amparo Serrano* 355 (MA 65955); Sierra Nevada, Hoya de la Mora, in pratis humidis, solo siliceo, alt. 2400 m, 25-VIII-1978, *J. Fernandez Casas* (COI).

Portugal: BRAGANÇA: Cabeço de S. Bartolomeu, VI-1884, *A. Moller* s. n. (COI). GUARDA: Serra da Estrela, Penha do Gato, alt. 1760 m, VIII-1881, *Daveau* (LISU); Serra da Estrela, Covão do Boi, VII-1884, *Fonseca* (LISU).

La distribution du *L. boissieri* A. Fernandes dans la Péninsule Ibérique est montrée sur la fig. 2.

Comme nous l'avons remarqué, **BOISSIER** (loc. cit.) a créé le *L. corniculatus* var. *glacialis* pour y ranger des plantes des régions élevées de la Sierra Nevada. Plus tard, **BOISSIER & REUTER** transfèrent la variété dans l'espèce qu'ils venaient de décrire, en devenant ainsi *L. glareosus* var. *glacialis* (Boiss.) Boiss & Reuter. En 1922, **PAU** (loc. cit.) élève le *L. corniculatus* var. *glacialis* Boiss. à la catégorie d'espèce qu'il désigne par le nom

de *L. glacialis* (Boiss.) Pau, en même temps qu'il range le *L. glareosus* Boiss. & Reuter, publié en 1852, comme variété dans cette espèce.

Étant donné que, d'après PAU (loc. cit.), *L. glacialis* (Boiss.) Pau et *L. glareosus* Boiss. & Reuter appartiennent à la même espèce, le nom *L. glacialis* (Boiss.) Pau est illégitime, puisqu'il y a dans la catégorie d'espèce le nom antérieur de *L. glareosus* Boiss. & Reuter. De cette façon, si on considère le var. *glacialis* comme une espèce indépendante du *L. glareosus*, ce qui correspond à notre avis, il faut créer un nom nouveau. Nous avons donc choisi celui de *L. boissieri* en hommage au botaniste qui a reconnu ce taxon comme une entité distincte et auquel la botanique péninsulaire doit autant.

7. *Lotus glareosus* Boiss. & Reuter, Pugillus: 36 (1852). — Láz.-Ibiza, Comp. Fl. Esp.: 250 (1907). — P. W. Ball & Chrtková-Zertová in Fl. Eur. 2: 174 (1968). — Guinea & Ceballos, Elenco Fl. Vasc. Esp.: 111 (1974).

Lotus corniculatus var. *arvensis* Brot., Fl. Lusit. 2: 121 (1804), non *L. arvensis* Pers. in Usteri, Ann. Bot. 14: 39 (1795).

Lotus corniculatus sensu Samp., Man. Fl. Portug. 244 (1911) excl. var. *pedunculatus*, var. *alpinus* et raça *longipes*, non L. (1753).

Lotus corniculatus sensu Samp., Fl. Portug.: 295 (1947) excl. var. *alpinus* et raça *longipes*, non L. (1753).

Plante pérennante, herbacée, couchée sur le sol ou ascendante, verte, jusqu'à 40 cm de long. Racine pivotante produisant plusieurs tiges, celles-ci allongées, durcies à la base, pleines ou quelquefois à fistule étroite à la base, rameuses, striées, glabres, glabrescentes, éparsément ciliées ou à poils denses et \pm dressés. Feuilles 3-foliolées, à folioles 4-15 \times 2-7 mm, le plus souvent obovées, parfois lancéolées ou ovées, apiculées au sommet, glabres, glabrescentes, éparsément ciliées ou à poils denses \pm dressés et à petiolule ca. 0,5 mm de long; stipules ressemblant les folioles; pétiole jusqu'à 5 mm de long, beaucoup plus court que les stipules. Pédoncule 5-13 cm de long, glabre ou à poils épars et apprimés, pourvu au sommet d'une feuille sans stipules, parfois à une seule foliole 6 \times 2 mm, lancéolée. Ombelles (1) 2-6-flores. Fleurs 10-13 mm de long, d'un jaune-rougeâtre; pédicelles jusqu'à 2 mm de long, souvent réfléchis; calice bilabié, à tube long de 3-4 mm, glabre ou à poils épars et apprimés ou \pm velu et à dents jusqu'à 6 mm

de long, à base triangulaire, s'atténuant progressivement vers le haut, les supérieures courbées, séparées à la base par un sinus obtus et conniventes vers l'extrémité, les latérales aussi courbées, mais divergentes. Étendard arrondi, ca. 6,5 mm de diamètre, émarginé au sommet, subitement contracté en onglet largement canaliculé, devenant rougeâtre par dessiccation; ailes obliquement subtronquées au sommet, 6 × 3 mm et à onglet ca. 2 mm de long; carène courbée en angle presque droit, courtement rostrée, dépassant légèrement les ailes. Légume linéaire, droit. 2n = 10.

Fl. et fr.: Mars-Août.

Habitat dans les terrains pierreux ou sablonneux, prairies, champs, bois, etc., particulièrement sur les sols granitiques, mais aussi sur les schistes et moins souvent sur les calcaires.

Plantes glabres, pubescentes ou éparsément ciliées sur les tiges, bords des folioles et sur les calices var. *glareosus*
Plantes ± densément velues, à poils ± dressés var. *villosus*

Var. *glareosus* — Pl. II.

Lotus corniculatus var. *gracilis* Willk. in Willk. & Lange, Prodr. Fl. Hisp. 3: 343 (1877) pro parte quoad spemim. glabra vel glabrescentia in Gallec. et in Cast. Nova lect. et excl. syn. — Mariz in Bol. Soc. Brot. 2: 83 (1884) pro parte quoad specim. glabra vel glabrescentia et excl. syn. — Henriq., Esb. Fl. Bac. Mondego: 204 (1913).

Lotus corniculatus var. *vulgaris* sensu Henriq., Rei. Exped. Sci. Serra Estrella, Bot.: 101 (1883), non Willk. (1877).

Lotus corniculatus var. *genuinus* sensu Mariz in Bol. Soc. Brot. 2: 83 (1884). — Henriq., Esb. Fl. Bac. Mondego: 204 (1913). Non Willk. (1877).

Lotus corniculatus var. *ciliatus* sensu Mariz, loc. cit. excl. syn. — Henriq., loc. cit. Non Koch (1835).

Lotus corniculatus var. *arvensis* forma *typicus* Coutinho, Fl. Port.: 349 (1913); ed. 2: 418 (1939).

Lotus corniculatus var. *arvensis* forma *ciliatus* sensu Coutinho, loc. cit. 1913 et 1939, non Koch (1835).

Lotus glacialis (Boiss.) Pau var. *glareosus* (Boiss. & Reut.) Pau in Mem. Mus. Cien. Nat. Barcelona, Bot. 1 (1): 37 (1922), comb. illegit.

Lotus corniculatus var. *corniculatus* sensu Franco, Nova Fl. Port.: 378 (1971), non L. (1753).

SPECIMENS OBSERVÉS

Espagne: LA CORUNA: cercanias del Ferrol, VI-1894, *Candida Seoane* (COI-Willk.); Puente Maceira, 22-IV-1951, *Bellot & Casaseca* (MA 178809). PONTEVEDRA: Villaboa, San Adrián, 1-VI-1970, *Castroviejo* (MA 197651).

LEÓN: Villaruso de Mena, s. d., *Salcedo* 852 (MA 66170). ALAVA: Ali, orillas de los campos, s. d., *Gredilla* (MA 65915). MADRID: Valdemoro, 6-VII-1857, *Isern* (MA 66016). GUADALAJARA: Trillo, VII-1821, *Conde* (MA 65971). CIUDAD REAL: El Osero, 3-VII-1934, *Gz. Albo* (MA 66021). JAEN: Sierra de Segura, barranco de Rocaveros, above rio Segura, edge of stream, alt. 1030 m, 21-VII-1955, *Heywood* (MA 175427); Sierra de Segura, El Campillo, Pinetum clusianae, meadows, alt. 1410 m, 21-VI-1955, *Heywood* 2676 (MA 175426). MÁLAGA: Sierra Almijara, Canada del Agua, 23-VI-1935, *Modesto Laza* (MAF 39713); Cómpea, Canada del Agua, 23-VI-1935, *Modesto Laza* (MA 65993). GRANADA: in glareosis hummidis fluvii Darro pr. Granatam, VII-1849, *Reuter* (G); in arenosis regionis callidae, prope monasterium Jesus dei Valle ad fluvium Darro haud... ab urbe Granada, alt. 800 m, 20-VI-1845, *Willkomm* (COI-Willk.); ad aquaeductum Alhambrae pr. conventum Jesus dei Valle, raro, 20-VI-1845, *Willkomm* 909 (COI-Willk.); Sierra Nevada, Canar, in pascuis humidis reg. montanae, 27-VII-1930, *C. Vicioso* (MA 65994); Lanjaron, Sierra Nevada, in pascuis montanis, 25-VII-1930, *C. Vicioso* (MA 65995). ALMERIA: Rago, 18-V-1929, *Gros* (MA 65996). S. LOCL.: s. d., s. coll. (MA 65997).

Portugal: VIANA DO CASTELO: Melgaço, pr. das muralhas, VI-1885, *A. R. Cunha* (LISE); pinhal da Raposeira, VI-1885, *A. R. Cunha* (LISE); Montedor, Pinhal da Gandra, VI-1886, *A. R. Cunha* (LISE). BRAGA: Serra do Gerês, XI-1882, *Capello & Torres* (LISU, P 21478); Serra do Gerês, Caldas, V-1885, *M. Ferreira* (COI); Serra do Gerês, Torgo, VI-1884, *A. Moller* (COI); Serra do Gerês, Caldas, V-1907, *J. S. Tavares* (COI); Cabeceiras de Basto, 1878, *M.ª Henriques* (COI); Tibães, V-1883, *A. Sequeira* (COI); montes de Guimarães, VI-1902, *A. Luisier* (COI); arredores de Guimarães, Lordelo, IV-1900, *A. Machado* (COI). PORTO: Santo Tirso, Escola Agrícola, Bouça, V-1932, *D. F. Vilhena* (LISE); arredores do Porto, Ermesinde, V-1882, *H. T. Bastos* (LISU, P 56343). VILA REAL: arredores de Montalegre, VI-1910, *Palhinha, Navel & F. Mendes* (LISU, P 21476). BRAGANÇA: Vila Verde, Cabanelas, 12-V-1970, *A. Fernandes, R. Fernandes & J. Matos* 11003 (COI); Serra da Nogueira, VI-1915, *Palhinha & F. Mendes* (LISU, P 21525). AVEIRO: Castelo de Paiva, IV-1899, *João Salema* (COI); arredores de Águeda, ponte do Alfusqueiro, VI-1884, *J. Henriques* (COI); Bussaco, V-1883, *F. Loureiro* (COI). VISEU: Adorigo, V-1881, *Barão de Schmitz* 248 (COI; LISU); S. Pedro do Sul, a 1 km das Termas, 8-VI-1973, *A. Fernandes, R. Fernandes & A. Matos* 12438 (COI); estrada Vouzela-Caramulo, antes do ramal para Vilarinho, 10-VI-1973, *A. Fernandes, R. Fernandes, J. Matos & A. Matos* 12526 (COI); Serra do Caramulo, Vila de Rei de Besteiros, VIII-1941, *G. da Cunha* (LISU, P 1419); arredores de Tondela, Lobão, V-1892, *A. Moller* (COI). GUARDA: Seia, 1848, *Wehwitsch* (LISU, P 21479). COIMBRA: Travanca de Lagos, 16-V-1885, *Canto e Castro & Rodrigues Nogueira* (COI); Serra da Lousã, fonte do Sótão, VI-1883, *J. A. Guimarães* (COI); Góis, ponte do Sótão, VI-1883, *J. Henriques* (COI); entre a Catraia do Farropo e Pampilhosa da Serra, a 14 km de Pampilhosa da Serra, terreno xistoso, nas bermas da estrada, 8-VI-1962, *A. Fernandes, R. Fernandes & J. Matos* 8554 (COI); Cantanhede, IV-1880, *A. Moller* (COI); Mata de Foja, 19-VI-1936, *F. de Sousa* (COI); Quiaios, pinhais do litoral, 15-V-1933, *Fernandes Costa* 349

(COI); Quiaios, pr. Figueira da Foz, 2-VI-1923, *Carrisso & Mendonça* (COI). CASTELO BRANCO: Oleiros, 25-V-1954, *B. Rainha* 2614 (LISE); S. Fiel, V-1907, *J. S. Tavares* (COI); S. Fiel, 1901, *Zimmermann* (COI). LEIRIA: pinhal de Leiria, V-1884, *C. Pimentel* (COI). SANTARÉM: Cadaval, Serra de Montejunto, pr. Pedreira na vertente da Abrigada, 11-V-1947, *E. J. Mendes* (LISU, P 64359). LISBOA: Montargil, V-1883, *J. S. Cortezão* (COI); Caneças, V-1884, *J. Daveau* 1066 (COI; LISU, P 21477); in collinis editionibus prope Montemor et Corçussus, IV-1845, *Wehwitsch* (LISU); Sintra, pr. S. Pedro, 29-V-1938, *Rothmaler* 13389 (LISE); Sintra, 12-V-1944, *B. Rainha* 249 (LISE). SETÚBAL: Alcácer, Charnecas, III-IV-1880, *J. Daveau* (LISU, P 21438). FARO: Samouqueira, pr. Vila do Bispo, V-1906, *Palhinha & F. Mendes* (LISU, P 21487).

Var. *villosus* Boiss. & Reuter, *Pugillus*: 36 (1852). — Henriq., *Rel. Exped. Sci. Serra Estrella, Bot.*: 101 (1883).

Lotus corniculatus var. *gracilis* Willk., op. cit. 345 pro parte quoad specim. villos. in *Gallec. et in Cast. Nova lect. et excl. syn.*

Lotus corniculatus var. *villosus* Willk., op. cit. 344 quoad specim. prov. Granat. et Extremad. et excl. syn. — Henriq., *Rel. Exped. Sci. Serra Estrella, Bot.*: 101 (1883); *Esb. Fl. Bac. Mondego*: 204 (1913). — Mariz in *Bol. Soc. Brot.* 2: 83 (1884) excl. syn.

Lotus corniculatus var. *arvensis* forma *hirsutus* sensu Coutinho, *Fl. Port.*: 349 (1913); ed. 2: 418 (1939), non var. *hirsutus* Koch (1835).

Lotus corniculatus var. *pilosus* Willk. forma *villosus* (Willk.) Merino, *Fl. Galicia* 1: 349 (1935).

Lotus carpetanus Lacaita in *Cavanillesia* 1: 10 (1928).

Lotus corniculatus var. *hirsutus* sensu Franco, *Nov. Fl. Port.* 1: 378 (1971), non Koch (1835).

SPÉCIMENS OBSERVÉS

Espagne: LUGO: Monteseiro-Fonsagrada, VII-1957, *E. Carreira* (MA 170284). OVIEDO: in valle supra Pajares, 14-VII-1892, *A. E. Lomax* (MA 65952). PONTEVEDRA: Costa de Oya, s. d., *Merino* (MA 65975); Caldas de Reyes, en los prados, 1-VIII-1894, *V. L. Seoane* (COI-Willk.). ORENSE: Carratera de Pinor, 22-V-1905, *Herb. Bescansa* (MA 152221); Castelo de Mino, Sierra de S.^{ta} Marta, 18-VII-1935, *A. Rodriguez* (MA 65950). GALICIA: Lamas, 13-V-1933, *J. Cuatrecasas* 3802 (MAF 39635); Pena Corneira, granitos, 13-V-1933, *J. Cuatrecasas* (MAF 39636); cerca de Xesta, 14-V-1933, *J. Cuatrecasas* 3804 (MAF 39637); s. d., *Merino* (MA 66097). LEÓN: Puerto de Ponton, VI-1909, *Gandoger* (COI). BURGOS: Pancorbo, 2-VI-1899, *Gandoger* (MA 66080). NAVARRA: Sierra Urbasa, VII-1930, s. coll. (MA 65913), SORIA: Espejo de Tera, in rupestribus, 24-V-1934, *Ceballos & Vicioso* (MA 66075); Buimanco, 30-V-1934, *L. Ceballos* (MA 66076). SALAMANCA: ad Penagarcia, solo siliceo, 15-V-1956, *Lainz & F. Suarez* (COI). AVILA: Navarredonda, 7-VIII-1852, *Isern* (MA 66077); Pinar de Hoyocasero, 19-VI-1945, *A. Caballero* (MA 66078); Avila, VI-1900, *Barras* (MA 66079). MADRID:

Poveda, VIII-1925, *Cátedra* (MAF 39652); Alhama y Totatna (tambien cerros secos del Escorial), 18-VI-1904, *Reyes* (MA 65956); Escorial, 15-VI-1851, *Lange* (MA 66074); Escorial, collibus siccis, 13-VI-1851, *Lange* (COI-Willk.); Escorial, in dumetis, 16-V-1897, *Pau* (MA 66059); El Escorial, 20-V-1924, *Font Quer* 320 (MA 66060); Buitrago, in rupestribus, 1-VI-1918, *C. Vicioso* (MA 66061); Dehesa de Somosierra, in pascuis saxosis, 18-VI-1918, *C. Vicioso* (MA 66065); Braojos, Pto. de Arcones, in glareosis, 31-V-1918, *C. Vicioso* (MA 66062); Braojos, in pratis, VI-1918, *C. Vicioso* (MA 66073); Sierra de Guadarrama, Canencia, in graminosis rupestribusque, 7-VI-1916, *C. Vicioso* (MA 66063); Arganda, in collibus siccis, V-1915, *C. Vicioso* (MA 66066); Sierra de Guadarrama, Cercedilla, in rupestribus, V-1914, *C. Vicioso* (MA 66067); Sierra de Guadarrama, Cercedilla, in graminosis rupestribusque humidis, VI-1929, *M. Martínez* (MA 175429); Nuevo Baztán, 16-V-1854, *Isern* (MA 66068); El Paular, 12-VI, *Cutanda* (MA 66069); Guadarrama, 18-VI, s. coll. (MA 66070); Chozas, 15-VI, *Isern* (MA 66071); San Martín de Valdeiglesias, 2-V, *Cutanda* (MA 66072); Monte de Paredes, Paredes de Buitrago, arroyo de la huerta, 5-VII-1954, *J. Merino* (MA 202801); Miraflores, 25-VI-1954, *L. C. & C. R.* (MA 202802). GUADALAJARA: Guadalajara, 2-V, *Isern* (MA 66081). CÁCERES: Pelouses à Gerte près Plasencia, 5-VI-1863, *Bourgeau* (COI-Willk.); Penas Altas sobre Banos de Montemayor, 11-VI-1945, *A. Caballero* (MA 66106); Banos de Montemayor, prados del Puerto de Bejar, 13-V-1944, *A. Caballero* (MA 66089). JAEN: Sierra Mágina, Pena Gragera, alt. 1900 m, 30-VI-1925, *J. Cuatrecasas* (MA 66099). CÁDIZ: entre Chipicna y Rota, bordos del camino, 22-IX-1967, *B. Valdés* (MA 192647). MÁLAGA: Sierra de la Nieve de Ronda, 11-12-VII-1919, *E. Gros* (MA 66096). GRANADA: S.^a Nevada, in glareosis ad fluv. Monachil, VII-1849, *Reuter* (G); S.^a Nevada, reg. media ad fluv. Monachil, VII-1849, *Reuter* (G); in monte Sierra de Harana? provincia granatensis, alt. 1280-1600 m, 2-VII-1845, *Willkomm* (COI-Willk.).

Portugal: VIANA DO CASTELO: arredores de Melgaço, VI-1894, *A. Moller* (COI); Melgaço, Oliveira, VI-1885, *A. R. Cunha* (LISU, P 21503); Valença, Pinhal da Raposeira, *A. R. Cunha*, VI-1885 (LISU, P 21486); entre Valença e Gândara, na berma da estrada para S. Bento da Porta Aberta, sítios um tanto arrelvados, 17-IV-1946, *M. Silva* 686 (COI; LISE); Caminha, Camarido, VI-1885, *A. R. Cunha* 91 (COI; LISU, P 21572); Caminha, pinhal do Camarido, VI-1885, *A. R. Cunha* (LISE); Caminha, arredores da Estação, VI-1885, *A. R. Cunha* 92 (COI); Montedor, Pinhal da Gandra, VI-1886, *A. R. Cunha* 13 (COI; LISU, P 21485 et 21524); pr. Apúlia, pinhais, 30-VII-1949, *Romariz* (LISU, P 2042); Praia de Montedor, nas fendas das rochas, 24-VI-1968, *A. Fernandes, R. Fernandes & J. Matos* 10614 (COI); serra de S.ta Luzia, *Myre & Fontes* 275 (LISE); pinhal do Monte de Santa Luzia, VI-1886, *A. R. Cunha* (LISE; LISU, P 21523); Ponte da Barca, Santa Eulália de Ruivas, s. d., *A. Rocha Peixoto* (COI); Serra do Soajo, Portela do Bentinho, VII-1890, *A. Moller* (COI). BRAGA: Serra do Gerês, a 22 km das Termas, alt. 1450 m, por entre a rocha granítica, 3-VII-1967, *J. Paiva, J. Matos & M. C. Alves* 10004 (COI); Termas do Gerês, campos e regatos, V-1907, *J. S. Tavares* (COI); Gerês,

Pedra Bela, VI-1391, *A. Moller* (COI); Serra do Gerês, entre Borrageirinho e curral da Mesa, num ribeiro (Água da Cigarra), 6-VIII-1948, *A. Rozeira, J. Alte & J. Castro* (PO, 13940); Serra do Gerês, entre Preguiça e Leonte, 1-VII-1948, *Sobrinho & Romariz* (LISU, P 1048); Serra do Gerês, pr. Reserva da Abelheirinha, 5-VII-1948, *R. Fernandes & Sousa* 2465 (COI); Serra do Gerês, berma da estrada, pr. Reserva da Abelheirinha, 5-VII-1948, *R. Fernandes & Sousa* 2457 (COI); Serra do Gerês, Caldas, V-1885, *M. Ferreira* (COI); Póvoa de Lanhoso, IV-1883, *A. S. Couceiro* (COI); Cunha, IV-1899, *A. S. Torres* (COI). PORTO: arredores de Vila do Conde, IV-1886, *J. Craveiro* (COI); Serra do Pilar, V-1887, *A. V. Araújo* (COI); entre Cristim e o rio Leça, 2-V-1948, *P. Silva* 7077 (LISE); Gaia, 29-VI-1917, *Mário de Castro* (MA 65903); Vila Nova de Gaia, Afurada, s. d., s. coll. (COI). VILA REAL: arredores de Montalegre, VI-1910, *Palhinha, Navel & F. Mendes* (LISU, P 21481, 21511 et 21530); Montalegre, Corujeira, 16-VI-1943, *Gomes Pedro* 9091 (LISE); Carrazedo, III-1910, *A. A. Pavão* (COI). BRAGANÇA: arredores de Vimioso, Vale de Frades, VI-1888, *J. Mariz* (COI; LISU, P 21529); Vimioso, pr. Argozelo, 15-VI-1959, *A. Teles & B. Rainha* 755 (LISE); Vimioso, Argozelo, s. d., *P. Miranda Lopes* 79 (COI); Vimioso, pr. Argozelo, num arrelvado ruderalizado, 15-VI-1959, *A. Teles & B. Rainha* 755 (MA 192645); Montesinho, Alto do Facho, VI-1884, *A. Moller* (COI); arredores de Bragança, V-1887, *Pereira Coutinho* 1432 (LISU, P 21493 et 21494); pr. Soeira, 21-VI-1968, *P. Silva & Teles* 8246 (LISE); solo anfibólitico, 6-VII-1970, *P. Silva & Teles* 8724 (LISE); pr. Paço, 7-VI-1970, *P. Silva & Teles* 8732 (LISE); margens do Sabor, VI-1915, *Palhinha & F. Mendes* (LISU, P 21510); Cabeço de S. Bartolomeu, VI-1884, *A. Moller* (COI); arredores de Bragança, 27-V-1941, *A. Carneiro* 143 (COI); arredores de Bragança, V-1874, *Paulino d'Oliveira* (COI); arredores de Bragança, V-1877, *M. Ferreira* 28 (COI); Campo Redondo, VI-1884, *A. Moller* (COI); estrada Mogadouro-Freixo de Espada à Cinta, à saída de Mogadouro, cabeço de rochedos, nas fendas das rochas, 16-VI-1958, *A. Fernandes, R. Fernandes & J. Matos* 6485 (COI); arredores de Moncorvo, Assureira, V-1887, *J. Mariz* (COI); arredores de Moncorvo, Maçores, V-1887, *J. Mariz* (COI); Moncorvo, V-1887, *J. Mariz* (COI); Serra de Rebordãos, Carvalhal, VII-1897, *J. Mariz* (COI); Serra de Rebordãos, VI-1884, *A. Moller* (COI). AVEIRO: Serra da Freita, V-1902, *J. Henriques* (COI); Sernada, pr. de Albergaria-a-Velha, num pinhal, 23-IV-1965, *A. Fernandes, R. Fernandes & J. Paiva* 9588 (COI); Frossos, Albergaria-a-Velha, terreno saibroso, inculto, 22-V-1954, *J. Matos, A. Matos & A. Marques* 4899 (COI); arredores de Aveiro, IX-1894, *E. Mesquita* (COI); ilhavo, Ermida, terreno arenoso inculto, 20-V-1954, *J. Matos, A. Matos & A. Marques* 4808 (COI); arredores de Agueda, ponte do Alfusqueiro, VI-1884, *J. Henriques* (COI); Bussaco, V-1885, *J. Henriques* (COI); Bussaco, VI-1904, *F. Mendes* (LISU, P 21484); Estação da Pampilhosa, V-1884, *A. R. Cunha* (LISE). VISEU: Armamar, Gogina, 30-V-1931, *F. de Vilhena & J. Vasconcellos* (LISE); arredores de Lamego, V-1886, *Carminé Coelho* (COI); Tabuaço, IV-1892, *C. de Lima* (COI); Adorigo, V-1881, *Schmitz* 248 (LISE; LISU, P 21534); Serra da Lapa, corgo do rio Coja, VII-1890, *M. Ferreira* (COI); S. Pedro do Sul, no ramal para Tepim,

9-VI-1973, *A. Fernandes, R. Fernandes, J. Matos & A. Matos* 12450 (COI); Caramulo, V-1892, *A. Moller* (COI); Caramulinho, 10-VI-1973, *A. Fernandes, R. Fernandes, J. Matos & A. Matos* 12546 (COI); Silgueiros, V-1886, *H. Marques Cortez* (COI); Lobão, arredores de Tondela, V-1892, *A. Moller* (COI); Idem, *M. Ferreira* (COI). GUARDA: Vilar Formoso, lameiros, VII-1890, *M. Ferreira* (COI); arredores da Guarda, VII-1885, *M. Ferreira* (COI); Arrifana, 24-IV-1943, *J. G. Garcia* 114 (COI); entre Maçainhas e Corujeira, 20-V-1973, *A. Fernandes, R. Fernandes & A. Matos* 12357 (COI); acima da estrada do Caldeirão, 12-VI-1949, *R. Fernandes & Sousa* 3197 (COI); Carris de Famalicão, 20-V-1973, *A. Fernandes, R. Fernandes & A. Matos* 12340 (COI); Carris de Famalicão, 20-V-1973, *A. Fernandes, R. Fernandes & A. Matos* 12341 (COI); entre Mato Fôjo e os Perciros, a caminho do Seixo Amarelo, encosta granítica exposta a leste, 17-VI-1953, *A. Fernandes, R. Fernandes & F. Sousa* 4404 (COI); Serra da Estrela, margens da ribeira de Beijames, VI-1882, *A. R. Cunha* (LISE; LISU, P 21497); Serra da Estrela, ao km 8 da estrada Manteigas-S. Lourenço, 18-XI-1975, *M. Correia & J. Cardoso* 4399 (COI; LISU); entre o Zêzere e Manteigas, VII-1881, *A. R. Cunha* (LISU, P 21506); Alto Zêzere, V-1933, *Palhinha* (LISU, P 1433); estrada das Penhas Douradas a Seia, pr. Sabugueiro, 16-VI-1949, *R. Fernandes & F. Sousa* 3424 (COI); Serra da Estrela, Mondeguinho, 13-VI-1973, *J. Matos* (COI); Serra da Estrela, VI-1882, *M. Ferreira* (COI); Serra da Estrela, Fraga das Penhas, VI-VII-1882, *A. R. Cunha* (LISU, P 21517); Serra da Estrela, Souto de Valezim, VI-1883, *Fonseca* (COI); Serra da Estrela, Poio Negro, VII-1886, *A. Moller* (COI); Serra da Estrela, Lagoa Comprida, VI-1882, *M. Ferreira* (COI); Serra da Estrela, Lagoa Comprida, 20-V-1949, *Braun-Blanquet & al.* (LISE); Serra da Estrela, S. Romão, VII-1879, *Fonseca* (COI); S. Romão, VIII-1881, *J. Henriques* (LISU, P 21492); S. Romão, 8-V-1944, *J. G. Garcia* 292 (COI); Seia, pr. Hospital, Fonte do Marvão, num pinhal, 8-V-1961, *J. Matos, F. Cardoso & A. Marques* 7861 (COI). COIMBRA: S. Martinho da Cortiça, V-1892, *M. Ferreira* (COI); Ponte da Mucela, IV-1883, *M. Ferreira* (COI); Ponte da Mucela, V-1892, *M. Ferreira* (COI); Ponte da Mucela, Moura Morta, V-1892, *M. Ferreira* (COI); Valdoeiro, arredores da Vacariça, IV-1888, IV-1888, *M. Ferreira* (COI); entre Cova do Ouro e Dianteiro, 1-V-1945, *M. Silva* 766 (LISE); Mata da Baleia, IV-1883, *A. Moller* (COI); Baleia, V-1876, *A. Moller* (COI); pinhal de Vale de Canas, V-1883, *A. Moller* (COI); Coimbra, *A. Moller* 718 (LISU, P 21489); Penedo da Meditação, V-1887, *A. Valle* (COI); Penedo da Melancolia, IV-1886, *A. Moller* 147 (COI); Penedo da Saudade, V-1882, *J. A. Guimarães* (LISU, P 56344); Cernache, pr. de Coimbra, Venda do Cego, V-1911, *M. Ferreira* (COI); Antanhol, Cidade Velha da Mata, 28-VI-1958, *A. Fernandes, B. Neves & J. Matos* (COI); Figueira aa Foz, Quiaios, 25-V-1976, *A. Matos & M. C. Alves* 13566 (COI); Carapinheira do Campo, Boa Joia, IV-1885, *C. Joyce Diniz* (COI); Lousã, VI-1883, *J. Henriques* (COI); Lousã, V-1883, *J. A. Guimarães* (COI); Miranda do Corvo, pr. de Godinhela, na barreira da estrada, 15-V-1968, *A. Fernandes, R. Fernandes & J. Paiva* 10567 (COI); Miranda do Corvo, VI-1885, *B. F. Mello* (COI); Arneiro, faldas da serra de Soure, 17-V-1931, *G. Cunha &*

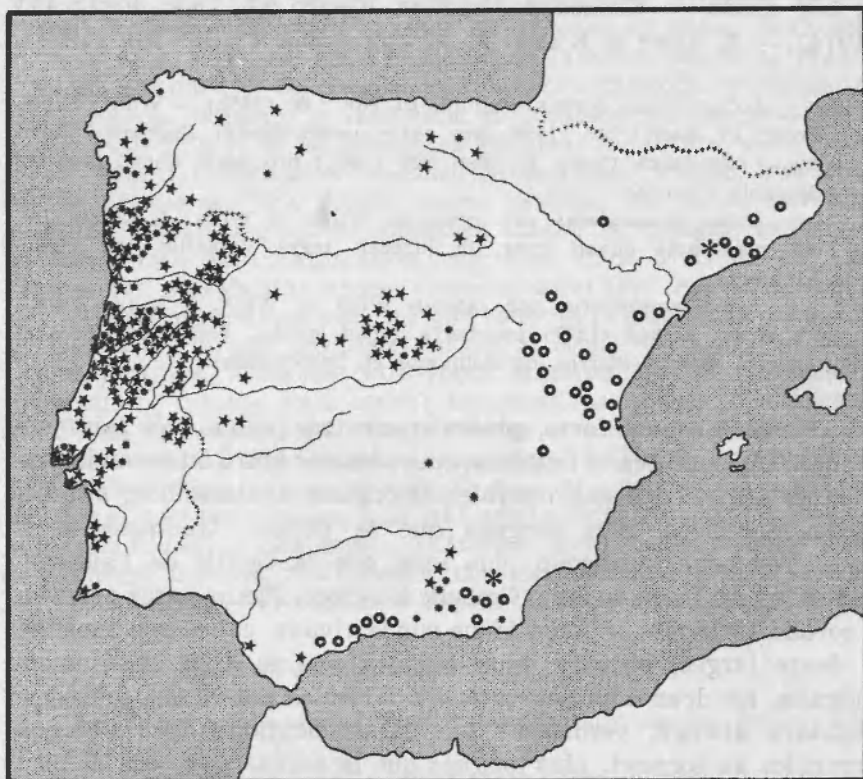
Sobrinho (LISU). CASTELO BRANCO: rio Zêzere e Covilhã, VI-VII-1881, A. R. *Cunha* (LISU, P 21509); Covilhã, pr. Rosa Negra, 23-VI-1948, B. *Rainha* 1166 (LISE); Covilhã, Unhais da Serra, VI-1897, J. A. *Vaz Serra* (COI); Alcaide, Barroca do Chorão, VI-1882, A. R. *Cunha* (LISU, P 21520); Saião do Alcaide, VI-1882, A. R. *Cunha* (LISU, P 21586); Alcaide, sítio da Serra, VI-1882, A. R. *Cunha* (LISE); S. Martinho, VI-1882, A. R. *Cunha* (LISE); Serra de Alpedrinha, VI-1882, A. R. *Cunha* (LISU, P 21528); Penamacor, 20-VI-1948, B. *Rainha* 1673 (LISE); rio Ocreza, VI-1881, A. R. *Cunha* (LISU, 21487); Castelo Branco, a 1 km para N, nas aluviões, 24-IV-1966, A. *Moura* 654 (COI); Soalheira; S. Fiel, V-1899, *Zimmermann* (COI); Cernache do Bonjardim, cerca do Colégio, VI-1890, M. M. *Barros* 154 (COI); S. Fiel e arredores, in arenosis, 15-IV-1900, *Zimmermann* (COI); S. Fiel, 1901, *Zimmermann* (COI); Serra da Melriça, V-1902, J. *Silva Tavares* (COI); entre Vila Velha de Ródão e Castelo Branco, searas de centeio, 18-IV-1955, *Malato-Beliz & al.* 1805 (COI; LISE); Malpica, monte de Bradadouro, VI-1882, A. R. *Cunha* (LISU, P 21521). LEIRIA: Pinhal do Urso, V-1895, F. *Loureiro* (COI); Pinhal do Urso, V-1888, M. *Ferreira* (COI); Figueiró dos Vinhos, IV-1888, J. V. *Freitas* (COI); Pinhal de Leiria, IV-1917, G. *Felgueiras* (COI). SANTARÉM: Caxarias, V-1879, J. *Daveau* (LISU, P 21508); Ferreira do Zêzere, V-1914, M. *Ferreira* (COI); entre Ferreira do Zêzere e Tomar, V-1914, M. *Ferreira* (COI); Alcanede, pr. Pé da Pedreira, 30-V-1958, B. *Rainha* 3549 (LISE); Alto da Serra, na estrada Batalha-Rio Maior, terreno calcário de cultivo, 23-IV-1970, A. *Fernandes*, R. *Fernandes* & J. *Matos* 11059 (COI); Montejunto, pr. Cercal, Espinhaço do Cão, VI-1879, J. *Daveau* (LISU, 21500); Serra de Montejunto, pr. Pedreira na vertente da Abrigada, 11-V-1947, E. J. *Mendes* (LISU, P 4860). PORTALEGRE: estrada Bemposta-Ponte de Sor, a 1 km de Bemposta, 16-V-1976, T. *Leitão* & A. *Matos* 13546 (COI); Póvoa e Meadas, pr. ribeira de Soure, VI-1882, A. R. *Cunha* (LISU, P 21505); Boi d'Água, VI-1882, A. R. *Cunha* (LISU, P 21532); Castelo de Vide, Serra de S. Mamede, 1949, *Malato-Beliz* (LISE); Castelo de Vide, Prado, VI-1882, A. R. *Cunha* (LISU, P 21498); Castelo de Vide, Arieiro, VI-1882, A. R. *Cunha* (LISE); Marvão, Escusa, VI-1882, A. R. *Cunha* (LISU, P 21533); Marvão, S. Salvador, VI-1882, A. R. *Cunha* (COI); Senhora da Penha, VI-1882, A. R. *Cunha* (COI; LISE); LISU, P 21522); Casa Alta, VI-1882, A. R. *Cunha* (LISU, P 21531). LISBOA: Lezíria da Azambuja, VI-1882, A. R. *Cunha* (LISE); inter Montemor et Caneças, IV-1845, *Welwitsch* (LISU, P 21480); Caneças, Serra de Montemor, V-1884, *Oliveira David* 248 (COI; LISE); LISU, P 21491 et 21504); Quinta de Penha Verde, in herbicis, 25-V-1852, *Welwitsch* (LISU); Colares, III-1882, J. *Daveau* (LISU, P 21587); Caneças, V-184 (LISU, P 21496); Sintra, Tapada do Mouco, V-1927, J. *de Vasconcellos* 1747 (LISE); Sintra, entre Linhó e Cruz Alta, 29-V-1938, *Rothmaler* 13390 (COI; LISE); Sintra, arredores do Pinhal Escouto, pr. Mercês, 30-IV-1944, B. *Rainha* 225 (LISE); Sintra, pr. Castelo dos Moiros, V-1909, J. *dos Santos* (LISU, P 21501); Sintra, V-1887, A. *Moller* (COI); Sintra, Chão do Menino, IV-1909, J. *dos Santos* (LISU, P 21495); Sintra, V-1880, H. *de Mendia* (COI); Sintra, VI-1884, *Sophia R. S.* (COI); Monserrate, III-1883, A. R. *Cunha* (LISE); Belas, 9-V-1956, B. *Rainha* 3198 (LISE); Trafaria, XII-1912,

s. coll. (LISU, P 21537); Alfeite, V-1878, *J. Daveau* (LISU, P 21507); Pinhal do Marechal, próx. Alfeite, IV-1881, *A. R. Cunha* (LISU, P 21499). SETÚBAL: Pegões, V-1928, *A. Seabra* (LISE); Azeitão, IV-1880, *A. Moller* (COI); Serra da Arrábida, IV-1880, *A. Moller* (COI); Vale do Pixaleiro, V-1901, *A. Luisier* (COI); Sesimbra, pr. Alto da Apostiça, 20-V-1943, *M. Silva & Lourenço* 240 (LISE); Alcácer do Sal, terrenos arenosos, 30-IV-1947, s. coll. (LISU, P 21526); Deixa-o-Resto, estrada Melides-S. Tiago do Cacém ao km 38, 18-III-1973, *Barros Neves, J. L. Cabral, A. Matos & M. C. Alves* 12283 (COI); Santiago de Cacém, 14-V-1953, *A. Teles, B. Rainha & P. Silva* 585 et 583 (LISE); Sines, ribeira dos Moinhos, 13-IV-1946, *B. Rainha* 1015 (LISE); Cabo de Sines s. d., s. coll. (LISU, P 21514). ÈVORA: Vendas Novas, encosta da Serra da Arriça, 16-IV-1946, *Garcia & Sousa* 1307 (COI); Vendas Novas, Polígono, 10-IV-1946, *Garcia & Sousa* 972 (COI); Vendas Novas, Cova do Boi, Serra da Arriça, 16-IV-1946, *Garcia & Sousa* 1300 (COI). BEJA: entre Vila Nova de Mil Fontes e Cercal, IV-1886, *J. Daveau* (LISU, P 21512). FARO: Vila do Bispo, 27-III-1962, *B. Rainha* 5233 (LISE); entre Santa Catarina e Sagres, V-1906, *Palhinha & F. Mendes* (LISU, P 21482).

Bien que les deux variétés se distinguent sur le terrain par le fait que le var. *glareosus* présente une couleur verte tandis que le var. *villosus* montre une tonalité griseâtre, il y a toutes les formes de transition entre elles en ce qui concerne la pubescence. D'autre part, comme la fig. 5 le montre, les deux taxa se trouvent mélangés dans toute l'aire de distribution, bien que le var. *villosus* soit le plus fréquent. Cette distribution suggère que le var. *glareosus* correspond, peut-être, à une ségrégation de caractères récessifs existant dans les populations.

Après la description du *L. glareosus* Boiss. & Reuter, P. W. BALL & CHRTKOVÁ-ZERTOVÁ (in Fl. Eur. 2: 174, 1968) ajoutent: «Variable and possibly containing two species. One relatively dwarf with dense, silvery, appressed hairs and small leaflets, peduncles and pedicels, the other larger, with patent hairs and larger leaflets, peduncles and pedicels». En référence à cette note, on constate que la première entité admise par les auteurs cités correspond aux plantes croissant dans les régions élevées de la Sierra Nevada, Sierra de Gata, Serra da Estrela et Bragança, lesquelles, comme nous l'avons déjà mentionné, ont, tout d'abord, été considérés comme *L. corniculatus* var. *glacialis* Boiss., ensuite comme *L. glareosus* var. *glacialis* (Boiss.) Boiss. et Reuter, après comme *L. glacialis* (Boiss.) Pau et finalement comme *L. boissieri* A. Fernandes dans ce travail.

La seconde entité correspond au *L. glareosus* Boiss. & Reuter, lorsqu'on sépare de cette espèce le var. *glacialis* (Boiss.) Boiss.



- *Lotus glareosus* var. *glareosus*
- * *Lotus glareosus* var. *villosus*
- *Lotus delortii* var. *delortii*
- * *Lotus delortii* var. *rivasi*

Fig. 5. — Carte montrant la distribution dans la Péninsule Ibérique du *Lotus glareosus* Boiss. & Reuter et du *L. delortii* Timb.-Lagr. ex F. W. Schultz, d'après les spécimens examinés.

& Reuter que nous avons élevé à la catégorie d'espèce. Nous croyons donc que le problème est ainsi résolu d'accord avec la suggestion de P. W. BALL & CHRTKOVÁ-ZERTOVÁ.

8. *Lotus delortii* Timb.-Lagr. ex F. W. Schultz in Arch. Fl. Fr. Allem.: 201 (1852). — Ujhelyi in Ann. Hist.-Nat. Mus. Hung. 52: 191 (1960). — P. W. Ball & Chrtková-Zertová in Fl. Eur.

2: 174 (1968). — Guinea & Ceballos, *Elenco Fl. Vasc. Esp.*: 111 (1974). — A. Löve & Kjellqvist in *Lagasalia* 4 (2): 161 (1974).

Lotus pilosus Jordan, *Pugillus Pl. Nov.*: 60 (1852). — Willk., *Suppl. Prodr. Fl. Hisp.*: 243 (1892) pro parte quoad specim. *Serraniae Cuencae*. — Láz.-Ibiza, *Comp. Fl. Esp.* 259 (1907) pro parte quoad distr. in *Serrania Cuencae*.

Lotus corniculatus var. *genuinus* Willk. in Willk. & Lange, loc. cit. pro parte quoad distr. in littorali regni Valentini (ad lacum *Albufera*).

Lotus corniculatus var. *villosus* Willk. in Willk. & Lange, *Prodr. Fl. Hisp.*: 3: 344 (1877) pro parte quoad specim. *Sierra de Chiva et Aragon. austr.* (*Sierras de Belmonte et Torrevellilla*).

Plante à souche forte, généralement très poilue, très rarement glabre. Tiges minces et flexibles, couchées sur le sol ou ascendantes. Folioles 4-9 × 1,5-3 mm, obovales-oblongues, acutiuscules; stipules ovales-lancéolées, plus longues que le pétiole, tronquées à la base. Pédoncule beaucoup plus long que la feuille de l'aisselle; pédicelles ca. 1 mm de long. Ombelle 2-4-flore. Fleurs assez grandes, à corolle 12-18 mm de long, jaune sur le vivant; calice zygomorphe, à dents larges, obtuses, plus longues que le tube, légèrement inégales, les deux supérieures et les latérales nettement courbées; étendard allongé, verdissant par la dessiccation; ailes obovées, arrondies au sommet, plus longues que la carène. Légume 20-35 × 2,5-3 mm. Graines subglobuleuses. 2n = 24.

Plante velue var. *delortii*
 Plante glabre var. *rivasii*

Var. *delortii*

SPÉCIMENS OBSERVÉS

Espagne: ZARAGOZA: Calatayud, Sierra de Vicort, 10-VII-1910, *C. Vicioso* (MA 66082); Calatayud, Sierra de Vicort, 10-VII-1910, *C. Vicioso* (MA 66083); Daroca, in collibus siccis, 30-V-1907, *C. Vicioso* (MA 66084); Daroca, 10-V-1907, *C. Vicioso* (MA 66085); Sierra de Atea, 30-V-1909, *C. Vicioso* (MA 66086). HUESCA: Aineto, Monte Aineto, parcela «El Salto», 31-VII-1953, *L. C. & A. R.* (MA 202800). CATALUÑA: S.^{ta} Creu d'Olorde, VIII-1914, *A. Caballero* (MA 65963). GERONA: Figueras, 21-IV-1901, *Sennen* (MA 65920); Figueras, s. d., *Reyes* (MA 65921). TERUEL: ...de Segura, s. d., *J. Benedicto* (MA 66087); Campo do Bello, s. d., *D. Almagno* (MA 66088); Monroyo, 1881, *Loscos* (MA 66112); Fuentes de Rubielos,

VIII-1884, s. coll. (MA 66113); Sierra de Jabalambre, Arcos de Salinas, IV-1962, *S. Arjá* (MA 178810); Alcalá de la Selva, S.^a Gúdar, 29-VI-1955, *J. Borja & A. Rodríguez* (MA 199836). TARRAGONA: Sierra de Prades, Vimbodí, 3-IV-1934, *J. Cuatrecasas* (MAF 39662). CUENCA: Cordillera de las sierras de Belmonte y Torrevelilla in Aragonia australis, V-VI-1860, *Loscos* (COI-Willk.); en los rodenos de Boniches, 10-VII-1974, *Ginés Lopez* (MAF 91586). CASTELLÓN: Zucaina, Villahermosa, VI-1895, *Pau Herbarium Hispanicum* (MA 66090); Sierra Espádan, alt. 900 m, 16-V-1908, *Pau* (MA 66092); Algimia de Almonacid «Corral de Orenga», 10-VI-1914, *F. Beltrán* (MA 66094). ALBACETE: Sierra del Vidrio, 3-VI-1934, *Gz. Albo* (MA 66022). VALENCIA: Fredes Valenciae, 25-VI-1917, *Pau* (MA 66093); in graminosis regionis montanae, in regno Valentino in pratis haud proval (?) a fonte lateris borealis cacuminis Malouco in monte Sierra de Chiva, alt. 1120 m, 6-VI-1844, *Willkomm* (COI-Willk.). MALAGA: Farajan, in dumetis, 8-IV-1931, *L. Ceballos* (MA 66107); Benahavis, La Maquina, in dumetis, 24-IV-1931, *L. Ceballos* (MA 66108); Canillas de Abaida, 30-V-1931, *L. Ceballos* (MA 66109); Sierra Tejada, sobre caliza, 8-VI-1914, *J. Cuatrecasas* (MA 66110); Sierra Tejada, VI-1919, *E. Gros* (MA 66111); Sierra Tejada, alt. 1800 m, 9-VI-1935, *Modesto Laza* (MA 65894). GRANADA: Sierra Nevada, VIII-1931, *F. Beltrán* (MA 65998). ALMERIA: Sierra de los Filabres, Calar del Gallinero, Barcares, 20-VI-1929, *E. Gros* 841 (MA 66095); zona superior de Sierra de Gador, VI-1962, *Losa Espana & Rivas Goday* (MAF 90421).

Var. rivasii A. Fernandes, var. nov.

Lotus catalaunicus Sennen in sched. quoad specim. *Sennen* 6559 (MA 65923).

Lotus glareosus var. *mariana* Rivas Goday in sched.

Lotus corniculatus var. *montserratensis* Pau in sched.

A typo planta omnino glabra et leguminibus interdum lutescentibus praecipue differt.

Fl. & fr. Maj.-Jun.

SPECIMENS OBSERVÉS

BARCELONA: Montserrat ad viam regiam, 8-V-1905, *C. Marcel* (MA 65958); Massif du Tibidabo, sur le schiste et l'argile, 1928, *Sennen* 6559 (MA 65923). ALMERIA: Sierra Maria, 15-VI-1960, *S. Rivas Goday* (MAF 82942, holotypus).

Remarques caryologiques

Le nombre chromosomique de quelques espèces des Lotiers du groupe *corniculatus* a été déterminé dans des plantes croissant à la Péninsule Ibérique, comme le Tableau I le montre.

TABLEAU I

Espèces	Localités	Nombre diploïde	Auteur
<i>Lotus tenuis</i> Waldst. & Kit. ex Willd.	Espagne: Hipódromo de Madrid	12	CHUECA (1975)
<i>Lotus corniculatus</i> L.	Espagne: Minao, pr. Bilbao	24	K. LARSEN (1954)
	Espagne: Pena Bargindia, au sud d: Bilbao, alt. 400 m	24	Idem
	Espagne: Santander, Picos de Europa, Jou Sin Terre, alt. 1940 m	24	KÜPPER (1974)
<i>Lotus boissieri</i> A. Fernandes	Espagne: Sierra Nevada	12	K. LARSEN (1953)
	Espagne: Sierra Nevada	12	A. FERNANDES & QUEIRÓS (1980)
<i>Lotus glareosus</i> Boiss. & Reuter	Espagne: Madrid, Sierra de Guadarrama (1)	10	ANGULO & REAL (1976)
	Portugal: Serra do Gerês, Carris (2)	10	A. FERNANDES & M. FÁTIMA SANTOS (1975)
	Portugal: Serra de Valongo (2)	10	Idem
	Portugal: Trás-os-Montes, entre Tourém et Covelãs	10	A. FERNANDES, QUEIRÓS & SANTOS (1977)
	Portugal: Amarante, route vers Vila Real	10	Idem
	Portugal: Caldeira, entre Fafe et Gandarela	10	Idem
	Portugal: Vila Nova de Gaia, Afurada	10	Idem
	Portugal: Alpedrinha	10; 10 + 1 et 10 + 3 (3)	Idem
<i>Lotus pedunculatus</i> Cav. (<i>L. uliginosus</i> Schkuhr) (4)	Portugal: Serra do Gerês	12	A. FERNANDES & M. FÁTIMA SANTOS (1971)
	Portugal: Castro Daire, S. Domingos	12	Idem
	Portugal: Coimbra, Baleia	12	Idem

TABLEAU I (Suite)

Espèces	Localités	Nombre diploïde	Auteur
	Portugal: Matas de Foja	12	Idem
	Portugal: Meleças	12	A. FERNANDES & M. FÁTIMA SANTOS (1975)
	Portugal: Viseu, le long de la route vers Satão	12	A. FERNANDES & QUEIRÓS (1978)
<i>Lotus delortii</i> Timb.- Lagr. ex F. W. Schultz	Espagne: Prov. de Teruel, Sierra de Albarracin, Sierra Alta	24	A. LÖVE & KJELLQVIST (1974)

(¹) Sous le nom de *Lotus castellanus* Boiss. & Reuter.

(²) Sous le nom de *Lotus corniculatus* vel aff.

(³) Il s'agit probablement de chromosomes surnuméraires hétérochromatiques.

(⁴) Nous considérons le *L. uliginosus* Schkuhr et le *L. pedunculatus* Cav. comme une seule entité spécifique.

D'autres espèces existant dans la Péninsule Ibérique ont été étudiées sur du matériel d'autres provenances. Telles sont le *L. alpinus* qui possède $2n = 12$ et qui a été étudiée dans des plantes des Alpes (FAVARGER, 1953; LARSEN, 1953, 1954; GRANT, BULLEN & NETTANCOURT, 1962; HARVEY & GRANT, 1965; CHENG & GRANT, 1973) et des Pyrénées françaises (KÜPFER, 1974), le *L. preslii*, à $2n = 24$ (CHUECA, 1975), sur du matériel provenant du Jardin des Plantes de Montpellier (à notre avis, obtenu à partir de graines récoltées probablement sur la côte française de la Méditerranée) et le *L. palustris* à $2n = 12$ (voir GRANT, 1965). On constate donc que, chez les Lotiers du groupe *corniculatus*, les nombres de base 6 et 5 existent et que les *L. corniculatus*, *L. preslii* et *L. delortii* sont des espèces tétraploïdes à base 6.

Nous avons signalé (FERNANDES, 1951, p. 163-164) que chez *Narcissus bulbocodium* L. les formes diploïdes habitent particulièrement les montagnes, tandis que les formes polyploïdes se distribuent dans les régions plus basses allant jusqu'au littoral. Cependant, dans ce cas, les formes polyploïdes ne présentent pas, par rapport aux diploïdes, des différences morphologiques suffisantes pour être considérées comme des espèces distinctes,

sauf peut-être en ce qui concerne *N. obesus* Salisb., qui est une forme hypotétraploïde. Des cas semblables dans lesquels il y a des espèces diploïdes sur les montagnes et des espèces tétraploïdes voisines sur les plaines ont été signalés par FAVARGER dès 1954. À ce phénomène, KÜPFER (1974) donne le nom de pseudo-vicariance alpino-planitiaire et il présente, en dehors d'autres, le cas du *Lotus alpinus* (orophyte diploïde des régions élevées des Alpes et des Pyrénées) en confrontation avec le *Lotus corniculatus* (tétraploïde des plaines ou des régions moins élevées). KÜPFER signale aussi que le même arrive dans la Sierra Nevada, «avec cette seule réserve que dans ce dernier massif montagneux, le *Lotus alpinus* est remplacé par le *Lotus glareosus*, taxon très affine» (voir aussi FAVARGER, 1975).

Les études que nous avons menées à bout dans le sous-groupe des espèces à calice bilabié nous permettent de développer le problème de la vicariance chez ce sous-groupe. La plante qui, en réalité, correspond au *L. alpinus* dans les sommets de la Sierra Nevada est le *L. boissieri* A. Fernandes, espèce dans laquelle FERNANDES & QUEIRÓS (1980) ont dénombré $2n = 12$, en accord avec les résultats de LARSEN (1953). Dans la Sierra de Gata en Espagne et dans la Serra da Estrela et la région de Bragança au Portugal, on trouve des plantes tout à fait semblables à celles des sommets de la Sierra Nevada, lesquelles ont été identifiées tout d'abord par HENRIQUES (1913) comme *L. glareosus* var. *glacialis* et par SAMPAIO (1911; 1947) et COUTINHO (1913; 1939) comme *L. corniculatus* var. *alpinus*. Malheureusement, nous n'avons pas réussi à étudier au point de vue caryologique des plantes de ces localités. Donc, nous ne savons pas si elles possèdent aussi $2n = 12$ ou bien $2n = 10$. Dans le dernier cas, nous ne serions pas en présence du vrai *L. boissieri*, mais d'un accommodat aux sommets des montagnes de Gata, Estrela et Bragança du *L. glareosus* var. *villosus*. Le fait que, chez quelques échantillons de ces localités, les poils sont \pm dressés au lieu d'apprimés parle en faveur de la dernière hypothèse.

Dans les régions à moyenne altitude de la Sierra Nevada, on trouve des plantes correspondant aux vars. *glareosus* (= *glabrescens* Boiss. & Reuter) et *villosus* Boiss. & Reuter du *L. glareosus*. Ces plantes, qui possèdent probablement aussi $2n = 10$, se sont répandues vers le nord et l'ouest de la Péninsule Ibérique,

en occupant particulièrement les régions granitiques, soit des montagnes, soit des plaines.

FERNANDES & QUEIRÓS (1980) ont discuté le mécanisme au moyen duquel des plantes à $2n = 12$ (appartenant probablement au *L. boissieri* ou à un ancêtre commun) ont donné naissance à d'autres à $2n = 10$. Il est curieux de remarquer que le cas du *L. boissieri* - *L. glareosus* est comparable à celui du *L. alpinus* - *L. corniculatus* avec la seule différence que, dans le premier cas, il y a eu dysploïdie au lieu de polyplôïdie dans la naissance de la nouvelle espèce.

Le *L. glareosus* var. *villosus* ressemble beaucoup le *L. delortii*. Cette dernière espèce est, comme A. LÖVE & KJELLQVIST (loc. cit.) l'ont montré, un tétraploïde dont l'aire de distribution comprend le sud et l'est de l'Espagne, le sud de la France et le nord de l'Italie. Il s'agit d'une plante calcicole, existant aussi dans la partie calcaire de la Sierra Nevada. Nous pourrions donc dire que ces deux taxa sont pseudo-vicariants, un sur les terrains siliceux du sud (en partie), du centre-ouest et du nord de la Péninsule, l'autre sur les calcaires du sud et de l'est.

Etant donné les ressemblances entre le *L. glareosus* var. *villosus* et le *L. delortii* d'une part et entre le premier taxon et le *L. boissieri* d'autre part, nous pourrions penser que les espèces *L. glareosus* et *L. delortii* se sont différenciées à partir du *L. boissieri* ou plus probablement d'un ancêtre de cette espèce au moyen d'un mécanisme différent (dysploïdie pour le *L. glareosus* et tétraploïdie pour le *L. delortii*).

Il semble que le *L. tenuis* est un diploïde à $2n = 12$ dans toute son aire de distribution (voir GRANT, 1965 et la bibliographie citée, ainsi que PRZYWARA & SCHMAGER, 1967, qui ont trouvé ce nombre chez des plantes provenant de la Grande Bretagne, Danemark, Pologne, Hongrie, France et Jugoslavie). Les plantes de l'Espagne sont aussi des diploïdes (CHUECA, 1975).

CHUECA (1975) a constaté que le *L. preslii* est un tétraploïde à $2n = 24$. Les chromosomes des *Lotus* ne sont pas très adéquats à l'analyse des caryotypes, puisqu'ils sont assez petits et ne montrent pas facilement leurs caractères (position des constriction et satellites). Néanmoins, en comparant l'idiogramme du *L. tenuis* avec celui du *L. preslii*, on constate que, en mettant de côté des différences qui pourront être attribuées à des translocations de segments courts, le second correspond à la

duplication du premier. Il est donc probable que le *L. preslii* soit un autotétraploïde engendré à partir du *L. tenuis*. Cette idée s'accorde avec les données de la morphologie externe ainsi qu'avec l'écologie, le *L. preslii* étant un écotype adapté à des concentrations plus salines des marécages du littoral et des salines de l'intérieur.

Quant au *L. alpinus*, KÜPFER (1974) a dénombré $2n = 12$ dans des plantes des Pyrénées françaises (Ariège, Llaurenti, alt. 2200 m; Pyrénées Orientales, Pic Péric, versant S, alt 2450 m; Hautes Pyrénées, Soum des Salètes, alt. 2700 m; et Hautes Pyrénées, Petit Pic du Tapou, Vallé d'Ossoue, alt, 2550 m), ce qui s'accorde avec le nombre déterminé dans les plantes des Alpes.

À notre connaissance, des plantes de cette espèce des Pyrénées espagnoles n'ont pas encore été étudiées du point de vue caryologique. À notre avis, cette étude aurait de l'importance dans le but de mettre en évidence s'il s'agit en réalité du vrai *L. alpinus* ou d'un accommodat aux altitudes élevées du *L. corniculatus*. L'étude des échantillons espagnols que nous avons identifiés comme *L. alpinus* montre qu'ils s'écartent un peu du type par le fait que celui-ci est plus vigoureux, possède les calices, les tiges et les folioles plus densément ciliés et les folioles en général plus grandes. Cependant, on sait que le degré de villosité de cette espèce est très variable, ce que nous avons constaté chez les plantes de Panticosa où il y a des individus nettement ciliés comparables au type et d'autres presque glabres. Des plantes de Camprodón, Font del Boix, possèdent aussi des calices ciliés.

Nous avons été amené à confirmer la détermination de *L. alpinus* faite par VICIOSO en ce qui concerne la plante de Peña Vieja de Picos de Europa, puisqu'elle s'accorde avec les échantillons des Pyrénées espagnoles que nous avons examinés. Dans les plantes de Picos de Europa récoltées à Jou Sin Tierre, à l'alt. de 1940 m, KÜPFER (1974) a dénombré $2n = 24$, ce qui montre, comme cet auteur le remarque, qu'il s'agit du *L. corniculatus* et non du *L. alpinus*. Cependant, en considérant le cas du *L. glareosus*, espèce qui s'est répandu vers le nord et qui a monté dans les montagnes à des altitudes élevées, nous pourrions supposer qu'un cas semblable est arrivé quant aux *L. corniculatus* et *L. alpinus*, c'est-à-dire que les deux espèces existent aux Picos de Europa, la première aux altitudes plus basses et la deuxième aux sommets. Néanmoins, nous devons avouer que,

étant donné la ressemblance des deux taxa, seule la détermination des nombres chromosomiques des plantes des régions plus élevées de Picos d'Europa pourra résoudre le problème qui KÜPPER a posé, en considérant que le *L. alpinus* n'existe pas dans cette montagne.

D'après les recherches de DONOVAN & McLENNAN (1964), le *L. corniculatus* est un autotétraploïde et, par le fait qu'il ressemble beaucoup le *L. alpinus*, nous croyons que les conclusions de FAVARGER et KÜPPER sont correctes, c'est-à-dire que le *L. alpinus* doit être considéré comme une forme ancestrale du *L. corniculatus*, lequel, après sa différenciation, se serait répandu vers le nord et l'est en finissant par occuper presque toute l'Europe.

Quant à l'Espagne, nous pouvons penser que le *L. corniculatus* aurait traversé les Pyrénées par les dépressions et se serait répandu à la périphérie de l'Espagne comme notre carte de la fig. 3 le montre. Il est plus fréquent en Catalogne, devient très rare dans le sud de l'Espagne et il n'existe pas au Portugal. D'après cette hypothèse, on rencontrerait dans les Pyrénées espagnoles le *L. alpinus* et le *L. corniculatus*, le premier sur les sommets plus élevées et le second dans les régions plus basses.

Une hypothèse alternative serait celle d'admettre l'existence de deux centres de différenciation du *L. corniculatus* à partir du *L. alpinus*: le premier, localisé dans les Alpes, où le *L. alpinus* aurait engendré le tétraploïde qui se serait répandu après en occupant l'Europe centrale, du nord, du sud et de l'est; le second, situé dans les Pyrénées, où le *L. alpinus* aurait donné naissance aux tétraploïdes habitant à présent la France occidentale et l'Espagne.

De ces deux hypothèses, la première, c'est-à-dire celle qui admet un seul centre de différenciation, nous semble la plus probable.

Au Portugal, on ne trouve que des populations diploïdes ($2n = 12$) du *L. pedunculatus* Cav. (incl. *L. uliginosus* Schkuhr), appartenant soit au type, var. *pedunculatus*, soit au var. *villosus* (Ser.) Lawalrée (voir Tableau I). Il est à remarquer qu'on ne connaît pas encore des formes tétraploïdes naturelles (voir GRANT, 1955) chez cette espèce, qui occupe une aire assez vaste comprenant, d'après Flora Europaea, l'Europe occidentale, centrale

et du sud, en se prolongeant vers le nord jusqu'aux 60° N, en Fennoscandie et vers l'est jusqu'aux 25° E, en Ukraine.

CHENG & GRANT (1973) ont établi l'idiogramme de cette espèce d'une façon très précise, en signalant la présence de deux paires de chromosomes satellitifères. Cependant, des chromosomes de ce type ne sont pas figurés sur les idiogrammes des autres espèces, ce qui est certainement dû au fait que, souvent, il n'est pas facile de mettre en évidence ces régions des chromosomes. FERNANDES & QUEIRÓS (1980) ont identifié aussi deux paires à satellites chez le *L. boissieri* et le *L. glareosus*, en remarquant que toutes les espèces auront probablement des satellites qu'il faut chercher à identifier.

Bien que des chromosomes satellitifères n'aient pas été identifiés par CHENG & GRANT chez le *L. corniculatus* var. *brachyodon* et le *L. alpinus*, on constate que les plus grandes analogies de l'idiogramme du *L. pedunculatus* sont avec celui des deux taxa ci-dessus mentionnés. La ressemblance des idiogrammes s'accorde donc avec celle de la morphologie externe.

REMERCIEMENTS

Nous remercions vivement MM. les Directeurs du Conservatoire et Jardin Botaniques de la Ville de Genève (G), du «Real Jardín Botánico de Madrid» (MA), de la «Cátedra de Botánica de la Facultad de Farmacia de Madrid» (MAF), du «Museu, Laboratório e Jardim Botânico de Lisboa» (LISU), de l'«Instituto de Botânica do Porto» (PO), du «Departamento de Fitossistemática e Geobotânica da Estação Agronómica Nacional» (LISE) et de l'«Estação de Melhoramento de Plantas de Elvas» (ELVE) le prêt des spécimens d'herbier existant dans les respectives Institutions.

Au Conseil de Direction du «Museu, Laboratório e Jardim Botânico da Universidade de Coimbra», nous remercions l'aide qu'il nous a apporté en rendant possible la réalisation de ce travail.

À notre Collègue M. le Dr. J. FERNÁNDEZ CASAS, nous remercions l'envoi de spécimens d'herbier, ainsi que de graines du *Lotus boissieri* récoltées à la Sierra Nevada, ce qui nous a permis d'étudier du matériel vivant de ce taxon cultivé au Jardin Botanique de Coimbra.

À Madame ROSETTE FERNANDES nous devons la lecture critique du manuscrit et beaucoup de suggestions concernant particulière-

ment plusieurs questions de Nomenclature, dans lesquelles son avis nous a été particulièrement utile.

À M. le Dr. P. MONTSERRAT (Jaca) nous remercions quelques photocopies qu'il a bien voulu nous envoyer.

Nous remercions finalement les fonctionnaires de l'Institut Botanique de Coimbra, MM. FERNANDO CARDOSO, ARMÉNIO LOUREIRO, SÍLVIO CARDOSO et ARLINDO CARDOSO, de l'aide technique qu'ils ont bien voulu nous accorder.

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¹ Ces références concernent seulement le chapitre «Remarques caryologiques».

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PLANCHES

PLANCHE I

Lotus boissieri A. Fernandes

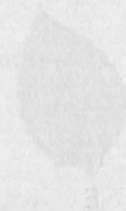
- A — Aspect général d'une plante en fleur ($\times \frac{3}{4}$).
- B — Aspect général d'une plante fructifiée ($\times \frac{3}{4}$).
- C — Feuille à stipules et folioles ovées vue par la face supérieure ($\times 12,5$).
- D — Feuille vue par la face inférieure ($\times 12,5$).
- E — Foliole terminale vue par la face inférieure ($\times 12,5$).
- F — Feuille à stipules et folioles lancéolées vue par la face supérieure ($\times 6$).
- G — Calice (entier et planifié), étendard, aile et carène.
- H — Graine ($\times 12,5$).

A — de *Funk*, Aug. 1848 (COI-Willk.). B-F et H — de *Fernández-Casas* s. n. (COI). G — Dessin inédit de WILLKOMM existant dans l'herbier (COI) de cet auteur.



Lotus boissieri A. Fernandes

PLANTAS



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TABLE II

Factors influencing the rate of the reaction

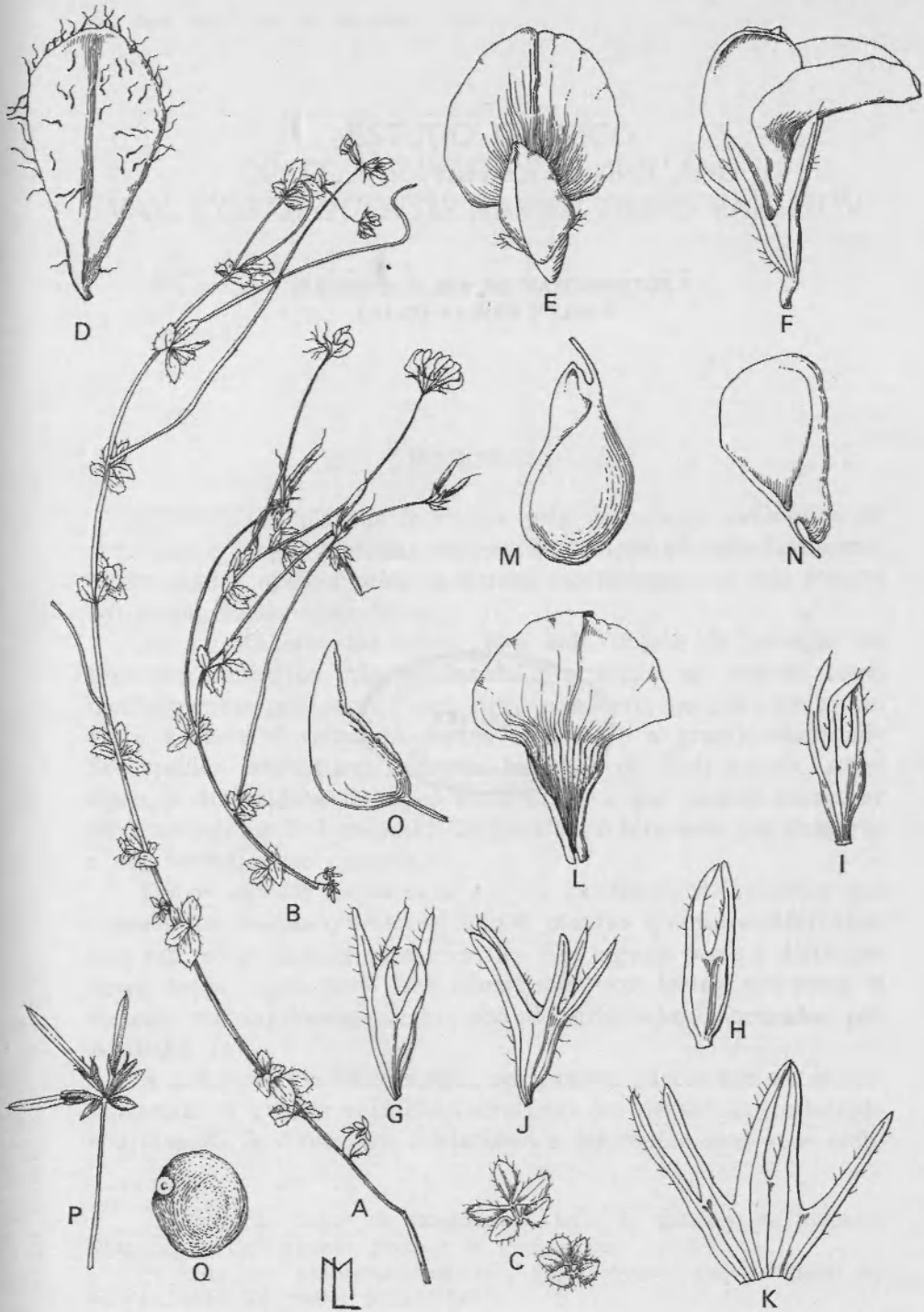
- 1. The nature of the solvent (XVI)
- 2. The concentration of the reactants (XVII)
- 3. The temperature (XVIII)
- 4. The presence of a catalyst (XIX)
- 5. The nature of the substituents (XX)
- 6. The nature of the reaction medium (XXI)
- 7. The nature of the reagents (XXII)
- 8. The nature of the products (XXIII)
- 9. The nature of the reaction conditions (XXIV)
- 10. The nature of the reaction apparatus (XXV)
- 11. The nature of the reaction time (XXVI)
- 12. The nature of the reaction pressure (XXVII)
- 13. The nature of the reaction volume (XXVIII)
- 14. The nature of the reaction surface (XXIX)
- 15. The nature of the reaction energy (XXX)
- 16. The nature of the reaction entropy (XXXI)
- 17. The nature of the reaction enthalpy (XXXII)
- 18. The nature of the reaction Gibbs free energy (XXXIII)
- 19. The nature of the reaction equilibrium constant (XXXIV)
- 20. The nature of the reaction rate constant (XXXV)
- 21. The nature of the reaction order (XXXVI)
- 22. The nature of the reaction mechanism (XXXVII)
- 23. The nature of the reaction transition state (XXXVIII)
- 24. The nature of the reaction activation energy (XXXIX)
- 25. The nature of the reaction pre-exponential factor (XL)
- 26. The nature of the reaction frequency factor (XLI)
- 27. The nature of the reaction collision frequency (XLII)
- 28. The nature of the reaction orientation factor (XLIII)
- 29. The nature of the reaction steric factor (XLIV)
- 30. The nature of the reaction electronic factor (XLV)
- 31. The nature of the reaction electrostatic factor (XLVI)
- 32. The nature of the reaction hydrogen bonding factor (XLVII)
- 33. The nature of the reaction van der Waals factor (XLVIII)
- 34. The nature of the reaction dipole-dipole interaction factor (XLIX)
- 35. The nature of the reaction pi-pi interaction factor (L)
- 36. The nature of the reaction pi-cation interaction factor (LI)
- 37. The nature of the reaction cation-pi interaction factor (LII)
- 38. The nature of the reaction anion-pi interaction factor (LIII)
- 39. The nature of the reaction pi-anion interaction factor (LIV)
- 40. The nature of the reaction pi-lone pair interaction factor (LV)
- 41. The nature of the reaction lone pair-pi interaction factor (LVI)
- 42. The nature of the reaction pi-sigma interaction factor (LVII)
- 43. The nature of the reaction sigma-pi interaction factor (LVIII)
- 44. The nature of the reaction pi-d orbital interaction factor (LIX)
- 45. The nature of the reaction d-orbital-pi interaction factor (LX)
- 46. The nature of the reaction pi-f orbital interaction factor (LXI)
- 47. The nature of the reaction f-orbital-pi interaction factor (LXII)
- 48. The nature of the reaction pi-g orbital interaction factor (LXIII)
- 49. The nature of the reaction g-orbital-pi interaction factor (LXIV)
- 50. The nature of the reaction pi-h orbital interaction factor (LXV)
- 51. The nature of the reaction h-orbital-pi interaction factor (LXVI)
- 52. The nature of the reaction pi-i orbital interaction factor (LXVII)
- 53. The nature of the reaction i-orbital-pi interaction factor (LXVIII)
- 54. The nature of the reaction pi-j orbital interaction factor (LXIX)
- 55. The nature of the reaction j-orbital-pi interaction factor (LXX)
- 56. The nature of the reaction pi-k orbital interaction factor (LXXI)
- 57. The nature of the reaction k-orbital-pi interaction factor (LXXII)
- 58. The nature of the reaction pi-l orbital interaction factor (LXXIII)
- 59. The nature of the reaction l-orbital-pi interaction factor (LXXIV)
- 60. The nature of the reaction pi-m orbital interaction factor (LXXV)
- 61. The nature of the reaction m-orbital-pi interaction factor (LXXVI)
- 62. The nature of the reaction pi-n orbital interaction factor (LXXVII)
- 63. The nature of the reaction n-orbital-pi interaction factor (LXXVIII)
- 64. The nature of the reaction pi-o orbital interaction factor (LXXIX)
- 65. The nature of the reaction o-orbital-pi interaction factor (LXXX)
- 66. The nature of the reaction pi-p orbital interaction factor (LXXXI)
- 67. The nature of the reaction p-orbital-pi interaction factor (LXXXII)
- 68. The nature of the reaction pi-q orbital interaction factor (LXXXIII)
- 69. The nature of the reaction q-orbital-pi interaction factor (LXXXIV)
- 70. The nature of the reaction pi-r orbital interaction factor (LXXXV)
- 71. The nature of the reaction r-orbital-pi interaction factor (LXXXVI)
- 72. The nature of the reaction pi-s orbital interaction factor (LXXXVII)
- 73. The nature of the reaction s-orbital-pi interaction factor (LXXXVIII)
- 74. The nature of the reaction pi-t orbital interaction factor (LXXXIX)
- 75. The nature of the reaction t-orbital-pi interaction factor (LXXXX)
- 76. The nature of the reaction pi-u orbital interaction factor (LXXXXI)
- 77. The nature of the reaction u-orbital-pi interaction factor (LXXXXII)
- 78. The nature of the reaction pi-v orbital interaction factor (LXXXXIII)
- 79. The nature of the reaction v-orbital-pi interaction factor (LXXXXIV)
- 80. The nature of the reaction pi-w orbital interaction factor (LXXXXV)
- 81. The nature of the reaction w-orbital-pi interaction factor (LXXXXVI)
- 82. The nature of the reaction pi-x orbital interaction factor (LXXXXVII)
- 83. The nature of the reaction x-orbital-pi interaction factor (LXXXXVIII)
- 84. The nature of the reaction pi-y orbital interaction factor (LXXXXIX)
- 85. The nature of the reaction y-orbital-pi interaction factor (LXXXXX)
- 86. The nature of the reaction pi-z orbital interaction factor (LXXXXXI)
- 87. The nature of the reaction z-orbital-pi interaction factor (LXXXXXII)

PLANCHE II

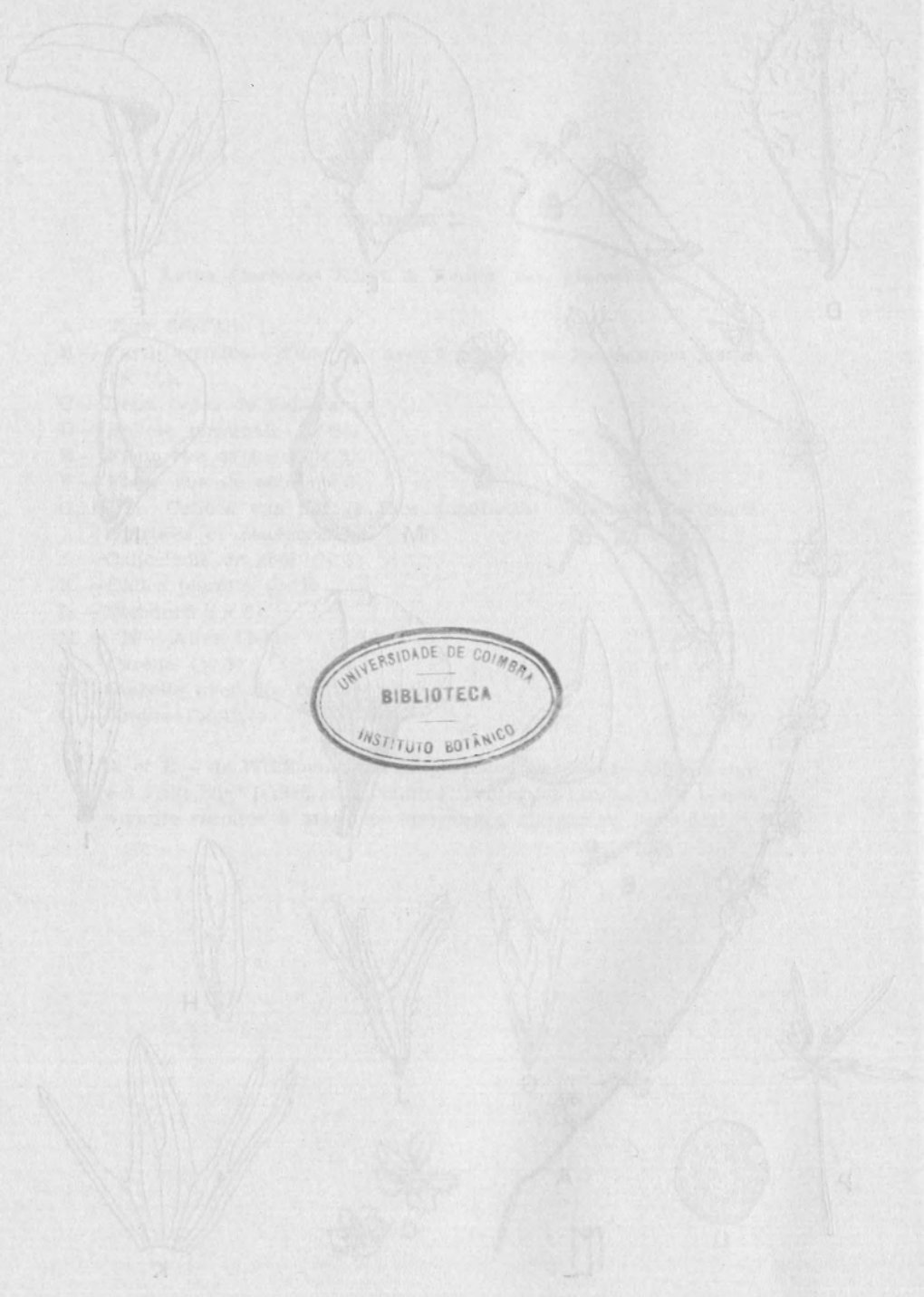
Lotus glareosus Boiss. & Reuter var. **glareosus**

- A — Tige florifère ($\times \frac{1}{2}$).
- B — Partie terminale d'une tige avec des fleurs et des légumes jeunes ($\times \frac{1}{2}$).
- C — Deux types de feuilles ($\times \frac{1}{2}$).
- D — Foliole terminale ($\times 3$).
- E — Fleur vue de face ($\times 3$).
- F — Fleur vue de côté ($\times 3$).
- G, H, I — Calices vus par la face supérieure, montrant les dents courbées et convergentes ($\times 3$).
- J — Calice vue de côté ($\times 3$).
- K — Calice planifié ($\times 3$).
- L — Etendard ($\times 3$).
- M et N — Ailes ($\times 3$).
- O — Carène ($\times 3$).
- P — Ombelle avec des fruits ($\times \frac{1}{2}$).
- Q — Graine ($\times 12,5$).

A et B — de *Willkomm* Iter hispanicum, pr. Monasterium *Jesus del Valle*, 20-VI-1845 (COI-Willk.). Toutes les autres d'une plante vivante récoltée à Mata da Margaraça (Arganil), Portugal.



Lotus glareosus Boiss. & Reuter var. *glareosus*



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ESTUDO QUÍMICO
DE *TELOSCHISTES FLAVICANS*
VAR. *COSTARICENSIS* XAVIER FILHO VAR. NOV.

IVANILDO ALVES DE VASCONCELOS *
LAURO XAVIER FILHO **

INTRODUÇÃO

LÍQUENS são plantas formadas pela associação simbiótica de alga e fungo. Algumas espécies liquênicas não são facilmente diferenciadas apenas pelos caracteres morfológicos, o que resulta em ambiguidade taxonômica.

As substâncias liquênicas têm sido objeto de atenção de químicos orgânicos, não só devido à utilidade de líquens como medicamentos populares, mas, principalmente, porque, tendo em vista a vasta distribuição destes vegetais e a grande variedade de espécies, constituem material botânico de fácil acesso. Além disso, a diversidade de tipos estruturais a que podem pertencer os constituintes de líquens (1, 2) justifica o interesse que desperta a sua investigação química.

Outro aspecto importante é o da existência de espécies que apresentam «cepas químicas», isto é, plantas químicas diferentes, mas morfológicamente idênticas (3). Em alguns casos a distinção entre estas cepas pode ser conseguida por testes químicos, o método microquímico, tendo sido desenvolvido, sobretudo, por ASAHINA (4).

A principal via biossintética em Líquens parece ser a acetato-malonato, a grande variação estrutural dos depsídeos, refletindo a utilização de diferentes iniciadores e diferentes modos de cicli-

* Prof. do Dept.º de Bioquímica — Lab. de Química de Produtos Naturais da Universidade Federal de Pernambuco.

** Prof. do Laboratório de Tec. Farmacêutica, Univ. Federal da Paraíba, Processo CNPq: 30.5940/78.

zação (5). YAMAZAKI e colaboradores (6) verificaram que este caminho leva ao ácido lecanórico (Fig. 1), em *Parmelia tinctorum*.

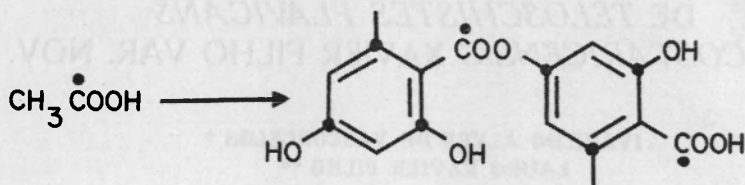


FIG. 1

O caminho do ácido chiquímico conduz a um único grupo de substâncias, a dos derivados do ácido pulvínico, cuja biossíntese foi investigada por MOSBACH e colaboradores. Fenil-(1 ^{14}C)-alanina (Fig. 2), foi administrada a *Letharia vulpina* Hue. fornecendo o ácido vulpínico marcado (Fig. 3), provavelmente por via de um intermediário quinônico (3).

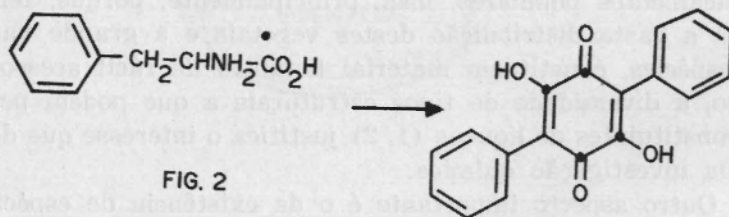


FIG. 2

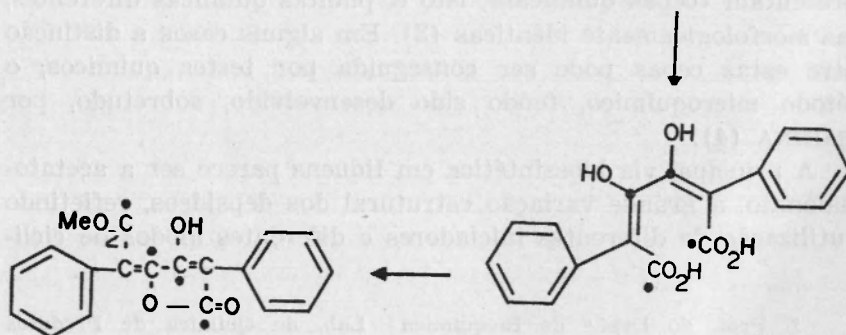


FIG. 3

MATERIAL E MÉTODOS

O material botânico utilizado no estudo do *Teloschistes* é oriundo da Costa Rica, coletado pelo segundo autor. Obteve-se uma única substância que foi denominada posteriormente fisciona.

A solução acetônica, após concentração, forneceu o extrato

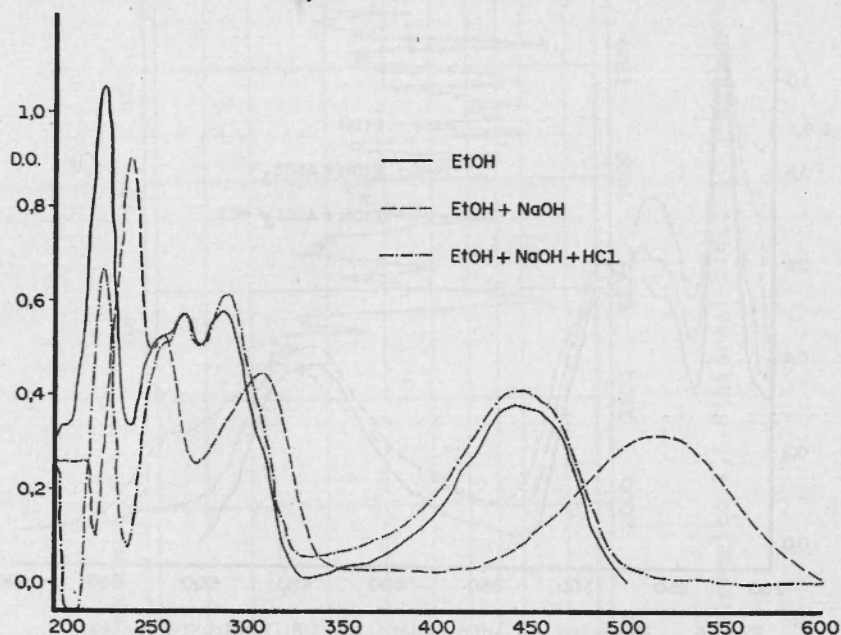


Fig. 4. — Espectro no ultravioleta de 1,8-Dihidroxi-6-metoxi-3-metilntraquinona, Sol. 2 mg %.

acetônico 0,111 g. Por tratamento deste com acetona, a frio, e filtração, separou-se um material sólido 45 mg que foi recristalizado em etanol fornecendo 29 mg de uma substância, de cor amarela, p. f. 208-210° C. Da água mãe resultante evaporou-se o solvente e o resíduo resultante (0,066 g) foi extraído com clorofórmio. Após filtração, a parte solúvel foi concentrada até resíduo e este recristalizado em etanol obtendo-se 44 mg do mesmo composto.

O espectro na região do ultravioleta (Fig. 4) mostrou quatro máximos de absorção em 225, 258, 287 e 438 nm (14.900, 7.800, 8.090 e 5.230, respectivamente), o que denota sua natureza antra-

quinônica. As modificações da curva espectral em presença de aditivos, indicaram a presença de hidroxila fenólicas deslocamento batocrômico dos máximos de absorção em presença de hidróxido de sódio, ausência de sistema *orto* ou *para*-dihidroxi regeneração da curva após adição de ácido clorídrico, presença de hidroxila

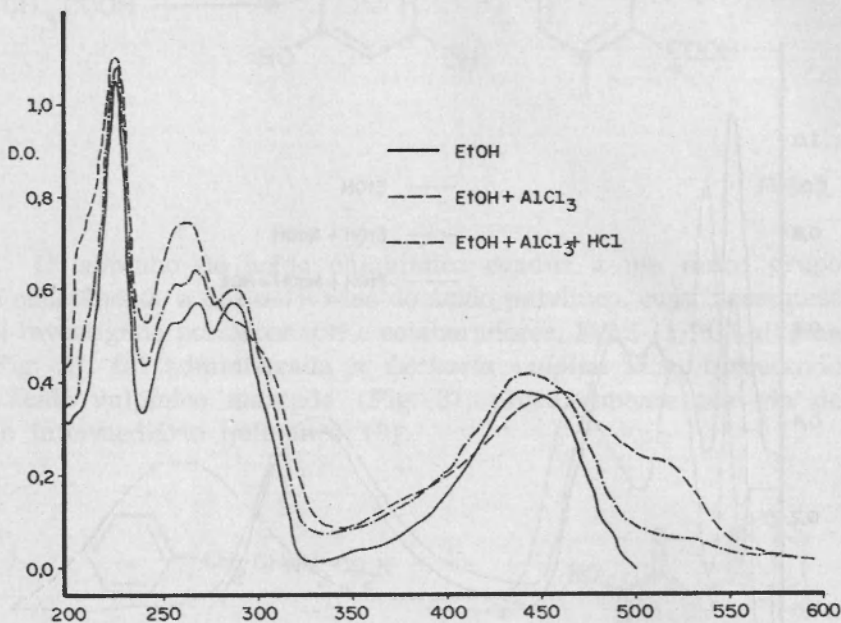


Fig. 5. — Espectro no ultravioleta de 1,8-Dihidroxi-6-metoxi-3-metilantraqüinona, Sol. 2 mg %.

quelatogênica modificação da curva espectral em presença de cloreto de alumínio e ausência de hidroxila de carácter ácido acentuado por efeito de conjugação curva inalterada em presença de acetato de sódio (Fig. 5).

Espectrometria no infravermelho (Fig. 5) confirmou a natureza aromática (1566 , 1477 e 1482 cm^{-1}), bem como a natureza quinônica (1675 e 1629 cm^{-1}) e a presença de grupos éter (1273 e 1037 cm^{-1}).

Comparação destes dados espectrais com aqueles de antraqüinonas anteriormente isolados nos levou a admitir que o nosso material possui um padrão de oxigenação muito semelhante ao daquelas. A ausência de hidroxila de carácter ácido acentuado,

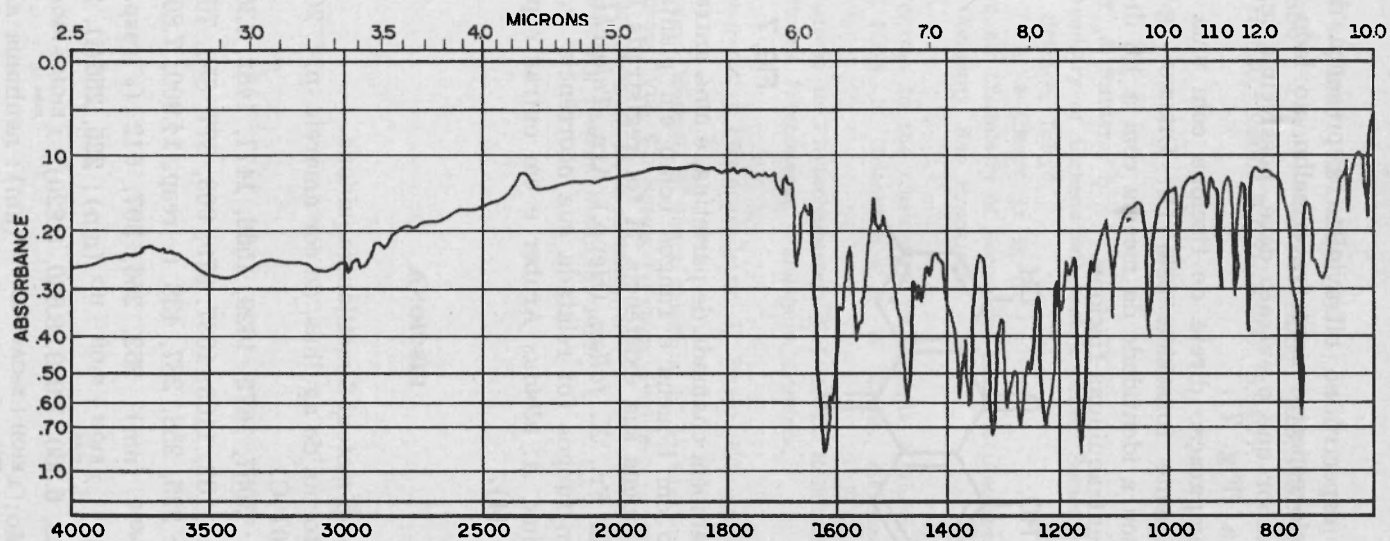


Fig. 6 - Espectro no infravermelho 1,8-Dihidroxi-6-metoxi-3-metilantraquinona.

evidenciada pelo espectro no ultravioleta a presença de grupo éter mostrado pelo espectro no infravermelho, ao lado do p. f. 208-210° C., fez supor que o extrato deve, possivelmente, corresponder à fisciona (Fig. 7).

De facto, comparação direta de fisciona com uma amostra autêntica, gentilmente fornecida pelo Dr. DIRCEU DE BARROS CORREIA, confirmou a identidade da mesma com a 1,8 di-hidroxi-6-metoxi-3-metilantraquinona-fisciona.

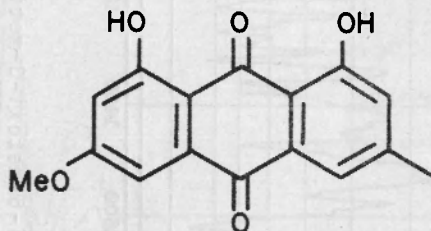


FIG. 7

A fisciona, também chamada de parietina, é uma antraquinona que ocorre tanto em líquens e fungos como em plantas superiores (7). Em líquens sua existência já foi registrada em *Xanтория parietina* L. Fr., *X. fallax* (Hepp.) Arn. *Teloschistes flavicans* Norm. Em fungos foi relatada sua ocorrência em *Aspergillus glaucus* Link, *A. albidus* Aruber e em outras espécies da série *A. glaucus* (4).

FISCIONA

1,8-Di-hidroxi-6-metoxi-3-metilantraquinona.

Cristais em forma de agulhas, de cor amarela, p. f. 208-210° C (EtOH), (14) 207° C.

$\nu_{\text{max}}^{\text{KBr}}$ (cm⁻¹): 3057, 1675, 1629, 1566, 1477, 1482, 1365, 1322, 1287, 1273, 1227, 1162, 1103, 1037, 979, 903, 877, 853, 762.

$\lambda_{\text{max}}^{\text{EtOH}}$ (nm): 225, 258, 287, 438 (ϵ resp. 14.900, 7.800, 8.090, 5.230); $\lambda_{\text{max}}^{\text{EtOH} + \text{NaOH}}$ (nm): 262, 256, 307, 512 (ϵ resp. 12.760, 7.430, 6.290, 4.400); $\lambda_{\text{max}}^{\text{EtOH} + \text{NaOH} + \text{HCl}}$ (nm): 225, 256(i), 267, 292, 242 (ϵ resp. 9.420, 6.360, 7.980, 8.660, 5.820); $\lambda_{\text{max}}^{\text{EtOH} + \text{NaOAc}}$ (nm): nenhuma alteração; $\lambda_{\text{max}}^{\text{EtOH} + \text{NaOAc} + \text{HsbOS}}$ (nm): nenhuma alteração;

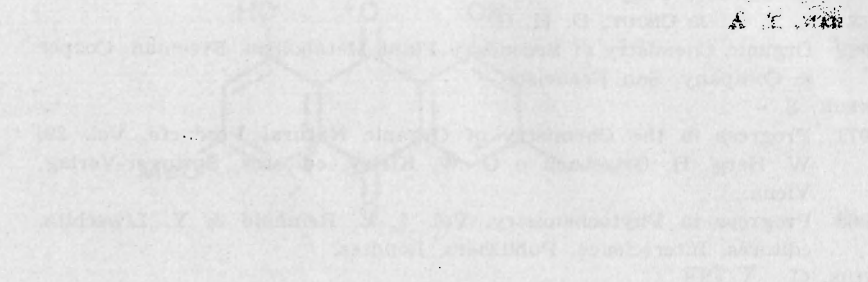
$\lambda_{\text{max}}^{\text{EtOH} + \text{AlCl}_3}$ (nm): 224, 264, 287(i), 460 (ϵ resp. 15.620, 10.520, 7.580, 5.350); $\lambda_{\text{max}}^{\text{EtOH} + \text{AlCl}_3 + \text{HCl}}$ (nm): 226, 262(i), 268, 288, 441 (ϵ resp. 15.530, 8.660, 9.120, 8.500, 5.940).

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RESULTS

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CRASSULACEAE AFRICANAE NOVAE VEL MINUS COGNITAE — II

AUCTORE

R. BATARDA FERNANDES *

Instituto Botanici Universitatis Conimbrigensis

Crassula Leachii, sp. nov. — Tab. I

Herba perennis succulenta satis ramosa. *Rami* principales elongati, usque ad 23 cm (vel ultra?) longi et 2,5 mm crassi, flexuosi, herbacei vel basin versus sublignosi, secundarii breviores ac graciliores, ascendentes, omnes carnosii, teretes, e basi ad apicem fere aequicrassi et foliosi, ad nodos non dilatati, brunneo-rubrescentes, \pm dense hispidi (pili patuli vel paululo retrorsi, acuti, albi vel flavescentes), in pedunculum terminati; internodia 0,4-2 cm longa, apicem ramorum versus breviora. Folia 1,2-2,2 \times \times 0,25-0,9 cm, oblonga usque elliptica, basi non contracta, sessilia et parum connata, apice obtusa vel obtusiuscula, margine integra et non distincte ciliata, patula vel erecto-patula, ut videtur plana, in sicco paullo crassa (sed non membranacea) et paullo rigida, basin ramorum versus plus minusve distantia, apicem versus plus minusve approximata (sed non rosulata), indumento ei caulis simili utrinque plus minusve dense vestita et propter ipsum colore grisea vel albida suffusa. Flores 5-meri, sessiles vel breviter pedicellati in cymas valde condensatas dispositi, eas apicis ramulorum singulas ac capituliformes, eas caulis et ramorum principalium in apice pedunculorum inflorescentias corymbiformes trifurcatas usque ad ca. 3 cm in diam. formantes; pedunculi 4,5-8 cm longi, graciles, dense hispidi, bracteis ca. 5 mm longis, oblongis, hispidis, in 2-3 paribus dispositis ornati; pedicelli nulli vel vix usque ad ca. 0,5 mm longi, crassi. Calyx 1,6-2 mm longus, dimidium corollae aequans vel id paullo superans; sepala ovata, oblongo-

* Centro de Fito-sistemática e Fito-ecologia (I. N. I. C., Ec C2) da Universidade de Coimbra.

-ovata vel triangularia, obtusa vel obtusiuscula, in basi ca. 0,75 mm longe connata, extus hispidula, margine ciliata, rubescentia. Corolla 3-3,25 mm longa, campanulata, alba; petala oblonga vel obovato-oblonga, erecta sed parte superiore reflexa vel patula, apice obtusa vel rotundata, sub apicem dorsi minute mucronata, ad $\frac{2}{3}$ superiores extus minute scabrido-papillosa. Filamenta 1-1,25 mm longa; antherae 0,4-0,5 mm, suborbiculares, purpureae. Folliculi ca. 1,5 mm longi, ampullacei, non vel breviter attenuati; stigmata subterminalia, fere sessilia. Squamulae nectariferae ca. 0,5 mm longae, cuneatae, apice truncatae vel leviter emarginatae.

Habitat in Mossambique, regione «Manica e Sofala, 10 miles S. of Vila Pery» ubi, s. d. a *Leach*, sub n.º 8135, collecta. Holotypus in PRE. Isotypi in M et SRGH.

Specimen alterum:

MOSSAMBIQUE: «C. 10 miles S. of Vila Pery, granite kopje, fl. white, leaves red where exposed to sun», 12-VI-1961, *Leach* 11107 (PRE; SRGH).

Propter indumentum, inflorescentias, corollas et fructus, similis *C. swaziensi* (praecipue subsp. *brachycarpae*), a qua habitu diverso (caulibus et ramis elongatis, non vel paullo lignosis, internodiis generaliter longioribus); foliis e basi ad apicem ramorum persistentibus, ad apicem ramorum non rosulatis, ellipticis vel oblongis, pro ratione angustioribus (vix 2,5-9 mm latis neque 7-25 mm latis), siccitate minus crassis ac rigidis, pilis minus adpressis sed subpatulis vestitis; calyce et corolla paullo minoribus praecipue differt.

A *C. pachystemone* Schonl. etiam characteribus permultis (habitu diverso, minus condensato; caule minus ramoso; ramis longioribus; pedunculis longioribus; corollis minoribus; etc.) differt.

Specimen *Barbosa* 1736 («Chimoio, Vila Pery, alto do Monte Bengo, erva vivaz, de 1-2 dm., das fendas dos rochedos, folhas crassas verdes ou avermelhadas, flores brancas», 11-VII-1948, in LISC), propter flores parvos et folia angusta, simili *C. Leachi*, sed propter caulem lignosum et folia inferiora caduca, dubium est. Forsan forma *C. swaziensis* subsp. *brachycarpae* proxima.

Crassula morrumbalensis, sp. nov.

Herba perennis, succulenta. Caulis humifusus, usque ad 4 mm crassus, glaber, radicans, ramosus, efoliatus, sed extremitatem versus ascendens et (ut rami) foliosus, ramulos erectos et foliorum rosulas subsessiles emittens. Ramuli usque ad 5 cm longi, nodosi (nodi satis proeminentes), in sicco acute quadranguli et lateribus \pm concavi, cortice (vel epidermide?) papyraceo basin ramulorum versus brunneo, apicem versus castaneo-rubenti vestiti, foliosi; internodia mediana usque ad 8 mm longa, ea basilaria et terminalia gradatim breviora, ea rosularum brevissima. Folia oblongo-elliptica usque ad 24×5 mm, basin versus sensim angustata ($\pm 2,5$ mm lata juxta supra vaginam) et apice acuta vel elliptica usque ad 13 mm longa et 7 mm lata et apice acutiuscula, omnia integerrima, margine acuta et ciliolata (cilia minuta, obtusa, alba, satis approximata usque fere contigua, retrorsa, sed circa foliorum basin paullo longiora — usque ad 0,3 mm longa —, subacuta, subpatula et inter sese \pm distantia), glabra, ut videtur plana, decussata, ad extremitatem caulis, ramorum et ramulorum rosulata et erecta, ea mediana ac inferiora (\pm persistentia) erecto-patentia vel patentia, siccitate paullo crassa et paullo rigida (sed inferiora seniora rigidiora), castaneo-rubentia (seniora fere nigra); vagina usque ad 1,5 mm alta. Pedunculi terminales et solitarii ad apicem ramulorum, 1,2-10 cm longi, graciles, erecti, glabri vel circa apicem sparse papilloso-pilosi (pili albidii, brevissimi, retrorsi, adpressi), bracteis parvis, marginibus ciliatis, in (1)-2 paribus dispositis, ornati. Flores 5-meri, subsessiles vel usque ad 1,5 mm longe pedicellati, in cymas corymbos \pm condensatos usque ad 20 mm in diam. (vel ultra?) formantes, dispositi; rami corymborum breves, ut pedicelli crassi, glabri vel sparse breviterque pilosi; bracteae et bracteolae margine ciliolatae. Calyx 2-2,25 mm longus, sub sepala 1,5-1,75 mm in diam., basi obconicus; sepala 1,25-1,75 mm longa, medietate corollae breviora, oblongo-lanceolata, subacuta, ut videtur non vel vix carinata, praeter margines et lineam medianam dorsi sparse ciliolata, apice papilla brevissima instructa. Corolla ± 4 mm longa, alba; petala oblongo-obovata, 1,25-1,5 mm lata, obtusa, extus sub apicem mucrone minuto ornata et ad $\pm \frac{2}{3}$ partes superiores extus scabrido-papillosa, erecta, per ca. 0,6 mm ad basin connata. Stamina corolla breviora; filamenta 2-2,25 mm longa; antherae $\pm 0,6$ mm longae,

ante dehiscentiam ovatae, post dehiscentiam oblongae. Folliculi (cum stylis) 3,5-4 mm longi, laeves, apicem versus in stylos satis attenuati; styli ca. 0,5 mm longi, laeves; stigmata apicalia, minute capitata. Semina ca. 0,5 mm longa, oblonga, obtusa, leviter pluricostata. Squamulae nectariferae ca. 0,4 mm longae, subquadrate, leviter emarginatae.

Habitat in Mossambique, regione Zambezia, Monte Morrumbala («Serra da Morrumbala»), loco dicto Massingire, ubi die 6-VIII-1943, a R. Torre sub n.º 4551, collecta. Holotypus in LISC. Isotypi in C, COI et K.

Affinis *C. globularioides* a qua foliis senioribus \pm persistentibus neque caducis; rosulis foliorum minus densis; foliis pro ratione angustioribus (vix usque ad 7 mm latis neque usque ad 12 mm latis), apice acutis vel acutiusculis neque plerumque obtusis, ciliis marginalibus brevioribus, siccitate minus rigidis et minus crassis; pedunculis glabris vel vix circa apicem sparsissime et brevius pilosis neque a basi ad apicem pilosis; calyce 2-2,25 mm neque 2,5-3 mm longo; sepalis medio corollae brevioribus neque aequalibus vel longioribus, non vel vix carinatis neque distincte carinatis, angustioribus (ad basin 0,5-0,75 mm neque 1-1,75 mm latis), ciliis marginalibus brevioribus; corollis plerumque paulo minoribus; petalis tenuioribus, extus papilloso-scabris neque laevibus, mucrone subapicali paulo brevioribus; antheris paulo minoribus; folliculis longioribus, 3,5-4 mm (cum stylis) longis neque 2,5-3 mm longis praecipue differt.

***Crassula atropurpurea* (Haw.) DiETR.**

***Crassula atropurpurea* (Haw.) DiETR.**

Var. *Muirii* (Schonl.) R. Fernandes, nov. comb.

Basion.: *Crassula clavifolia* var. *Muirii* Schonl. in Trans. Roy. Soc. S. Afr. 17: 263 (1929).

Syn.: *Crassula atropurpurea* var. *rubella* (Compton) Toelken in Journ. S. Afr. Bot. 41: 96 (1975); in Contr. Bolus Herb. 8, 2: 532 (1977), *comb. illegit.*

Crassula rubella Compton in Trans. Roy. Soc. S. Afr. 19: 291 (1931).

Specimen *Schlechter* 9793 in cor etiam adest.

***Kalanchoe sexangularis* N. E. Br.**

***Kalanchoe sexangularis* N. E. Br.** in Kew Bull. 1913: 120 (1913).

Syn.: *Kalanchoe Vatrinii* R.-Hamet in Journ. of Bot. 54, Suppl. 1: 9 (1916). — R. Fernandes in Bol. Soc. Brot., Sér. 2, 53: 420 (1980).

Kalanchoe mossambicana Resende in Bol. Soc. Portug. Ciên. Nat. 17: 184 (1949); in Portugalia Acta Biol. (A), vol. Goldsch.: 731 (1950), *nom. nud.*

Kalanchoe paniculata sensu Mogg in Macnae & Kalk, Nat. Hist. Inhaca Isl.: 145 (1958), pro parte, non Harv. (1862).

Kalanchoe mossambicana Resende ex Resende & Sobrinho in Rev. Fac. Ciên. Univ. Lisboa, Sér. 2, 2: 199, t. 1 (1952).

K. sexangularis cujus typus a nobis ante VI-1980 non visus et a cl. WICKENS amabiliter communicatus, eadem est ut *K. Vatrinii*. Ideo, prioritatem habet.

Var. **intermedia** (R. Fernandes) R. Fernandes, comb. nov.

Basion.: *K. Vatrinii* var. *intermedia* R. Fernandes, op. cit.: 422 (1980).

***Kalanchoe thyrsoflora* Harv.**

***Kalanchoe thyrsoflora* Harv.** in Harv. & Sond., Fl. Cap. 2: 380 (1862).

Kalanchoe alternans sensu Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 305 (1837), non Pers. (1805).

Habitat etiam in Botswana. Specimen: «At Gaborone-Lobatse Road, c. 35 km from Lobatse», alt. 1200 m, 17-VIII-1977, O. J. Hansen 3159 (C; GAB; K; PRE)¹.

¹ Specimen kewense a cl. WICKENS nobis communicatus.

Cl. TOELKEN in «A Revision of the genus *Crassula* in Southern Africa» (in Contr. Bolus Herb. 8, 1 et 2, 1977), specimina in herbariis europeis non refert (cf. TOELKEN, op. cit.: 8). In indice nostro infra, specimina Africae meridionalis aliquorum herbariorum Europae (et pro minima parte etiam Africae quae TOELKEN non citat) a nobis examinata citata sunt. Nomina specierum in ordine alphabetica collocata. Numerus ante nomen specificum idem TOELKEN in opere suo notatus. Numeri speciminum a TOELKEN non indicati, a * notati.

91. *Crassula acinaciformis* Schinz in Bull. Herb. Boiss. 2: 204 (1894); Tolken, op. cit.: 361 (1977).

TRANSVAAL: Gilmore in Moss 14717* (z); Rogers 14465 (z).

92 et 92a. *Crassula alba* Forsk., Fl. Aegypt.-Arab.: 60 (1775); Toelken, op. cit.: 363 et 364 (1977).

TRANSVAAL: Baines s. n. (z); Beeton 238 (z); Devenish 543 (K); Erens 195 (K); Galpin 8975* et 13641 (K); Leach 14735* (K); Leendertz 11122 (z); Rand 1219 (BM); Rehmann 6721* (z) pro parte; Repton 5296 (K); Rogers 10579* (z) et 20017* (K); Schlechter 6563* (z); Schlieben 10668 (BR; K); Sidey 1600 (K); Wasserfall 901 (BM; BR; LD); Werdermann & Oberdieck 2064 (K); Wilms 336 (K).

SWAZILANDIA: Bayliss 2085 (z); Leach & Bayliss 10614 (SRGH); Ross 1852 (K).

NATAL: Drège 5357* (P); Gerrard 39* (K); Hilliard & Burt 8021* (K); Humbert 15076* (P); Junod 378* (G; P); Killick 1652 et 4719* (K); McClean 166 et 866 (K), 809* (LD); Moll 4719 (K); Morris 775* (BR; K); Rehmann 6888* (z); Ross 2071 (K; SRGH); Rudatis 358* (P) et 1385 (K; P; z); Sutherland s. n. (K); Wood 39* (K), 409* et 1887* (z), 7745* (BM) et 8746* (P).

LESOTHO: Dieterlen 239 (K; z; isolectotypi var. *hispidae* Schönl.).

PROV. CAP.: Drège 5359 (P); Cooper 1118* (BM; K), 2313*, 2314*, 2317*, 2330* et 2331* (K).

111. *Crassula alpestris* Thunb. in Nova Acta Acad. Leop.-Carol. 6: 329 et 366, t. 5-b, fig. 4 (1778).

111a. Subsp. *alpestris* — Toelken, op. cit.: 443 (1977).

PROV. CAP.: *Rogers* 16402 (z); *Schlechter* 8663 (COI).

35e. *Crassula alsinoides* (Hook. f.) Engl. in Hochgebirgsfl. Trop. Afr.: 231 (1892).

Syn.: *Crassula pellucida* L. subsp. *alsinoides* (Hook. f.) Toelken in Journ. S. Afr. Bot. 41: 114 (1975); in Contr. Bolus Herb. 8: 193 (1977).

TRANSVAAL: *Codd* 9418 (K); *Merxmüller* 594* (BR); *Rogers* 400* et 21414 (z); *Scheepers* 230 (K; SRGH); *Schlieben* 7121* (BR).

NATAL: *Moll* 2873 (K); *Wood* 4466* et 4630* (z); *Strey* 4580 (z).

PROV. CAP.: *Fries, Norlindh & Weimarck* 614 (LD).

Annot. 1: *Wood* 4466 a J. H. ROSS (Fl. Natal: 180, 1972) ut *Crassula lineolata* citatum.

Annot. 2: Specimina *Strey* 4580 in NH et PRE ut *Crassula pellucida* subsp. *brachypetala* (Harv.) Toelken (= *C. brachypetala*) a TOELKEN (op. cit.: 192, 1977) citata sunt.

5. *Crassula aphylla* Schonl. & Bak. f. in Journ. of Bot. 36: 371 (1898). — Toelken, op. cit.: 98 (1977).

PROV. CAP.: *Schlechter* 8665 (COI, isotypus).

45. *Crassula arborescens* (Mill.) Willd., Sp. Pl., ed. 4, 1, 2: 1554 (1798).

45a. Subsp. *arborescens* — Toelken, op. cit.: 215 (1977).

PROV. CAP.: *Page* 50? (z).

138. *Crassula atropurpurea* (Haw.) Dietr., Synops. Pl. 2: 1031 (1840).



- 138c. Var. *anomala* (Schonl. & Bak. f.) Toelken in Journ. S. Afr. Bot. 41: 96 (1975); in Contr. Bolus Herb. 8: 529 (1977).

PROV. CAP.: *Schlechter* 9317 (COI, isotypus).

58. *Crassula biplanata* Haw. in Phil. Mag. 64: 186 (1824). — Toelken, op. cit.: 256 (1977).

PROV. CAP.: *Muir* 846 (Z); *Schlechter* 10403 (COI).

- 35d. *Crassula brachypetala* Drège ex Harv. in Harv. & Sond., Fl. Cap. 2: 354 (1862).

Syn.: *Crassula pellucida* L. subsp. *brachypetala* (Harv.) Toelken in Journ. S. Afr. Bot. 41: 114 (1975); in Contr. Bolus Herb. 8: 189 (1977).

TRANSVAAL: *Devenish* 591 (SRGH); *Junod* 1070* et 2664* (Z); *Rehmann* 6370 (Z).

NATAL: *Humbert* 14618* (P); *Junod* 235* (Z); *Killick* 1368 (LD); *Rehmann* 7423* et 8785* (Z); *Rogers* 9190* (Z), 24619* (K; Z) et 27994* (Z); *Ross* 2930* (SRGH); *Rudatis* 357 et 1364 (P); *Wager* s. n.* (LD); *Wood* 10280*, 10943* et 11103* (P) et 11109* (Z).

PROV. CAP.: *Pegler* 474 (BM).

Annot.: Numerus *Flanagan* 1079 (PRE), a nobis non visus, a TOELKEN (op. cit.: 193, 1977) ut *Crassula pellucida* subsp. *brachypetala* citatus, sed ab ipso auctore etiam ut *C. pellucida* subsp. *marginalis* in herbariis BOL, GRA, SAM et etiam in PRE relatus est (cf. op. cit.: 188).

106. *Crassula brevifolia* Harv. in Harv. & Sond., Fl. Cap. 2: 339 (1862).

- 106a. Subsp. *brevifolia* — Toelken, op. cit.: 425 (1977).

PROV. CAP.: *Schlieben* 9023 (BR).

20. *Crassula campestris* (Eckl. & Zeyh.) Endl. ex Walp., Repert. 2: 253 (1843). — Toelken, op. cit.: 128 (1977).

20a. Subsp. **campestris** — Toelken, op. cit. 129 (1977).

PROV. CAP.: *Drège* 6910* (K); *Ecklon & Zeyher* 1045* (K); *Fries, Norlindh & Weimarck* 121* (LD) et 895* (K; LD) et 895* (K; LD); *Muir* 8265* (K); *Schlechter* 1321, 8651 (K) et 11250 (LD); *Wall* 2425* (LD); *Whight* s. n.* (K); *Zeyher* 2416* (LD) et 2514 (K; LD).

99. **Crassula capitella** Thunb. in *Nova Acta Acad. Leop.-Carol.* 6: 330 et 339 (1778).

99a. Subsp. **capitella** — Toelken, op. cit.: 386 (1977).

PROV. CAP.: *Bolus* 772* (K); *Burchell* 4458* (K); *Daly & Sole* 335 (z, isosyntypus *C. albanensis*); *Drège* s. n. (BM); *Fourcade* 2147 (K); *Zeyher* 995 et 1905 (K) et 2546 (LD).

99d. Subsp. **Meyeri** (Harv.) Toelken in *Journ. S. Afr. Bot.* 41: 100 (1975); in *Contr. Bolus Herb.* 8: 393 (1977).

NATAL: *Rudatis* 984* (vel 982?) et 1386 (z).

71. **Crassula ciliata** L., *Sp. Pl.*: 283 (1753). — Toelken, op. cit.: 293 (1977).

PROV. CAP.: *Liebenberg* 6702 (BR); *Schlechter* 9373 (BR).

79. **Crassula coccinea** L., *Sp. Pl.*: 282 (1753). — Toelken, op. cit.: 317 (1977).

PROV. CAP.: *N. J. Andersson* s. n.* (LD).

97. **Crassula compacta** Schonl. in *Journ. Linn. Soc. (Bot.)* 31: 550 (1897). — Toelken, op. cit.: 381 (1977).

ORANGE STAT.: *Wood* 5773* (z).

39. **Crassula crenulata** Thunb. in *Nova Acta Acad. Leop.-Carol.* 6: 330 et 339 (1778). — Toelken, op. cit.: 201 (1977).

NATAL: *Rudatis* 1039* (z).

136. *Crassula cultrata* L., Mantissa Alt.: 361 (1771). — Toelken, op. cit.: 518 (1977).

PROV. CAP.: *Cooper* 363* (Z).

75. *Crassula dejecta* Jacq., Hort. Schoenbr. 4: 16, t. 433 (1805). — Toelken, op. cit.: 305 (1977).

PROV. CAP.: *Schlechter* 9849 (COI).

56. *Crassula dependens* Bolus in Journ. Linn. Soc. (Bot.) 18: 391 (1881). — Toelken, op. cit.: 247 (1977).

TRANSVAAL: *Rehmann* 6368* (Z).

NATAL: *Humbert* 15024* (P); *Killick* 1220 (LD); *Wood* 10877 (P; Z).

PROV. CAP.: *Galpin* 2002 et 2022 (IMA).

23. *Crassula dichotoma* L., Pl. Rar. Afr.: 9 (1761). — Toelken, op. cit.: 150 (1977).

PROV. CAP.: *Ecklon & Zeyher* 115* (LD); *Almborn* 605* (LD); *Schlechter* 5236 (COI); *Zeyher* 652* (LD).

9. *Crassula Doddii* Schonl. & Bak. f. in Journ. of Bot. 36: 372 (1898). — Toelken, op. cit.: 108 (1977).

PROV. CAP.: *Schlechter* 10994 (BR; COI, isotypi).

55. *Crassula ericoides* Haw. in Phil. Mag. 66: 30 (1825).

55a. Subsp. *ericoides* — Toelken, op. cit.: 244 (1977).

PROV. CAP.: *Lavier* s. n.* (BR); *Schlechter* 10427 (COI); *Theron* 1043* (LD).

- 55b. Subsp. *tortuosa* Toelken in Journ. S. Afr. Bot. 41: 103 (1975); in Contr. Bol. Herb.: 246 (1977).

PROV. CAP.: *Esterhuysen* 16753 (LD); *Zeyher* 2523 (LD).

86. *Crassula exilis* Harv. in Harv. & Sond., Fl. Cap.: 347 (1862).

86c. Subsp. *Cooperi* (Regel) Toelken in Journ. S. Afr. Bot. 41: 104 (1975); in Contr. Bolus Herb. 8: 338 (1977).

PROV. CAP.: *Holmberg* s. n.* (LD).

29. *Crassula expansa* Dryand. in Ait., Hort. Kew. 1: 390 (1789).

29a. Subsp. *expansa* — Toelken, op. cit.: 163 (1977).

TRANSVAAL: *Wilms* 517 (P; Z).

NATAL: *Rehmann* 7735* et 8784* (Z); *Rudatis* 950* (P; Z).

PROV. CAP.: *Drège* 783* (P); *Esterhuysen* 23875* et 23178* (LD); *Flanagan* 1081 (LD); *Fries, Norlindh & Weimarck* 170*, 212* et 992* (LD); *Liebenberg* 7394* (BR); *Pearson* 6815* (LD); *Schlechter* 11503 (LD); *Schlieben & Van Breda* 9832 (BR; SRGH); *Sparrmann** (LD); *Walk* s. n. (LD); *Zeyher* 985 (K, ut *C. filicaulis*).

29b. Subsp. *filicaulis* (Haw.) Toelken in Journ. S. Afr. Bot. 41: 105 (1975); in Contr. Bolus Herb. 8: 166 (1977).

PROV. CAP.: *Hutchinson* 1350 (K); *Pillans* 8159 (K); *Rogers* 26807 (K); *Schlechter* 9469 (COI); *Zeyher* 2524 (LD; P; Z).

Annot.: Specimen *Zeyher* 2524 (PRE; SAM) ut subsp. *expansa* a TOELKEN (loc. cit., 1977) citatum est, sed specimen in P radices adventitias lignosas habet.

131c. *Crassula falcata* Wendl., Bot. Beobacht.: 44 (1798).

Syn.: *Crassula perfoliata* L. var. *falcata* (Wendl.) Toelken in Journ. S. Afr. Bot. 41: 115 (1975); in Contr. Bolus Herb. 8: 502 (1977).

PROV. CAP.: *Zeyher* 2561 (LD).

77. *Crassula fascicularis* Lam., Encycl. Méth. Bot. 2: 171 (1786).— Toelken, op. cit.: 311 (1977).

PROV. CAP.: *Acocks* 19865* (BR); *Almborn* 355* (LD); *Esterhuysen* 24026* (LD); *Fries, Norlindh & Weimarck* 1427* (COI); *E. Wall* 10* (LD).

76. *Crassula fallax* Friedr. in Mitt. Bot. Staatss. München 11: 323, fig. 1 (1974). — Toelken, op. cit.: 308 (1977).

PROV. CAP.: *Schlechter* 9886 (COI).

26. *Crassula filiformis* (Eckl. & Zeyh.) Dietr., Synops. Pl. 2: 1032 (1840). — Toelken, op. cit.: 155 (1977).

PROV. CAP.: *Bachmann* 1024* (z); *Ecklon & Zeyher* 1*? et 2517* (z); *Esterhuysen* 19040 et 23764 (LD); *Mac Owan* 1899* (z); *Schlechter* 1429* et 5498 (z) et 9107 (COI; z); *Zeyher* 637 (z).

80. *Crassula Flanaganii* Schonl. & Bak. f. in Journ. of Bot. 36: 362 (1898). — Toelken, op. cit.: 322 (1977).

NATAL: *Haygarth sub Wood* 1277 (z).

- 29d. *Crassula fragilis* Bak. in Journ. Linn. Soc. (Bot.) 22: 469 (1877).

Syn.: *Crassula expansa* subsp. *fragilis* (Bak.) Toelken in Journ. S. Afr. Bot. 41: 105 (1975); in Contr. Bolus Herb. 8: 169 (1977).

TRANSVAAL: *Codd* 8431 (K, redet. ut *C. expansa* subsp. *filicaulis*); *Exell, Mendonça & Wild* 466* (BM).

SWAZILANDIA: *Bayliss* 1497* (z); *Compton* 29317 (K, ut *C. expansa* subsp. *filicaulis*).

- 131d. *Crassula heterotricha* Schinz in Bull. Herb. Boiss. 2: 203 (1894).

Syn.: *Crassula perfoliata* L. var. *heterotricha* (Schinz) Toelken in Journ. S. Afr. Bot. 41: 115 (1975); in Contr. Bolus Herb. 8: 503 (1977).

TRANSVAAL: *Buitendag* 599* (K); *Schijff & Marais* 3759 (K).

NATAL: *Letty* 225* (K); *McClellan & Ogilvie* (K); *Rudatis* 1433* (K; s; z) et 682* (K; s); *Strey* 7619 (BR; K); *Wood* 523 et 7988 (BM), 598 (BM; K) et 9124 (P; z); *Wylie* s. n.* (LD).

18. *Crassula hirsuta* Schonl. & Bak. f. in Journ. of Bot. 36: 365 (1898). — Toelken, op. cit.: 125 (1977).
PROV. CAP.: *Schlechter* 11283 (BR, isotypus).
36. *Crassula inandensis* Schonl. & Bak. f. in Journ. of Bot. 36: 364 (1898). — Toelken, op. cit.: 195 (1977).
NATAL: *Gerstner* 2401 (P).
2. *Crassula inanis* Thunb., Prodr.: 54 (1794) et Fl. Cap., ed. Schultes: 282 (1823). — Toelken, op. cit.: 92 (1977).
TRANSVAAL: *Wager* s. n.* (LD).
PROV. CAP.: *Hilliard & Burt* 6745 (COI); *Schlechter* 5899 (COI).
43. *Crassula lactea* Soland. in Ait., Hort. Kew. 1: 396 (1789). — Toelken, op. cit.: 209 (1977).
PROV. CAP.: *Flanagan* 1273 (Z).
114. *Crassula lanuginosa* Harv. in Harv. & Sond., Fl. Cap. 2: 347 (1862).
- 114a. Var. *lanuginosa* — Toelken, op. cit.: 455 (1977).
PROV. CAP.: *Drège* s. n.? (K, isolectotypus).
- 114b. Var. *paehystemon* (Schonl. & Bak. f.) Toelken in Journ. S. Afr. Bot. 41: 106 (1975); in Contr. Bolus Herb. 8: 455 (1977).
PROV. CAP.: *Pegler* 1526 (K).
70. *Crassula lasiantha* Drège ex Harv. in Harv. & Sond., Fl. Cap. 2: 344 (1862). — Toelken, op. cit.: 292 (1977).
PROV. CAP.: *Esterhuysen* 21311 (BR).
- 35c. *Crassula marginalis* Dryand. in Ait., Hort. Kew. 1: 396 (1789).
Syn.: *Crassula pellucida* L. subsp. *marginalis* (Dryand.)
Toelken in Journ. S. Afr. Bot. 41: 114 (1975); in Contr. Bolus Herb. 8: 187 (1977).

PROV. CAP.: *Erikwall* 107* (LD); *Esterhuysen* 23180 (LD); *Fries, Norlindh & Weimarck* 251*, 453* et 971* (LD).

42. *Crassula multicava* Lem. in Rev. Hort.: 97 (1862).

42a. Subsp. *multicava* — Toelken, op. cit.: 208 (1977).

Annot.: Numerus *Wood* 597 (BOL; SAM), in Inanda (Natal) collectus, a nobis non visus, ut *C. multicava* Lem. a Toelken (op. cit.: 209) citatus est., sed ab ipso auctore ut *C. sarmentosa* Harv. var. *integrifolia* Toelken etiam relatus (op. cit.: 201). Idem specimen *Wood* 597 a Schonland (in Trans. Roy. Soc. S. Afr. 17: 199, 1929) ut *C. inandensis* citatum est.

89. *Crassula natalensis* Schonl. in Bull. Herb. Boiss. 5: 861 (1897). — Toelken, op. cit.: 353 (1977).

NATAL: *Wood* 4637 (z).

LESOTHO: *Dieterlen* 696 (z).

1. *Crassula natans* Thunb., Prodr.: 54 (1794) et Fl. Cap., ed. Schultes: 282 (1823).

1a. Var. *natans* — Toelken, op. cit.: 88 (1977).

TRANSVAAL: *Conrath* 726* (z); *Rehmann* 4235 (z); *Schlechter* 3467 (BR; z).

ORANGE STAT.: *Moss* 7986* (z).

99b. *Crassula nodulosa* Schonl. in Rec. Albany Mus. 1: 56 (1903).

Syn.: *Crassula capitella* Thunb. subsp. *nodulosa* (Schonl.) Toelken in Journ. S. Afr. Bot. 41: 100 (1975); in Contr. Bolus Herb. 8: 390 (1977).

TRANSVAAL: *Codd* 4805 (K); *Conrath* 287 (z, isotypus *Crassulae pectinatae*); *Fries* 5302* (K; LD); *Junod* 824* (z); *Nation* 208 (K); *Rand* 143* (BM); *Rehmann* 5503* (z); *Rogers* 19114*, 23515* et 25121* (z) et 20920* (K); *Schlieben* 7654* (BR; K); *Wilms* 522* (K; P; z).

PROV. CAP.: *Acocks* 3631* (K); *Burt Davy* 10097* et 13801* (PRE).

8. *Crassula oblanceolata* Schönl. & Bak. f. in Journ. of Bot. 36: 365 (1898). — Toelken, op. cit.: 106 (1977).

PROV. CAP.: *Schlechter* 8523 (COI), 10886 (BR; COI) et 11213 (BR; COI).

95. *Crassula obovata* Haw., Suppl. Succ.: 18 (1819).

- 95a. Var. *obovata* — Toelken, op. cit.: 376 (1977).

NATAL: *Junod* 65* et 235a* (z); *Rehmann* 7945* (z); *Wood* 4629 et s. n.* (z).

81. *Crassula orbicularis* L., Sp. Pl.: 283 (1753). — Toelken, op. cit.: 323 (1977).

NATAL: *Acocks* 11660 (BR); *Rudatis* 1939* (BR).

44. *Crassula ovata* (Mill.) Druce in Rep. Bot. Soc. Exch. Club Brit. Isl.: 617 (1917). — Toelken, op. cit.: 211 (1977).

NATAL: *Morris* 967 (K); *Wood* 4489 (K).

PROV. CAP.: *Baur* 880 (K); *Burchell* 2905* et 3417* (K); *Drège* 6890* (BM; K); *Ecklon & Zeyher* 1876* (P; s) et 2536* (P; z); *Fourcade* 2257* (K); *Galpin* 1533 (K); *Harvey* s. n. (BM; K); *Long* 689 (K); *MacOwan* 727 (BM; K; P); *Pegler* 1759 (K); *Schonland* 537 (z).

- 35a. *Crassula pellucida* L., Sp. Pl.: 283 (1753). — Toelken, op. cit.: 183 (1977), *sensu str.*

PROV. CAP.: *Esterhuysen* 23973* et 24131 (LD).

131. *Crassula perfoliata* L., Sp. Pl.: 282 (1753). — Toelken, op. cit.: 498 (1977), *sensu str.*

PROV. CAP.: *Zeyher* 2560 (P).

104. *Crassula perforata* Thunb. in Nova Acta Acad. Leop.-Carol. 6: 319 et 338 (1778). — Toelken, op. cit.: 415 (1977).

NATAL: *Rudatis* 1005* (z); *Wood* s. n.* (z).

67. *Crassula pruinosa* L., Mantissa: 60 (1767). — Toelken, op. cit.: 284 (1977).

PROV. CAP.: *Schlechter* 7273 (COI).

- 20b. *Crassula rhodesica* (Merxm.) Wickens & Bywater in Kew Bull. 34, 4: 632, t. 18, fig. A-B (1980).

Syn.: *Crassula campestris* subsp. *pharnaceoides* Toelken in Journ. S. Afr. Bot. 41: 99 (1975); in Contr. Bolus Herb. 8: 130 (1977), non *C. pharnaceoides* Fisch. & Mey. (1841).

S. W. AFRICA: *Kers* 3038* (LISC).

105. *Crassula rupestris* Thunb. in Nova Acta Acad. Leop.-Carol. 6: 329 et 337 (1778).

- 105a. Subsp. *rupestris* — Toelken, op. cit.: 420 (1977).

PROV. CAP.: *Schlechter* 7487 (COI).

57. *Crassula sarcocaulis* Eckl. & Zeyh., Enum. Pl. Afr. Austr.: 295 (1837).

- 57a. Subsp. *sarcocaulis* — Toelken, op. cit.: 252 (1977).

AFR. AUSTR. (praecipue Transvaal): *Bolus* 244* (BM), 580 et 3025 (K); *Bruce* 334 (K); *Codd* 7912 (K); *Galpin* 2001 (K; IMA); *Haygarth* s. n.* (BM, specim. natal.); *Hutchinson & Gillett* 4402* (K); *Junod* 1675* et 2656* (Z); *Long* 918* (K); *MacOran* 919 (K); *Meeuse* 9855 (K); *Miller* S. 259 (K); *Prior* 4610* (K); *Rodin* 4527 (vel 2527, in TOELKEN, op. cit.: 254, 1977); *Rogers* 12598*, 14613 et 18807* (K) et 23046 (Z); *Rudatis* 1085 (K); *Scheepers* 950 (K); *Toelken* 1210 (BR) et 1212* (K); *Wilms* 516 (K).

- 57b. Subsp. *rupicola* Toelken in Journ. S. Afr. Bot. 41: 116 (1975); in Contr. Bolus Herb. 8: 254 (1977).

AFR. AUSTR. (praecipue Natal): *Cooper* 1129* (K); *Drège* 6905 (BM; K); *Edwards* 2278 (K); *Galpin* 6614 et 10027 (K); *Gerrard* 1782* (K); *Guillarmod* 2225 (K); *Killick* 1371 (K, iso-

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, isoelectotypus *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).



Exemplar depositado no Arquivo Botânico
Biblioteca do Instituto Botânico (1918)

NOVIDADES FICOLÓGICAS DA RIA DE AVEIRO

por

M. PÓVOA DOS REIS *

Instituto Botânico da Universidade de Coimbra

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

* Centro de Fito-sistemática e Fito-ecologia (Ec C2) do Instituto Nacional de Investigação Científica (INIC).

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⁻/l

2.º na vasa 1013,7 mg Cl⁻/100 g
de vasa

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

d) CO. combinado:

1.º na água 99,6 mg HCO₃/l

2.º na vasa 95,6 mg HCO₃/100 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 exsicação; 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 pericentraes 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. dissolvido ppm:

Enchente	9,7
Vazante	10,1

pH:

Enchente	8,15
Vazante	8,0

O CENTRO CHYZANTHES SWARTZ
EM PORTUGAL

ERRATA

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O GÉNERO *CHEILANTHES* SWARTZ EM PORTUGAL *

por

M. L. ROCHA AFONSO

Instituto Superior de Agronomia, Lisboa

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 *Reunion 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 (SAENZ 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.

TRÁS-OS-MONTES

Bragança, *P.^c 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.^a 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, Poiares, 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, Ameeira, 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. Koepf & 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.^a 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 editioribus 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. So-brinho & 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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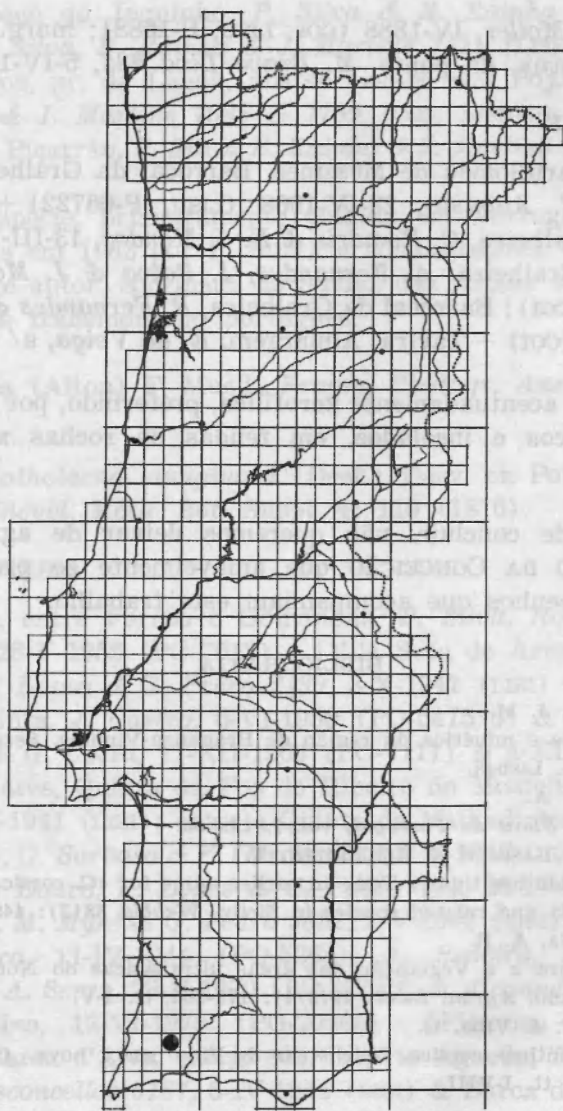
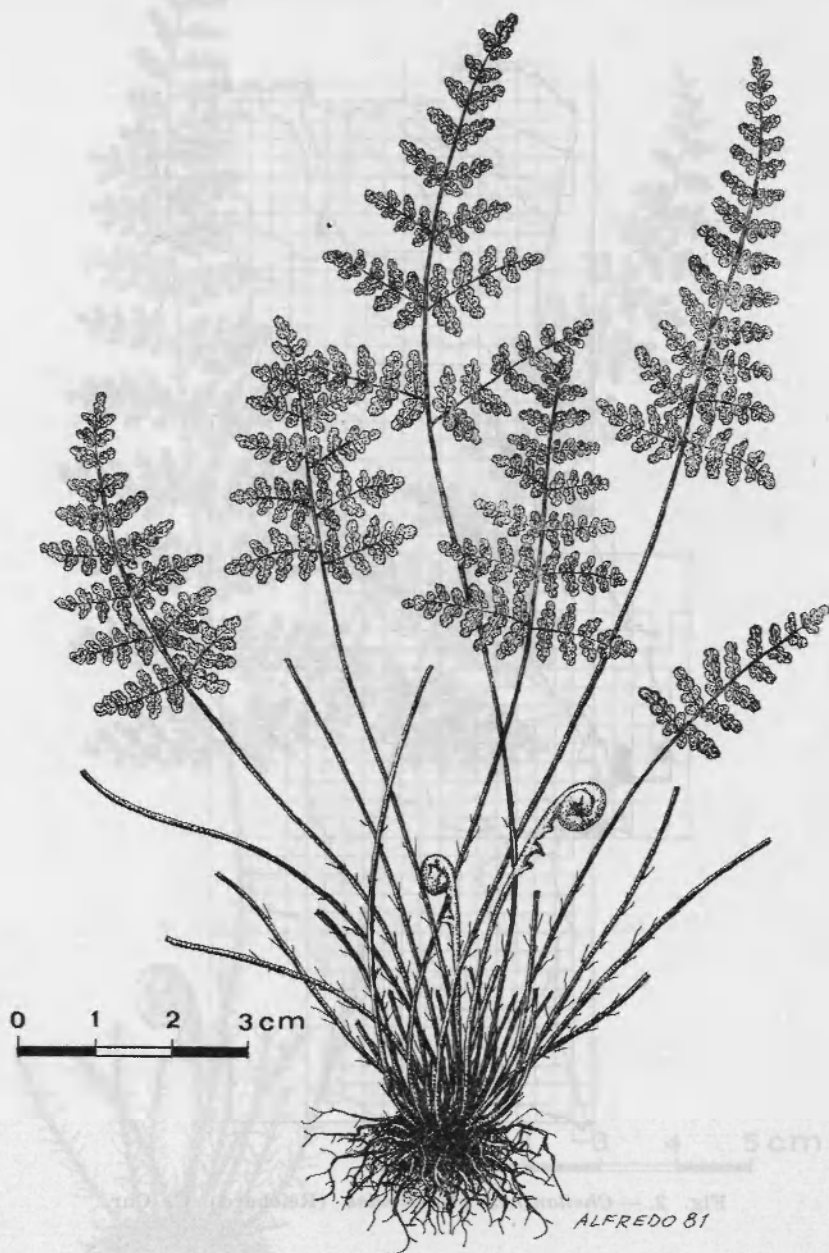


Fig. 1. — *Cheilanthes guanchica* Bolle



Cheilanthes guanchica Bolle

Cheilanthes pteridoides (Reichb.) O. Chr.

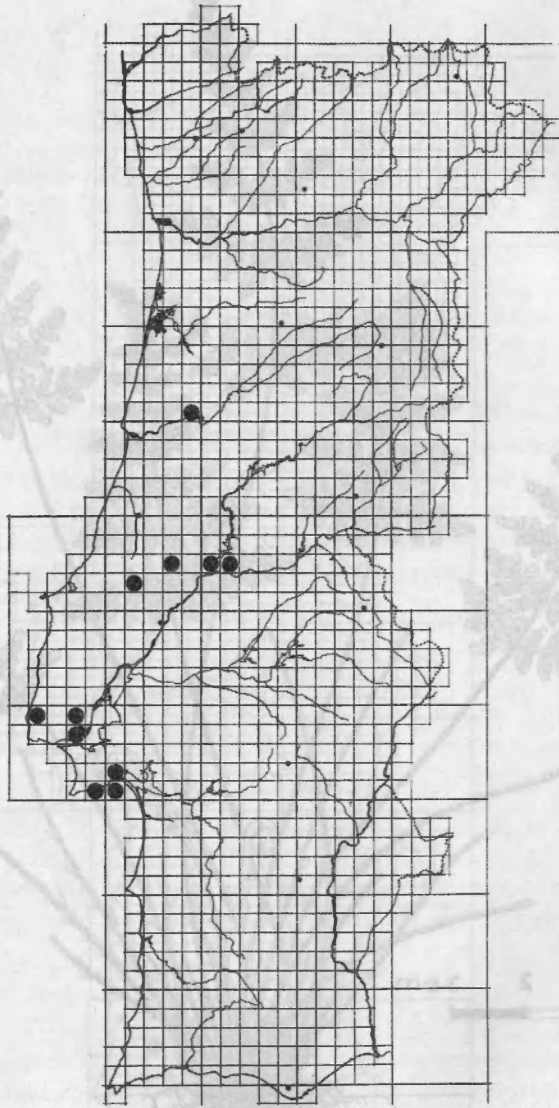


Fig. 2. — *Cheilanthes pteridioides* (Reichard) C. Chr



Cheilanthes pteridioides (Reichard) C. Chr.

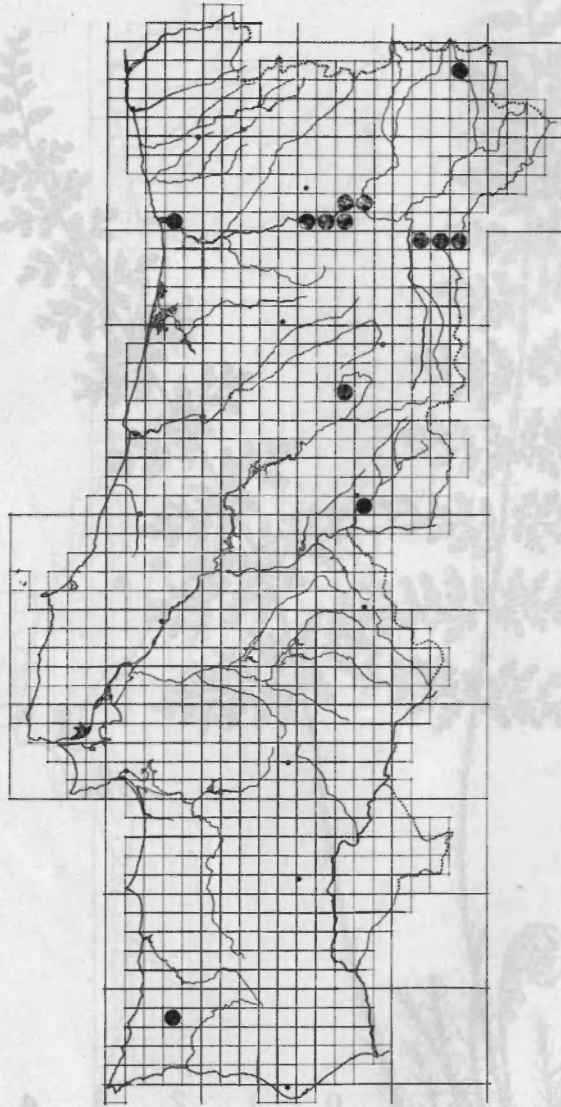


Fig. 3. — *Cheilanthes maderensis* Lowe



***Cheilanthes maderensis* Lowe**

Fig. 4.—*Cheilanthes maderensis* Tod.

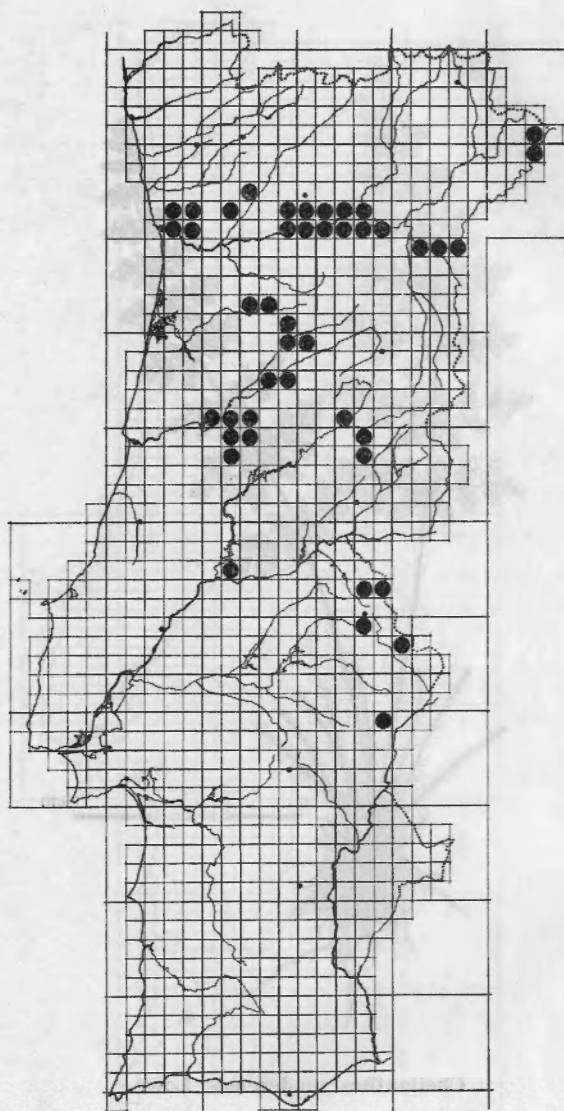
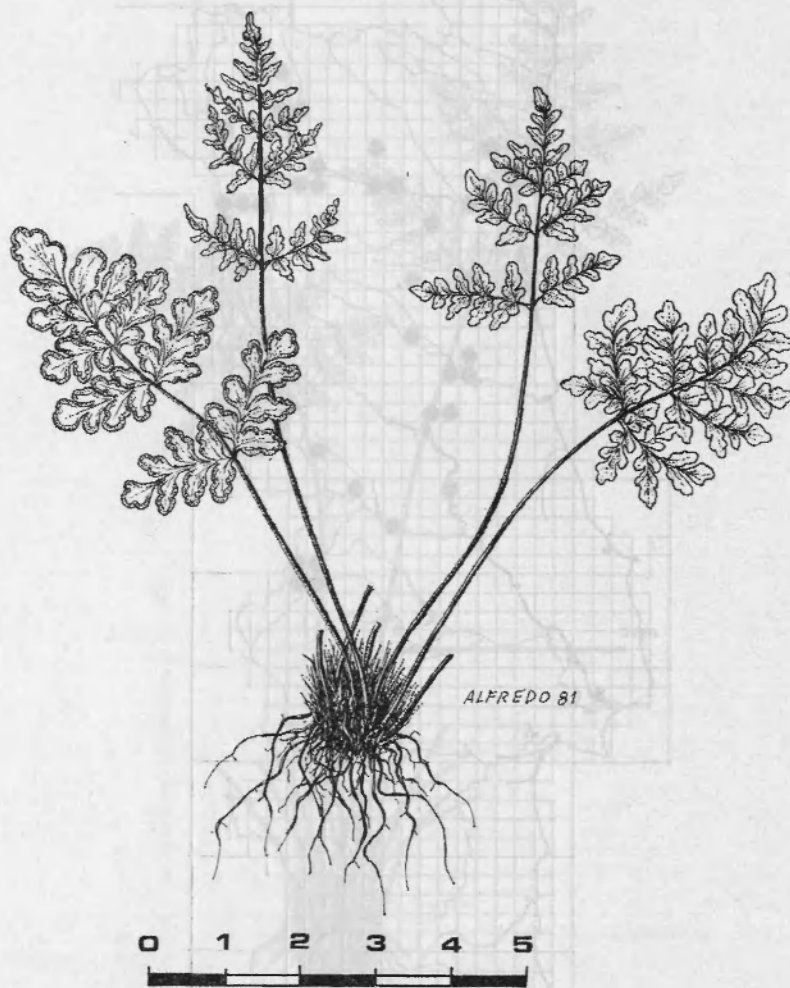


Fig. 4. — *Cheilanthes tinaci* Tod.



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0 1 2 3 4 5

Cheilanthes tinaei Tod.

Cheilanthes tinaei Mett.

Fig. 5. — *Cheilanthes tinaei* Mett.

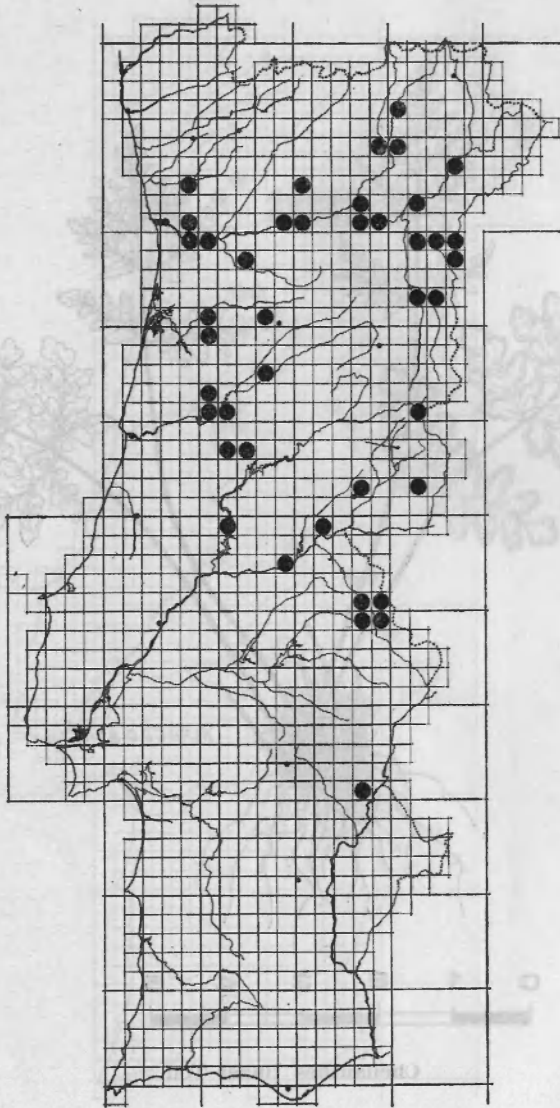
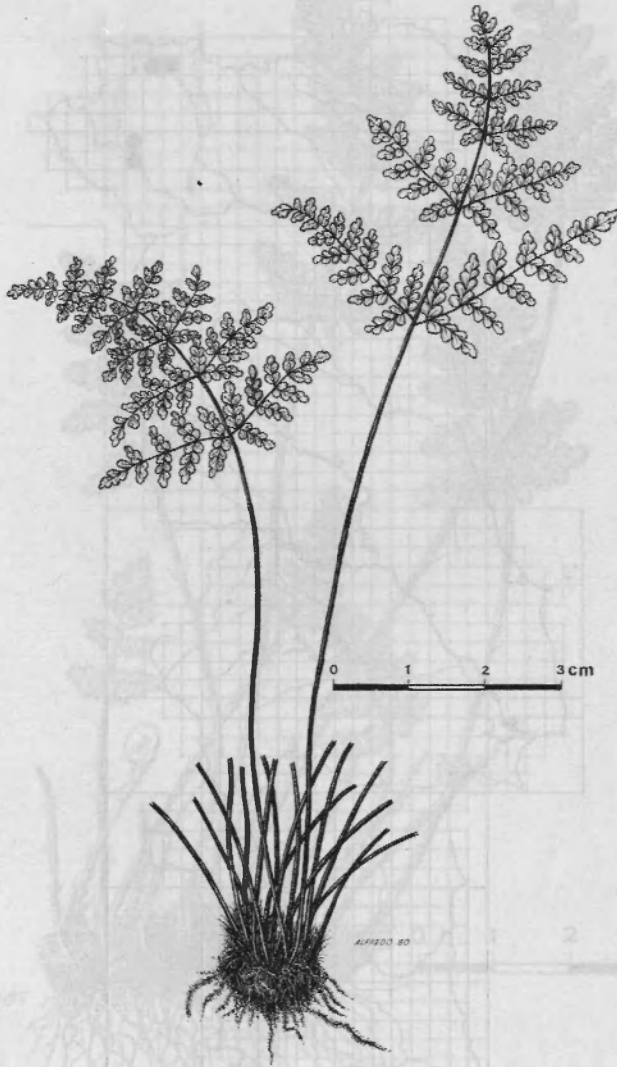


Fig. 5. — *Cheilanthes hispanica* Mett.



Cheilanthes hispanica Mett.

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

(L.) Donnell

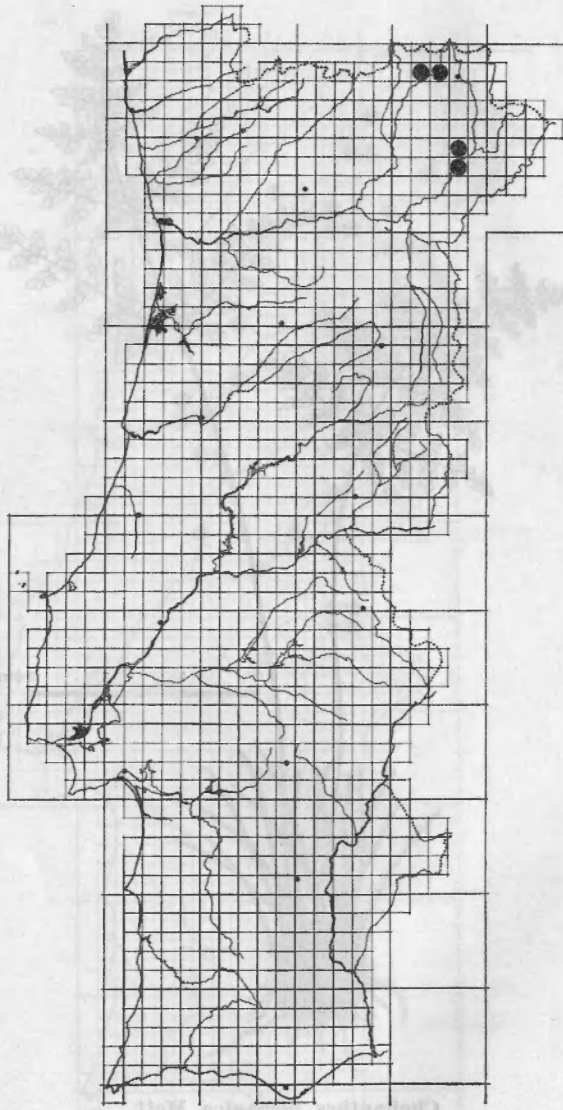
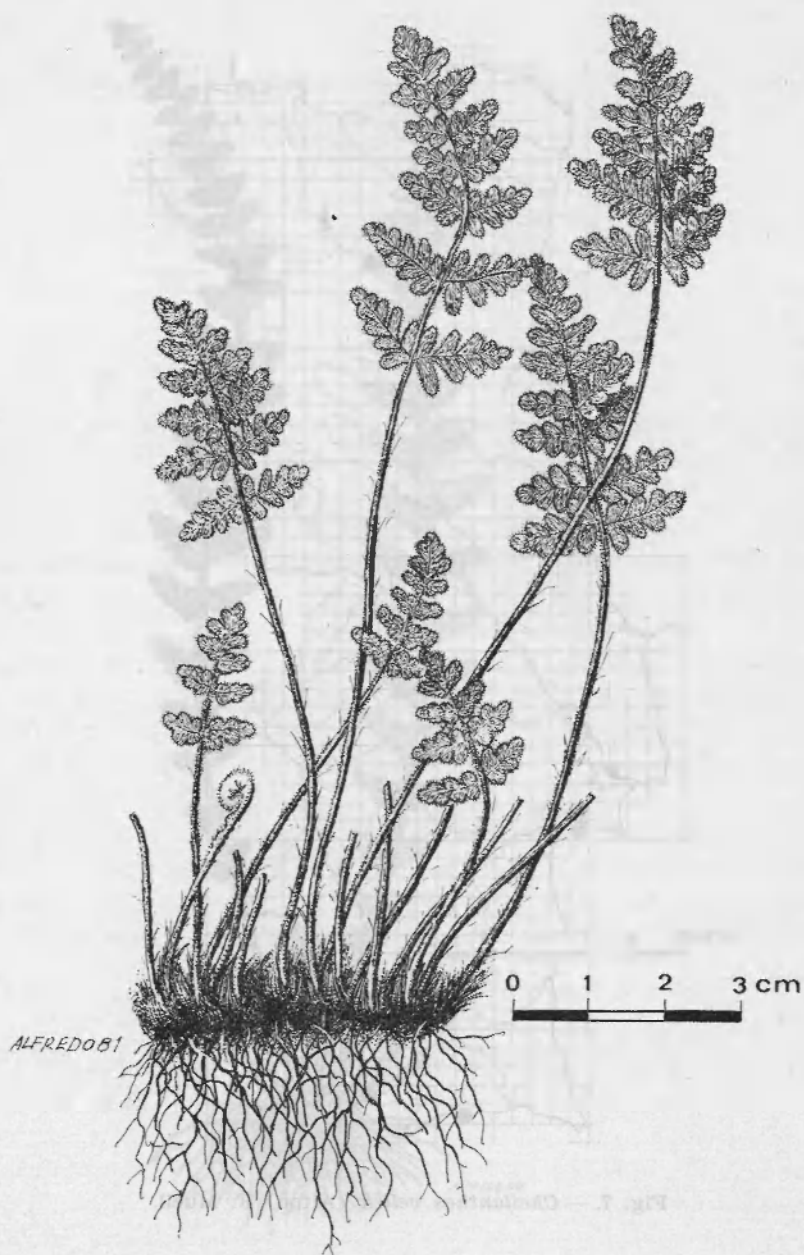


Fig. 6. — *Cheilanthes marantae* (L.) Domin



Cheilanthes marantae (L.) Domin

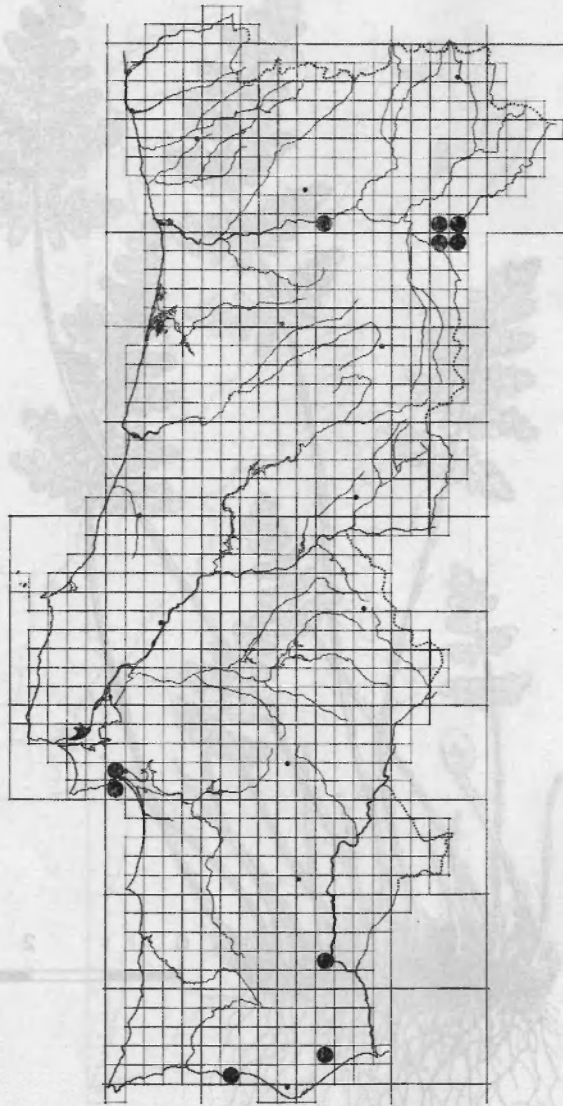
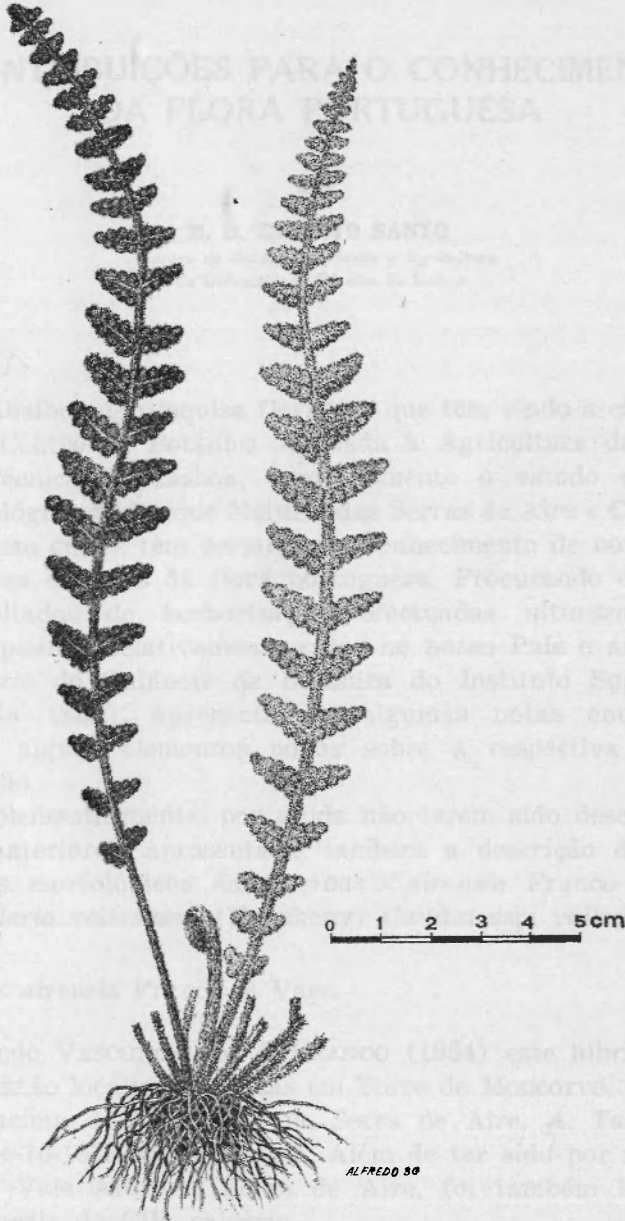
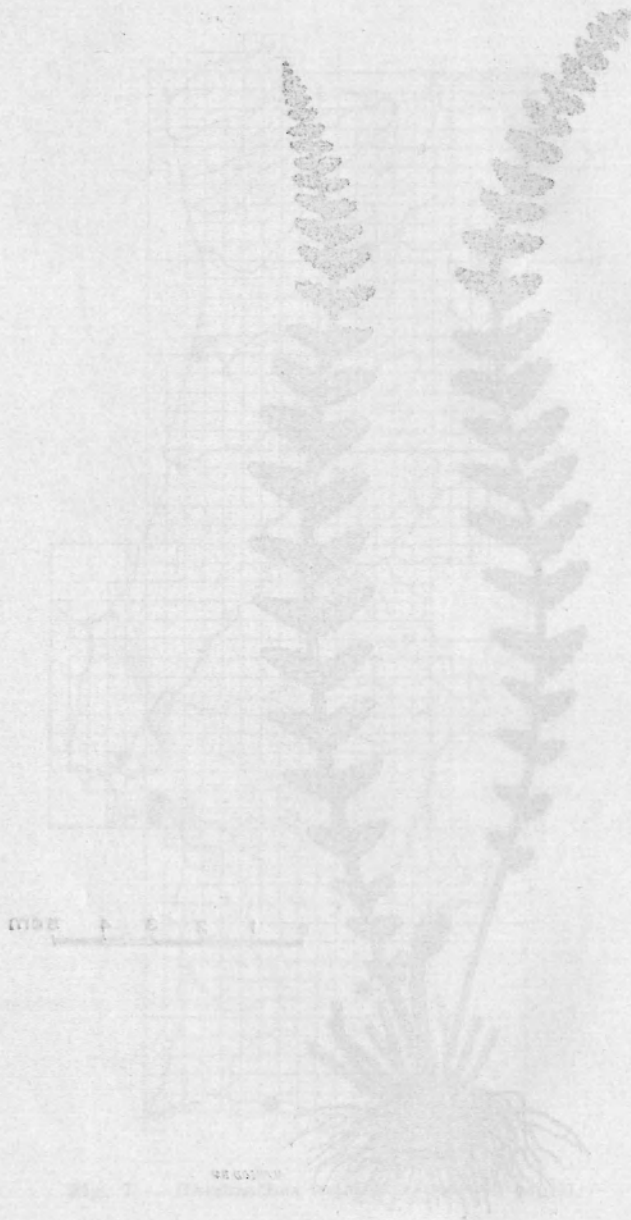


Fig. 7. — *Cheilanthes vellea* (Aiton) F. Muell.



***Cheilanthes vellea* (Aiton) F. Muell.**



Chelidonium majus (Aiton) J. Moench

CONTRIBUIÇÕES PARA O CONHECIMENTO DA FLORA PORTUGUESA

por

M. D. ESPÍRITO SANTO

Centro de Botânica Aplicada à Agricultura
da Universidade Técnica de Lisboa

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 Alardoiro, 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*

À 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*

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

by

REGINALD E. UGBOROGHO

Department of Biological Sciences, University of Lagos,
Nigeria

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 μm) 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 μm 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 μm). 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 Annex, 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 μm) 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, Tegin, *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 μm) 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 μm) 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. Ugborgho* 483 (LUH); Zaria-Kano Road, 18 km. to Kano, *R. E. Ugborgho* 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. grewooides</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 μm	26.47	36.75	26.55	30.21	30.66	33.00
Stomata breadth μm	16.89	23.54	17.63	22.71	20.55	24.65
Pollen diameter μm	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

The author is grateful to the University of Lagos for financial assistance.

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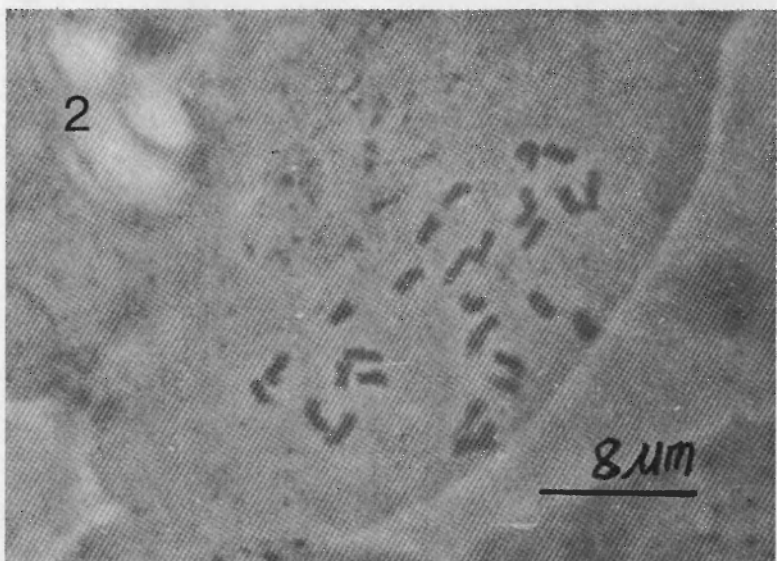
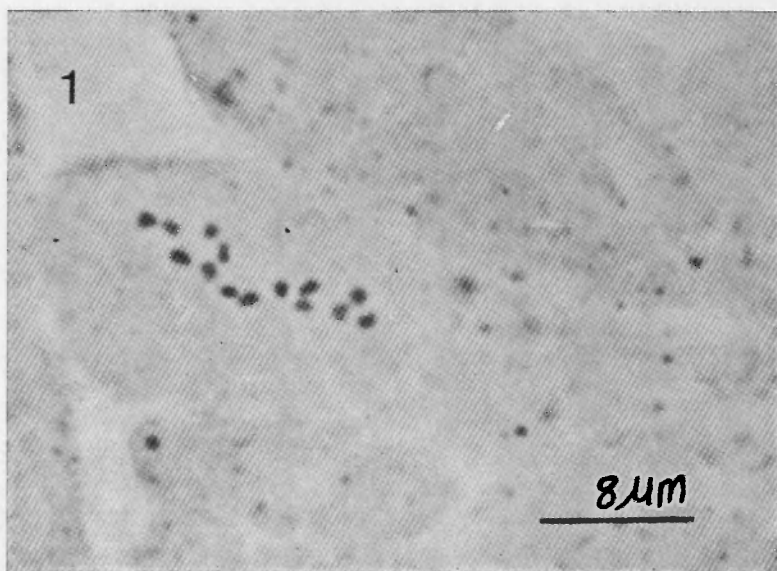
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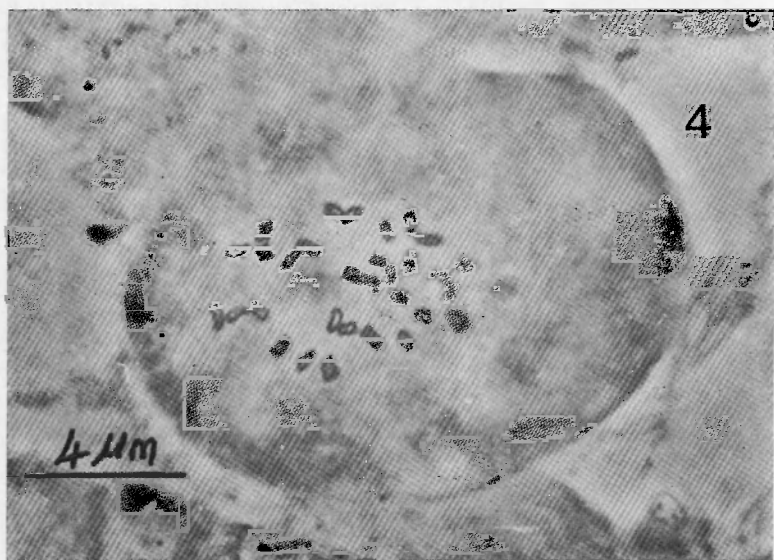
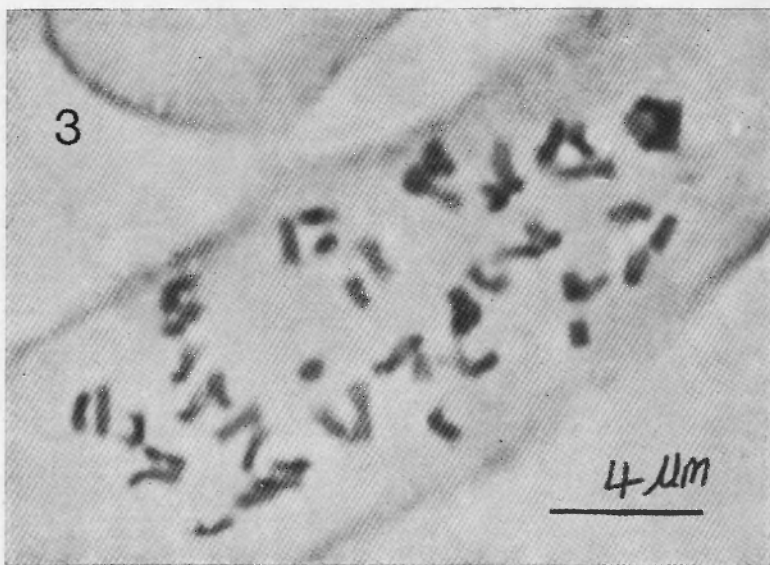
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2n = 24.
2. *S. cordifolia* from Badagry, Lagos state, Ugborogho 587.
2n = 24.



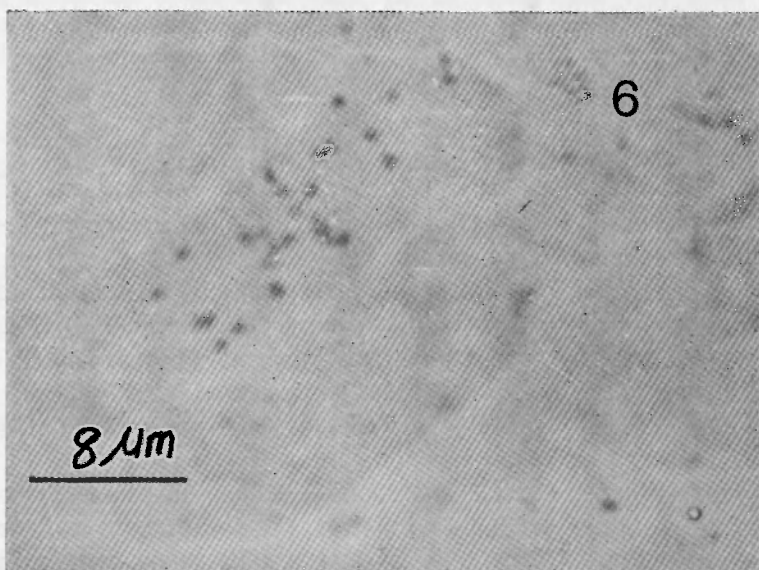
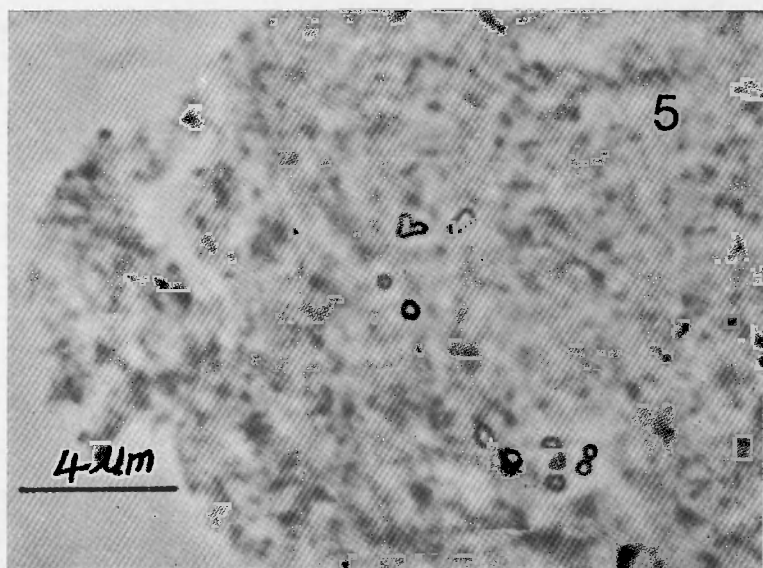


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2n = 14.
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2n = 28.

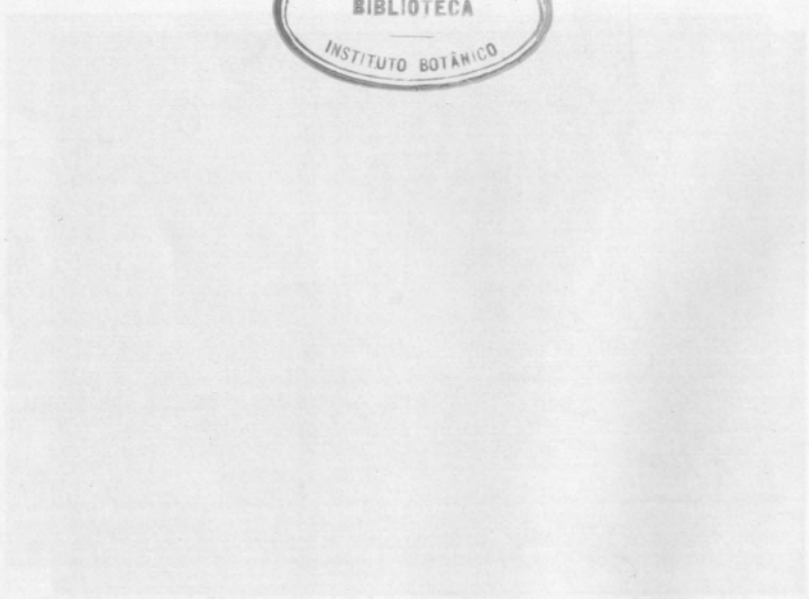
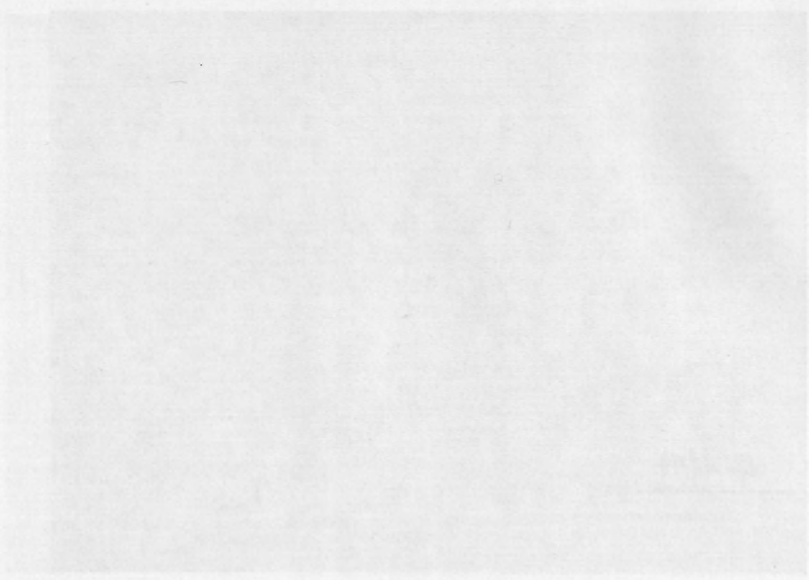




3. *S. pilosa* from University of Lagos, Akoka campus, Lagos state. Ugborogho 663. $2n = 56$.
4. *S. urens* from Bauchi, Bauchi state. Ugborogho 493. $2n = 32$.



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



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PADRÃO DE BANDAS C EM *CREPIS VESICARIA* L.

MARCELO DOS SANTOS GUERRA

Departamento de Biologia Geral — UFPE, Recife — PE, Brasil

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 cariossistemático 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 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 × 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)

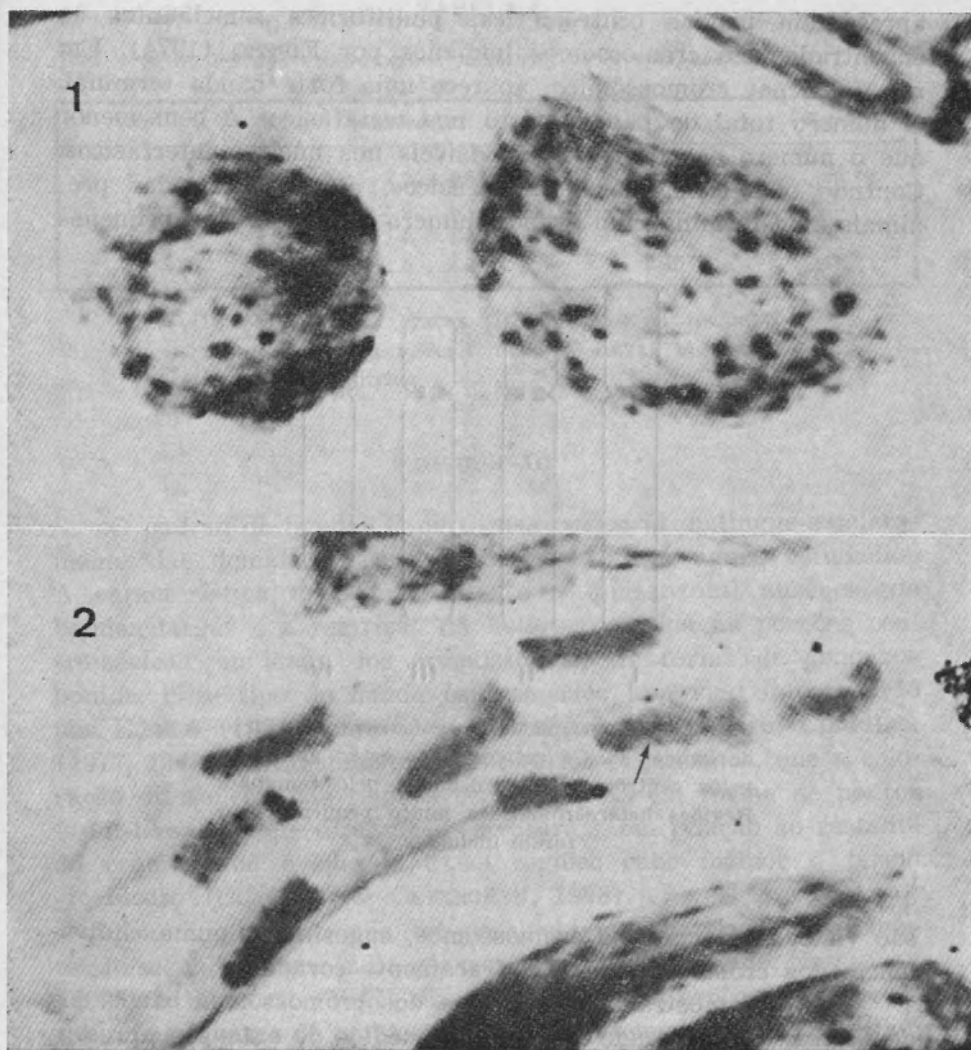


Fig. 1. — Núcleos interfásicos de *C. vesicaria* preparados segundo a técnica de bandeamento. Note o grande número de regiões heterocromáticas (cromocentros).

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

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

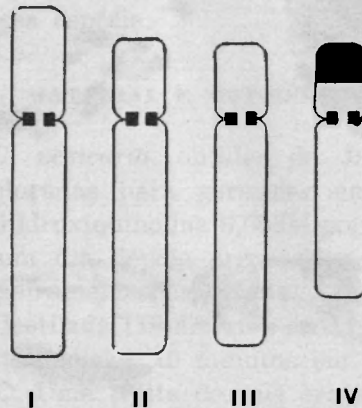


Fig. 3. — Idiograma de *C. vesicaria* com padrão de bandas C. Os cromossomos estão alinhados pelos centrômeros e ordenados pelo tamanho. Regiões heterocromáticas muito pequenas não foram incluídas.

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 (µ)	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 cromocêntricos 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 cromocêntricos. 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

C. R. FRASER-JENKINS

Botany Dept., British Museum (Natural History), Cromwell Road,
London S. W. 7, England

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 & LAÍNIZ, 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, 1980b). *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 phytogeographical 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 ne endemic, 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 reniforme* 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, COL, 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. LAÍN Z 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, Basel 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 superseded 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 Andalucia (e. g. the N.E. Sierra de Segura (Las Cabras and Revolcadores); Sierra de Magina; Sierra de Maria; 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.

Key¹

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.

¹ 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 (Schräd.) 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. borrieri*. 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.

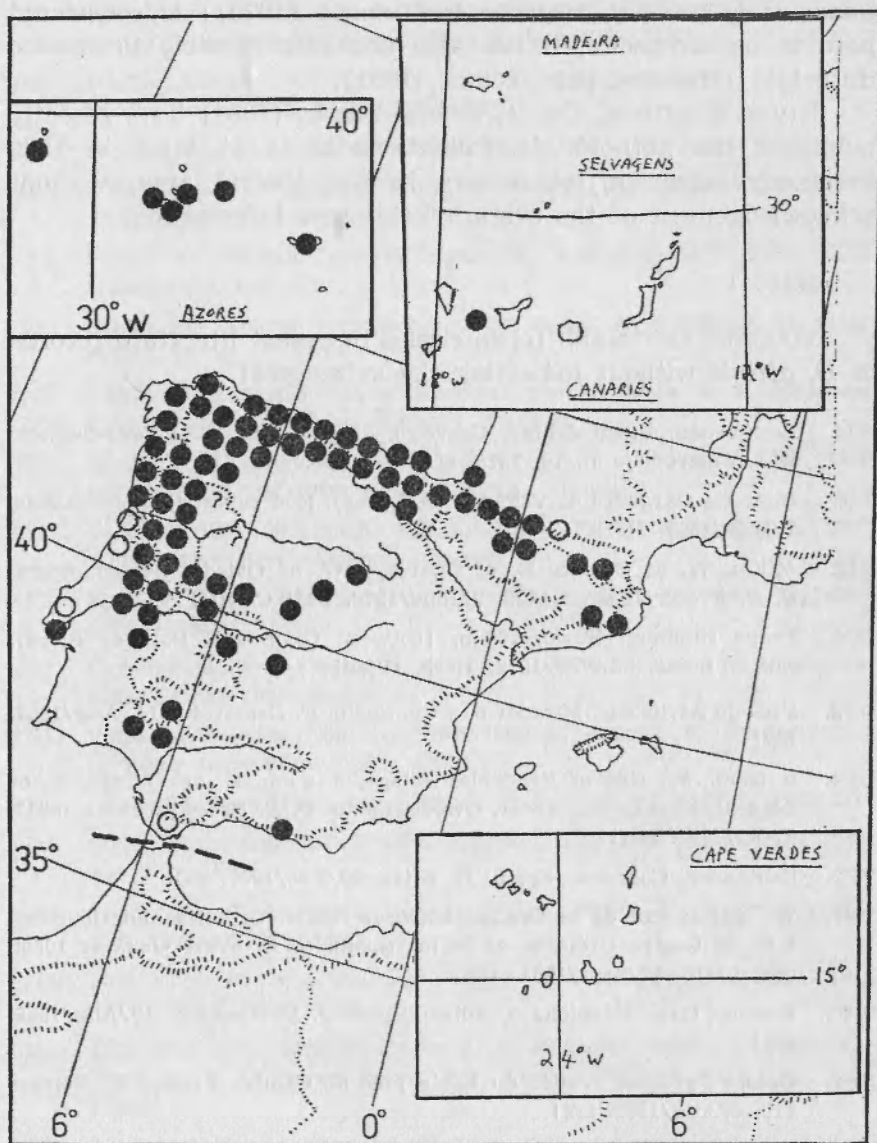
HABITAT: Banks and slopes, in woods, or among rocks and bushes on mountains, with no definite preference for calcareous or acidic rocks, though more common on the latter as they are usually less dry. From sea-level up to 2000 m. altitude or more. This subspecies is more common near the sea than the other 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 reseendeana* [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 Coruna, 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, Cobreces, Spain. *H. Elias*, 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 Coruna, N. de Ordenes, Spain. *L. Reichling* 21186, 29/June/1954. BR! M!
- NH3. Cuenca alta del Rio Mandeo (Coruna), riberas del Deo, Spain. *J. Dalda-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. ½ 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. Pena Salon [nr. Amieva, Sierra de Ponga], Spain. *J. M. Arguelles 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. Lendrono 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, Bihères, 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 Coruna, 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 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, 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 Galineiro, 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 Pena, 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 dei 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. *Wehwitsch*, 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. *Rouy* (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! COL.
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 Mna. 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.

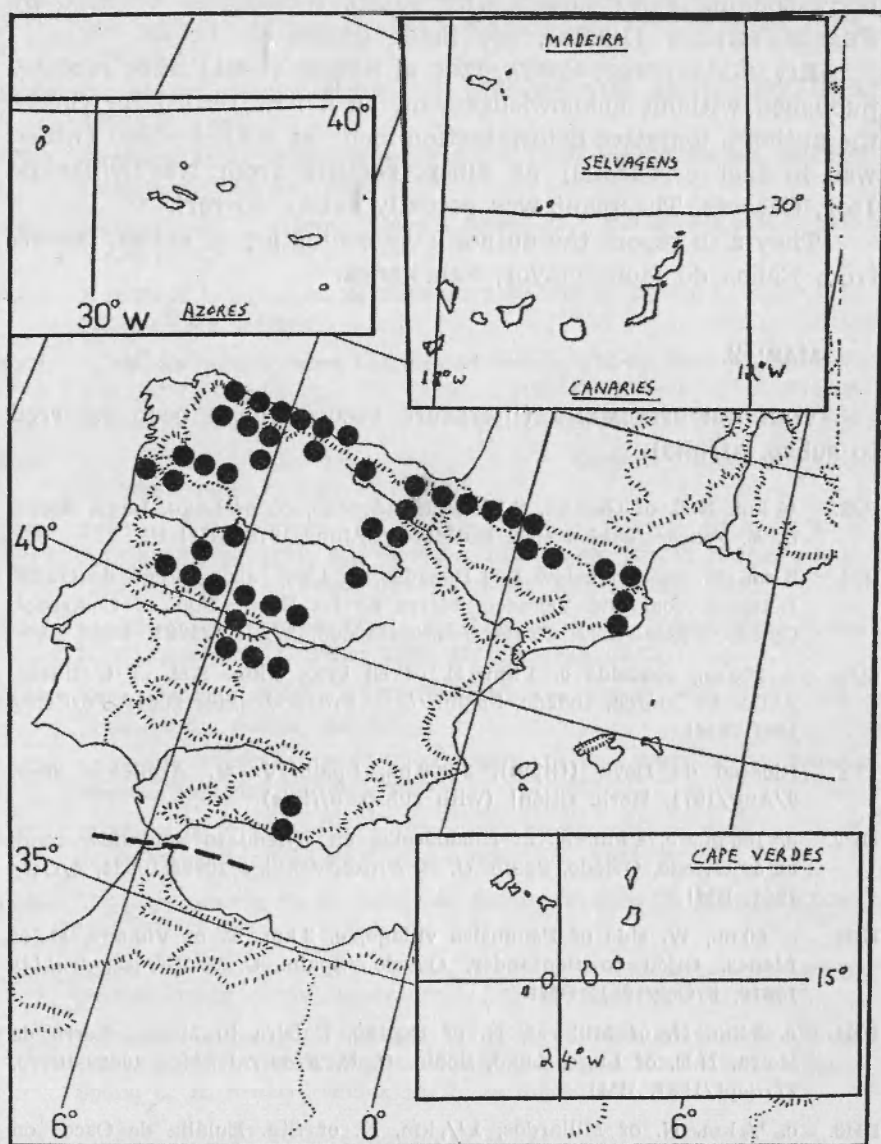
HABITAT: As for subsp. *affinis*, but perhaps occurring more commonly than that subspecies on calcareous rocks, though showing no definite preference. From c. 50-2000 m. altitude. Not as common near the sea as subsp. *affinis*.

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 Mondonedo, 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 Luarca, 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 Fontao, 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, 1 ¼ 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. Alejandre* 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. ½ km. up path between Lac d'Isabe and Gorges du Bitet, Val d'Ossau, S.W. of Les Eaux-Chaudes, Basses Pyrénées, France. *C. R. Fraser-Jenkins & J. Vivant*, 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 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* 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. Ccnill*, 6/July/1929. TL!
- NG3. ½ 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, Logrono, 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 Salient de Sta. Pau, Bac d'Esparragueres, pr. Font Suriola, 600 m., Spain. *A. & O. de Bolos*, 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 Muinos (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 dei 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 Rio de San Juan, Sierra Nevada, Granada, Spain. A. E. Salvo-Tierra, March/1978. MGC!
- VF3. Alpujarra Mts, Rio 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. Alexandre, 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.

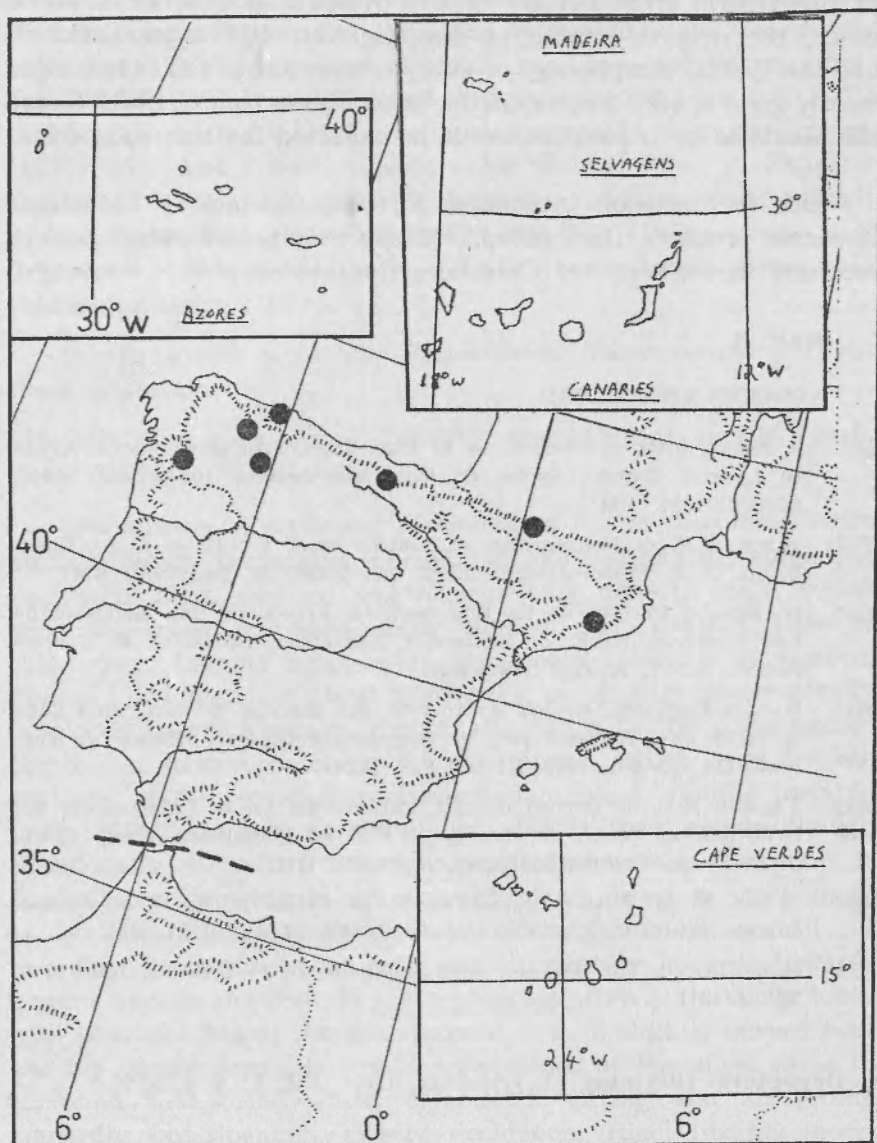
Pinna-lobes or pinnules narrow, becoming long at the bases of the pinnae, usually with indentations above the sori and often above the veins, their apices rounded-truncate and bearing \pm short, regular, somewhat narrow, but often obtuse-tipped teeth spread out in a fan-like arrangement; pinna-lobe or 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 Luarca, Oviedo, Spain. *C. R. Fraser-Jenkins* 10645 and 10648, 26/Sept/1981. BM!
- PH3. ½ km. N.E. of Fonsagrada, on Luarca 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* × *bohemica* 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.

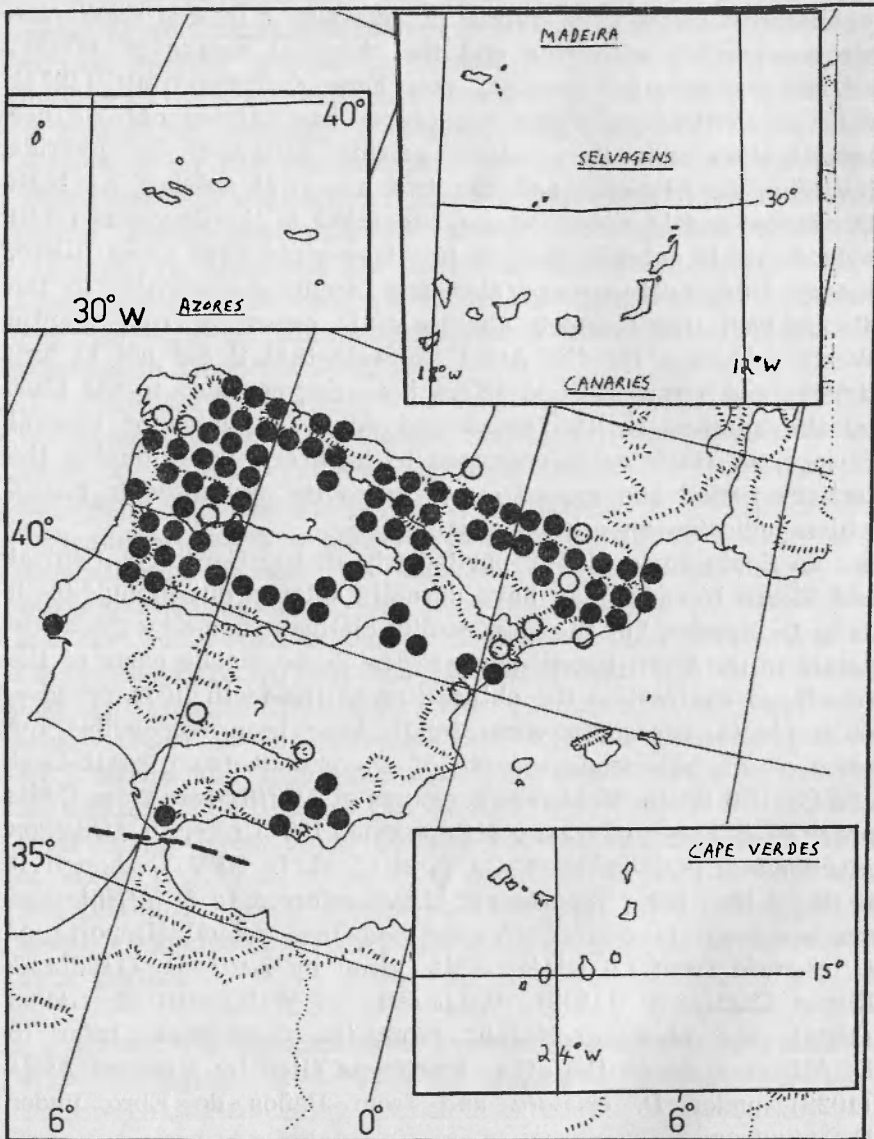
The cytological results of WAGNER (1971) on Eastern North American plants of the hybrid *D. filix-mas* × *D. marginalis* are also compatible with this and the chemical results of WIDÉN, FRASER-JENKINS, LOUNASMAA, VON EUW & REICHSTEIN (1973) help to confirm it; GIBBY (in prep.) has carried out further 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 Mondonedo, 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. Aviles. Spain. Chermeson (1919).
- UP2. c. 200 m., c. 1/2 km. below Rioseco village, S.W. of Posada on road to La Robellada and Onis, 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 Fontao, Baleira to Meira, Sierra de Meira, N.E. of Lugo, Spain. *C. R. Fraser-Jenkins* 10688, 27/Sept/1981. BM!
- PH3. c. 1/2 km. N. of Millardos, 1 1/2 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 ribereo en Pigüeces, Scmiedo, 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 Onis to Riano, 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. Alejandro & P. Uribe-Echebarria* 2570, 23/Aug/1980. Herb. AEPNA, Vitoria!
- XN1. Navarra, cuenca del Rio Irati, bosques, Spain. *M. Losa*, July/1965. PAMP (01736)!
- XN3. Refugia Labérouat, 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. Pena 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. Cabe-zudo, T. Luque & J. Ubersa*, 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. $\frac{1}{2}$ 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. Inés, 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 Muinos (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 Pena. 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 Rio Francia, Salamanca, Spain. F. J. Fernández-Diez, 10/Sept/1974. SA (6279)!
- TK3. Cáceres, La Garganta [Bejar to Hervas], Castanares. M. J. Díez, J. Pastor & S. Silvestre, 4/June/1979. SEV (40909)!

- UK1. Piedrahita to Hoyos, Sierra de Gredos, Avila, Spain. *C. R. Fraser-Jenkins* 3777, 23/July/1972. BM!
- UK3. Avila, interseccion del Rio Alberche con la carretera del Puerto de Menga, Spain. *J. A. Devesa, J. Pastor & S. Talavera* 5980/78, 28/July/1978. SEV!
- VK1. El Escorial, Spain. *Isern*, 17/July/1852. MA (155831)!
- WK3. Sierra de Cuenca, Spain. *Gandoger*, June/1898, W!
- XX1. Puerto de Orihuela, Teruel, Spain. *E. Fuertes, R. Garcia & J. Alvarez* 39c-07110, 5/April/1974. PAMP!
- YK1. El Maestrat, S. Juan de Penyaglossa, Torrent del'Avellanar, Sota el Mas de Benages, 1450 m., Spain. *J. Vigo*, 15/July/1961. BC (146570)!
- BE3. Tarragona, Alcanar, Na. Sa. del Remei, Spain. *Teodora*, 2/Aug/1926. BC!
- NE4. A cerca de 14.5 km. do ramal para Alvares, na estrada de Sotão a Pampilhosa da Serra, Portugal. *A. & R. Fernandes & J. Matos* 8534, 8/June/1962. M! COI! MA (195073)! MAF (72806)!
- PE2. [Rio] Ocreza, Portugal. *J. S. Tavares*, July/1896. COI!
- UK4. Jalas & Suominen (1972).
- YK2. Jalas & Suominen (1972).
- MC3. Serra de Sintra, Portugal. *Valorado* 36. [c. 1839] COI! (the only specimen seen from Sintra; very probably introduced into the Parc da Pena, see also comments under *D. guanchica*).
- UN3. Jalas & Suominen (1972).
- TH4. Montes de Gata [nr. Fuente-obejuna, Cordoba], Andalucia, Spain. *H. de Greg. Colmeiro y Penido* (1889).
- VH4. Cuesta de Santa Elena en Sierra Morena, Andalucia, Spain. *Colmeiro y Penido* (1889).
- WG1. Sierra de La Cabrilla, Spain. *J. Cuatrecasas*, 12/July/1926. MAF (44486)!
- UG4. Lucena. *Lagasca*. *Colmeiro y Penido* (1889).
- VG4. Sierra Nevada, 2,400 m., Borreguiles, Monachil valley, Granada, Spain. *C. R. Fraser-Jenkins* 3795-3800, 25/July/1972. BM!
- WG2. Almeria, Sierra Nevada, Chullo, 2,400 m., Spain. *A. Charpin & J. Fernández-Casas* 10605/1901, 19/July/1974. G!
- WG4. «Sierra de Bacarés, Almeria», Spain. *E. Gros* (Herb. Pau), 3/Oct/1929. MA (236)!
- VF3. Andalucia, Rio Bermejo, nr. Pampaneira, Alpujarra, 4000', Spain. *D. Brinton-Lee* 931, 5/Aug/1969. BM!

WF1. Jalas & Suominen (1972).

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

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

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

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

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

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

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

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

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

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

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

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

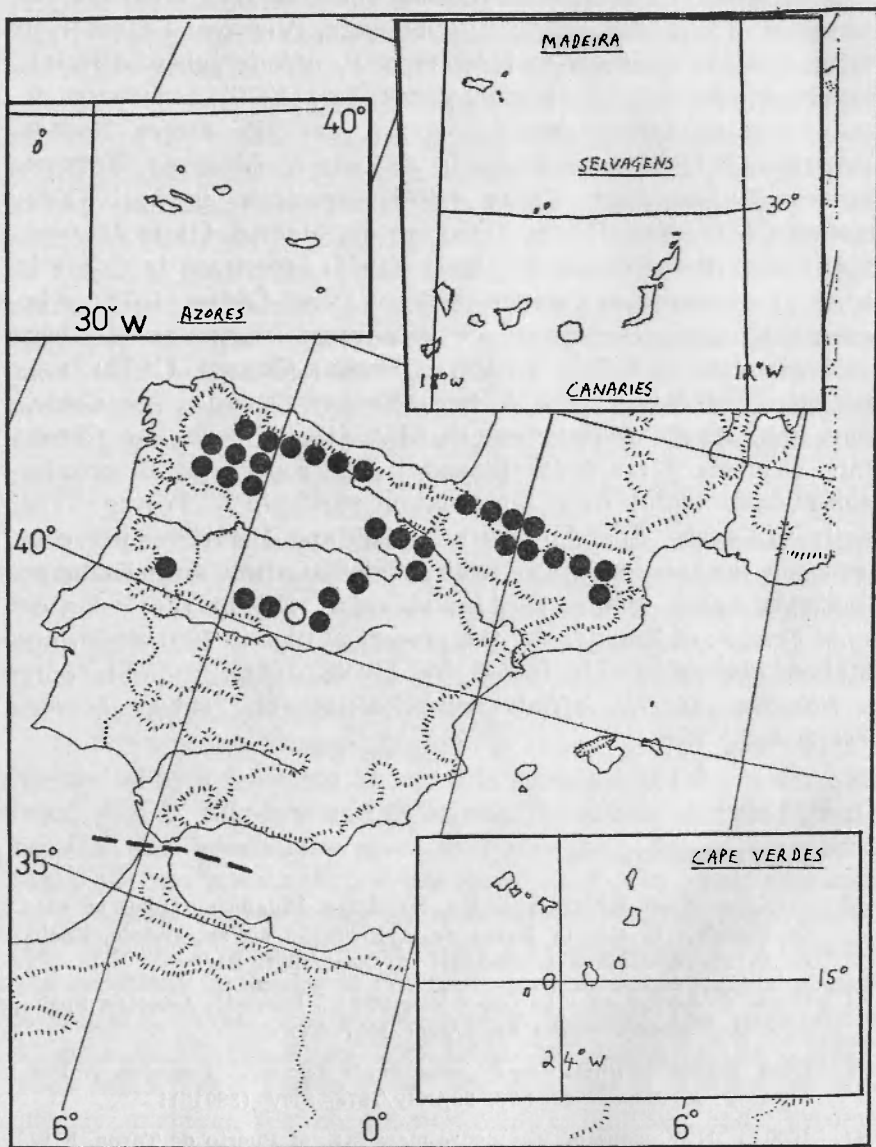
NOTES: The misapplication of the name, *D. abbreviata*, and whereabouts of its type (in BORD), were first pointed out by VIVANT (1974 & 1976), who had noticed that *D. oreades*, at that time known as *D. abbreviata* auct., does not grow in the low-lying area of the Department of Landes, from where *Polystichum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

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

MAP: 5.

VOUCHER SPECIMENS:

- PH3. c. 1/2 km. N. of Millardos, 1/2 km. N. of Sta. Eulalia de Oscos on road to Vegadeo, S. side of Sierra de la Bobia, c. 650 m., Oviedo, Spain. *C. R. Fraser-Jenkins* 10673-10674, 27/Sept/1981. BM!
- QH1. Borde de Arroyo en Villar de Vildas, 900 m., Somiedo, Asturias, Spain. *J. A. Fernandez-Prieto* 1191. 5/June/1977. FCO!
- TN3. León, Subida al Puerto de Pajares, Santa Lucia. *S. Talavera, J. Pastor & J. A. Devesa* 6080-78, 29/July/1978. SEV (38015)!
- UN1. 1650 m., N.W. slope of Mampodre massif, S. of Puerto de Tarna, N.W. of Riano, León, Spain. *C. R. Fraser-Jenkins* 10612-10614 and 10616-10624, 18/Sept/1981. BM!
- UN3. Infra lacum, Curavacas, Palencia, Spain. *Lainz*, 15/July/1962. Herb. Gijón! and c. 1800 m., S.E. side of Puerto de Tres Mares, S. side of Pena Labra, W. of Reinosa, Santander, Spain. *C. R. Fraser-Jenkins* 10602-10604 and 10607, 18/Sept/1981. BM!



MAP 5.

- VN1. Top of Puerto Estacasas de Trueba, between Vegas de Pas and Espinosa de Los Monteros, 1160 m., Santander, Spain. *C. R. Fraser-Jenkins* 10599, 17/Sept/1981. BM!
- XN1. Mt. Okolin, Lanz [E. of Puerto de Velate], Spain. *J. C. Bascones*, 3/Oct/1975. PAMP! (with *D. affinis* ssp. *affinis*).
- XN3. Basses Pyrénées, St. Engrâce, Mont Lacoura, 1906 m., France. *J. Vivant*, 5/July/1955. P! Herb. Vivant, Orthez!
- YN1. Col de Lurde to Morilas, Les Eaux Bonnes, 1840 m., France. *P. Montserrat & L. Villar* 2341, 16/July/1979. JACA!
- BH3. Ruisseau Dets Coubous, 3.5 km. E. of Barèges, 1550 m., Hautes Pyrénées, France. *F. Badré* 1641, 21/July/1975. P!
- PH2. Bosque de la Rogueira, como a 1100 m., [Caurel], Spain. *Lainz*, 1/July/1965. Herb. Gijón!
- PH4. De Grada a Piornedo, Sierra de Ancares, Lugo, Spain. *F. J. Fernández-Diez*, 23/Aug/1979. SA (19235)! and *S. E. González-Crespo*, 24/Aug/1979. Herb. S. E. González-Crespo, Fac. Ciencias, Univ. Santiago de Compostela!
- QH2. 3 1/2 km. NE. of Carbon del Sil. 5 km. N.E. of Paramo del Sil, S.W. of Palacios del Sil, N.W. side of Sierra de Jistredo, N.N.E. of Ponferrada, León, Spain. *C. R. Fraser-Jenkins* 10744-10746, 30/Sept/1981. BM!
- YN2. Mts. above Panticosa, Aragonese Pyrenees, Spain. *D. A. Webb*, 30/June/1953. BM!
- BH4. Junto Majada, El Gato, Gistain, 1920 m., Spain. *P. Montserrat* 5788, 18/Aug/1978. JACA!
- CH2. Rencluse, Huesca, Spain. *E. Garronte*, 14/July/1865. LY!
- CH4. Valley E. of Port Dret, Andorra. *E. F. Warburg* 1145, 7/Aug/1959, OXF! and Vali de Cardos, Sota el Llac d'Areste, Spain. *J. Vigo, J. Tondella et al.*, 26/Sept/1970. BC (607301)!
- DH2. Vallée de Galbe, Sous Carruby, Pyr. Or., 1800 m., France. *L. Conill*, 11/April/1921. TL!
- PG1. c. 1300 m., below Requeixo, N.W. side of Mt Seixo, S.E. of Chandreja de Queija, Sierra de Queija, E.S.E. of Orense, Orense, Spain. *C. R. Fraser-Jenkins* 10718-10723, 30/Sept/1981. BM!
- PG3. Rivadelago, faldes del Moncalvo y barrancos del Rio Jera, Zamora, Spain. *M. Losa*, June/1947. BCF (266)!
- QG1. Sierra Teleno, Penabellose, Maragata, 1900 m., Spain. *F. Bernis*, 19/July/1947. MA (258 & 257)! and June/1946. MA (256)!
- VM3. Burgos, Sierra de Neila, supra lacum 'Laguna Negra' dictum, 1950 m., Spain. *J. Fernández-Casas* 1313, 8/Aug/1976. MA (208551)! MAF (102047)! Herb. Gijón! Herb. Fernández-Casas, Fac. Cienc., Univ. Auton., Madrid!

- WM1. El Muchachón, Picos de Urbion, Soria, Spain. *Valdés-Bermejo*, 15/July/1975. MAF!
- WM3. Nava Lagunillo, Arnedillo, 1100-1200 m., Spain. *L. M. Medrano*, 2/Aug/1979. PAMP!
- DG1. Nuria, Pirineos, Gerona, Spain. *A. M. Hernandez* 1728, 7/July/1970. MGC!
- NG4. Picos de Fonte Fria, no concelho de Montalegre, Trás-os-Montes e Alto Douro, Portugal (S. of Requias, Muinos, Orense, Spain). *Lainz* 1965 & 1966).
- WM4. Santuario de Sierra de Moncayo, S. of Tarazona, Zaragoza, Spain. *C. R. Fraser-Jenkins* 3811, 29/July/1972. BM!
- VL3. Pico del Lobo, Sierra de Ayllón, Segovia, 1950 m., Spain. *S. Rivas-Martinez & C. Saenz de Rivas*, 12/July/1970. MAF!
- VL2. Pico de Penalarra, Sierra de Guadarrama, Spain. *A. Lawalrée* 5503, 14/Feb/1953. BR!
- PE1. Lagoa Comprida, nr. Seia, Serra da Estrela, E. of Coimbra, Beira, Portugal. *C. R. Fraser-Jenkins* 4920, 7/June/1976. BM!
- TK3. Subida al Calvitero, Sa. de Bejar, Salamanca, Spain. *Martinez, Navarro, Mayor & Diaz*, 29/July/1975. FCO (00175)!
- UK1. Hoyos de Espinos, Sierra de Gredos, Spain. *T. Reichstein* 1299. Herb. T. Reichstein, Basel!
- UK3. *Jalas & Suominen* (1972).
- VK1. El Escorial, Madrid, Spain. *A. Aterido*, 27/July/1941. MA (135715)!

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

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

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

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

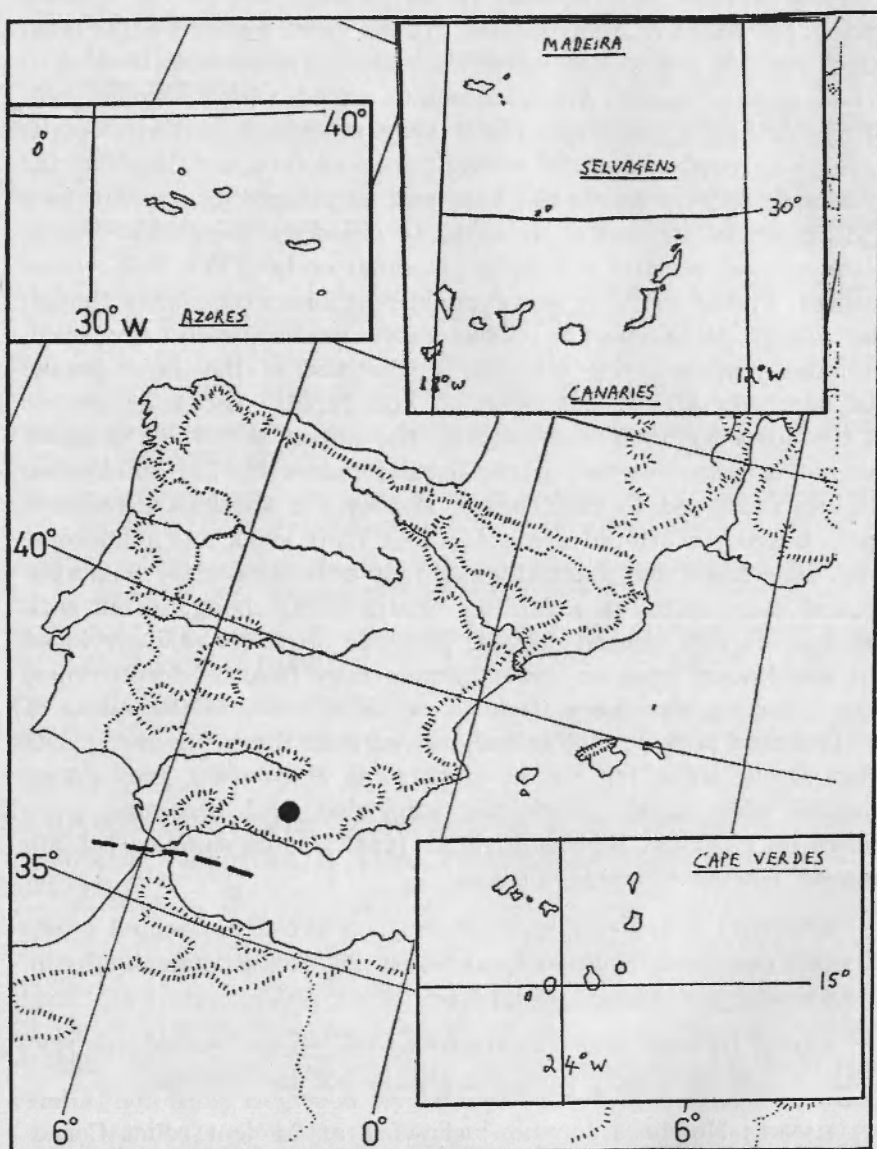
DESCRIPTION: Intermediate in morphology between *D. oreades* and *D. pallida* or *D. submontana*. Fronds twice pinnate. Stipe long, stipe, rachis and costae densely glandular; stipe base bearing \pm dense, pale or russet, ovate-lanceolate scales, which become scattered further up and small and very scattered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

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

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

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

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



MAP 3.

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

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

MAP: 6.

VOUCHER SPECIMEN:

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

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

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

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

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

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

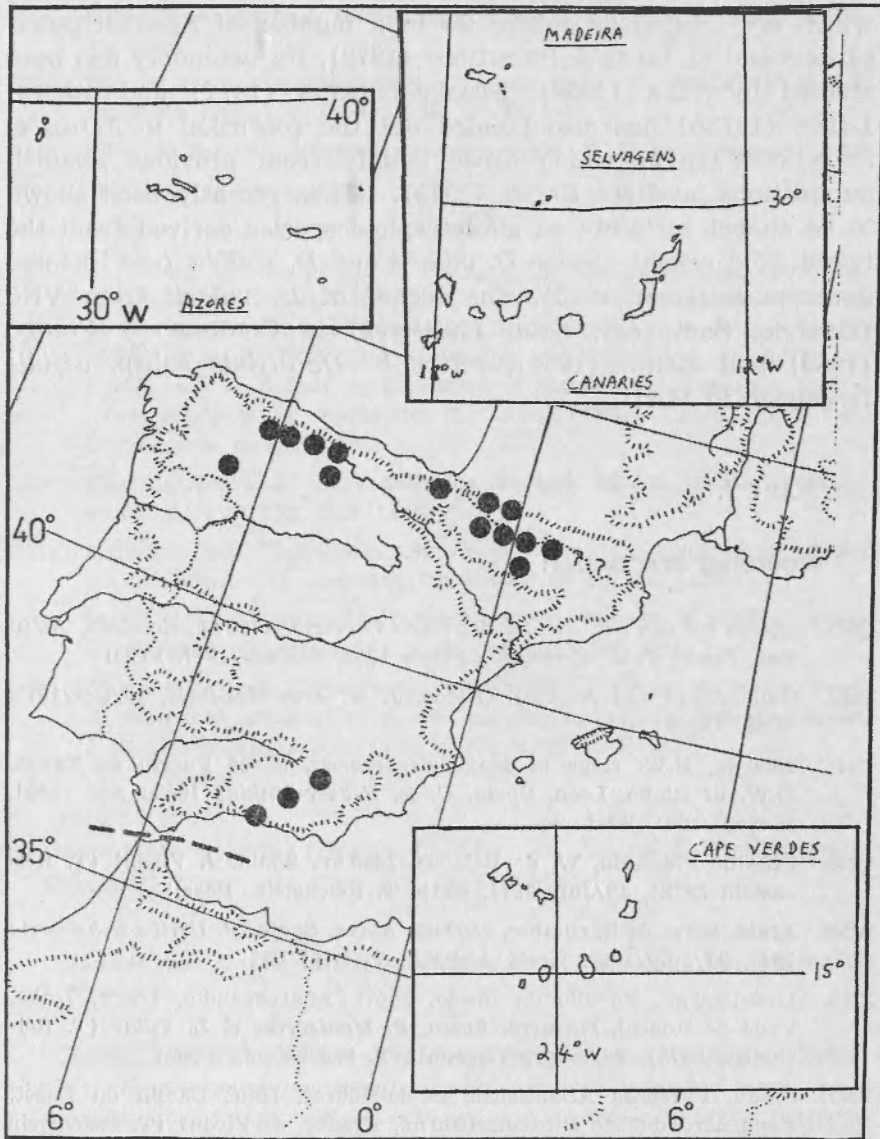
TYPE (Holotype): From England in BM!

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

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

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

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



MAP 7.

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

MAP: 7.

VOUCHER SPECIMENS:

- QH1. Gleras calizas por encima del Lago Cerveriz, 1750 m., Somiedo, Asturias, Spain. *J. A. Fernández-Prieto* 1202, 24/July/1977. FCO!
- TN3. Gamoniteiro [El Aramo], Oviedo. *J. M. Argüelles-Saéz*, 12/Oct/1971. Herb. Gijón!
- UN1. 1650 m., N.W. slope of Mampodre massif, S. of Puerto de Tarna, N.W. of Riano, León, Spain. *C. R. Fraser-Jenkins* 10630 and 10631, 18/Sept/1981. BM!
- UN3. Près de Palancón, W. de Reinosa, 1600 m., Spain. *J. Vivant* (T. Reichstein 3818), 18/July/1974. Herb. T. Reichstein, Basel!
- WN3. Aratz, karst de la cumbre, 1400 m., Alava, Spain. *P. Urribe-Echebarria* 2318, 31/July/1980. Herb. AEPNA, Vitoria! BM!
- XN3. 1700-1900 m., Portillo de Insolo, above Anabarcaudia, Larra, Isaba, Valle de Roncai, Navarra, Spain. *P. Montserrat & L. Villar* (T. Reichstein 3673), 28/Aug/1972. Herb. T. Reichstein, Basel!
- YN1. Ossau, Pyrénées Atlantiques, Pé-de-Hourat, Haut Bassin du Baset, flanc nord du Pic Durban, 1600 m., France. *J. Vivant* (T. Reichstein 3932), 26/Aug/1975. Herb. T. Reichstein, Basel! Herb. J. Vivant, Orthez!
- UN4. Pena Redonda [W. of Cervera], Palencia, 1750-1930 m., Spain. *P. Montserrat* 5906 & 5785, 10/Aug/1972. JACA!
- XN4. Bisaurin, Aragués, 1850 m., Spain. *P. Montserrat* 4176, 16/Aug/1967. JACA!

- YN2. Parc National d'Ordesa, Grande Cascade de Cotatuero, Pyrénées Espagnoles, Spain. *J. DuVigneaud*, 25/July/1957. BR! B! Herb. J. DuVigneaud, Bruxelles!
- BH4. Huesca, Pena Montanesa, N.E. of Ainsa, Spain. *P. Montserrat & N.Y. Sandwith* 4720, 13/July/1956. K! G! JACA!
- CH2. Silva de Bertrem in Vallée de Aran, Spain. *P. P. de Lapeyrouse*. BM!
- CH4. Jalas & Suominen (1972).
- DH2. Jalas & Suominen (1972).
- PG3. c. 1200 m., W. side of the N. facing calcareous cliff, «Los Apostoles», E. of «Campo de Las Danzas», S. of San Esteban de Valdueza, Montes de Los Aquilianos, S. of Ponferrada, León, Spain. *C. R. Fraser-Jenkins* 10730, 30/Sept/1981. BM! (following the indication of Rothmaler (1954), sub *D. pallida*, made without a voucher specimen and located more precisely by Rothmaler in Lainz (1960), Lainz (1973) and Lainz, pers. comm., 1981).
- BG3. Paso de Marradas, entre penascos, Turbón, 2300 m., Spain. *P. Montserrat*, 9/July/1952. BCF (4962)!
- WG1. Barranco del Guadalentin, Sierra de Cabrilla, 1800-2000 m., Spain. *E. Reverchon* 1372, June-July/1906. GM! G! P! MA (426)!
- VG4. N.W. slope of Dornajo bei Granada, Sierra Nevada, c. 2050 m., Spain. *H. Metlesics* (T. Reichstein 3023), 26/July/1969. BM!
- VF1. Sierra Tejada, parte septentr., 1,300-1,400 m., Spain. *E. Huter, Porta & Rigo* 120, 25/June/1879. P! and Sierra Tejada, Malaga, Spain. *J. M. Nieto* 5915, 4/Nov/1979. MGC! MAF (105479)!

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

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

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

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

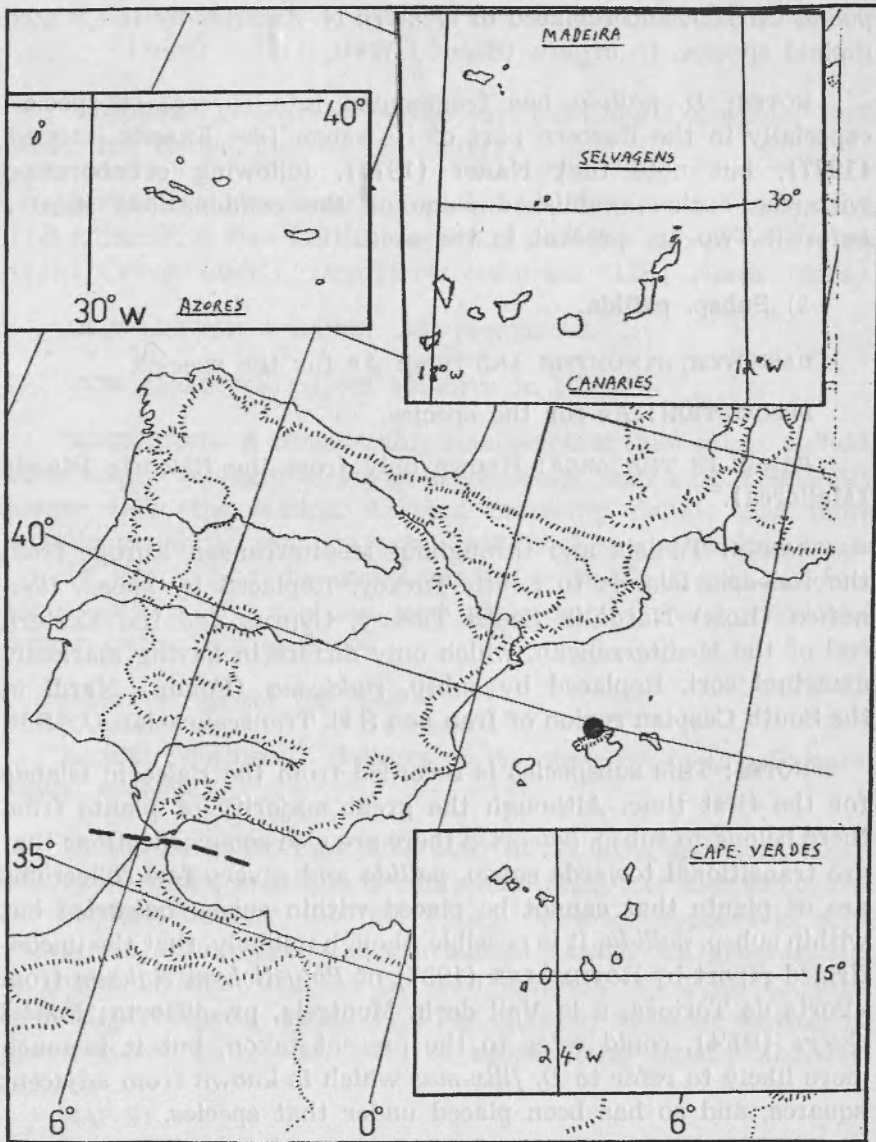
TYPE (Lectotype): S. Greece «Nephrodium pallidum Bory. Morée nr. 1335. Ravin des racines du Manglava. Bory de St. Vincent gère» (P!). Paratypes: (P!).

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

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

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

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



MAP P.

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

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

1) Subsp. *pallida*.

BASIONYM, SYNONYMS AND TYPE: As for the species.

DESCRIPTION: As for the species.

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

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

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

MAP: 8.

VOUCHER SPECIMEN:

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

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

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

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

IN WILLKOMM & LANGE: not recognised.

TYPE (Holotype): from Mallorca in P!

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

HABITAT: As for the species.

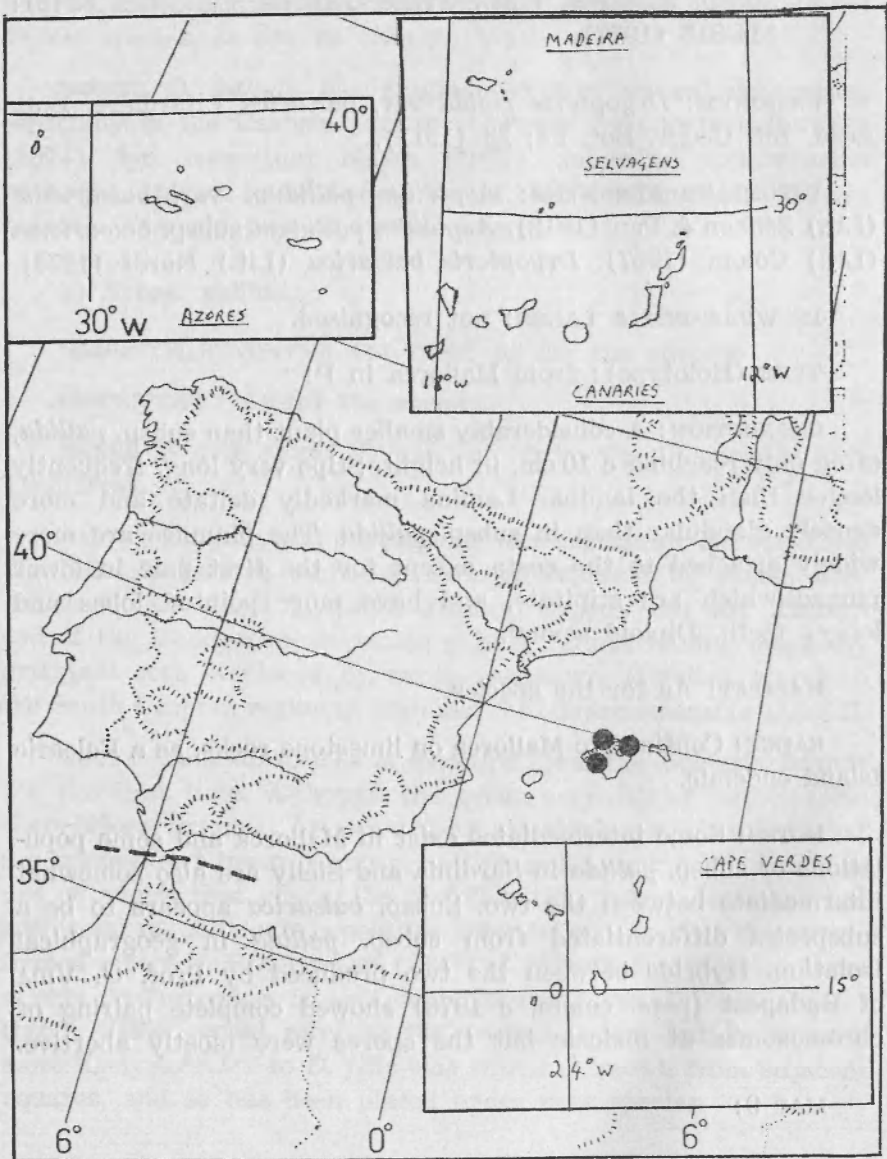
RANGE: Confined to Mallorca on limestone rocks, as a Balearic Island endemic.

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

MAP 9:

VOUCHER SPECIMENS:

- DF4. Sollér, lieux ombragés, Mallorca, Balearic Islands, Spain. F. Bianor 1893, 5/June/1910. P!
- ED2. Cala S. Vicente, nr. Pollenza, Mallorca, Balearic Islands, Spain. G. J. de Joncheere (WME 41), May/1955. BM! L!



MAP 9.

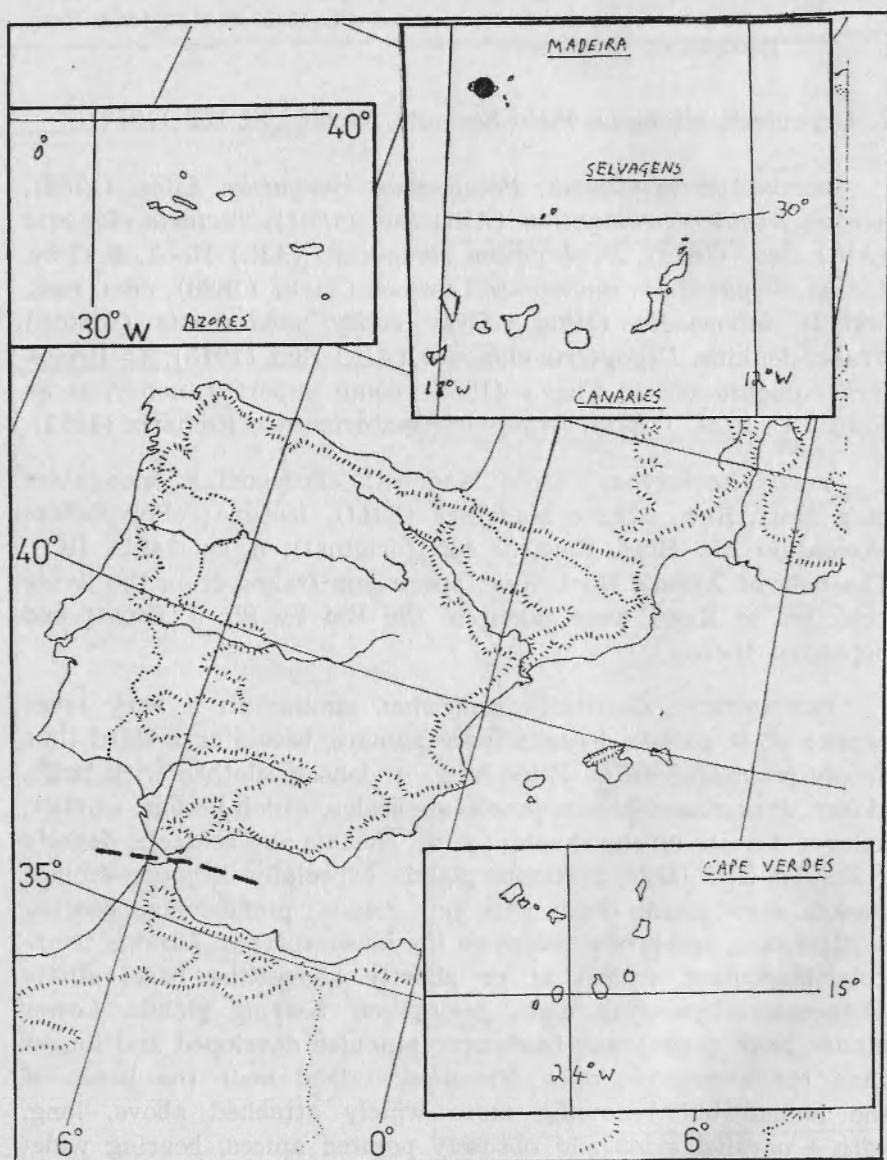
DD3. Alaro, Mallorca, le long de la route vers l'orient, avant Sellerich, Balearic Islands, Spain. *J. Duvigneaud* 69E 1533, 29/Aug/1969. Herb. J. Duvigneaud, Bruxelles!

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

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

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

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



MAP 10.

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

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

RANGE: Endemic to Madeira.

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

MAP: 10.

VOUCHER SPECIMENS:

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

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

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

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

IN WILLKOMM & LANGE: Not recorded.

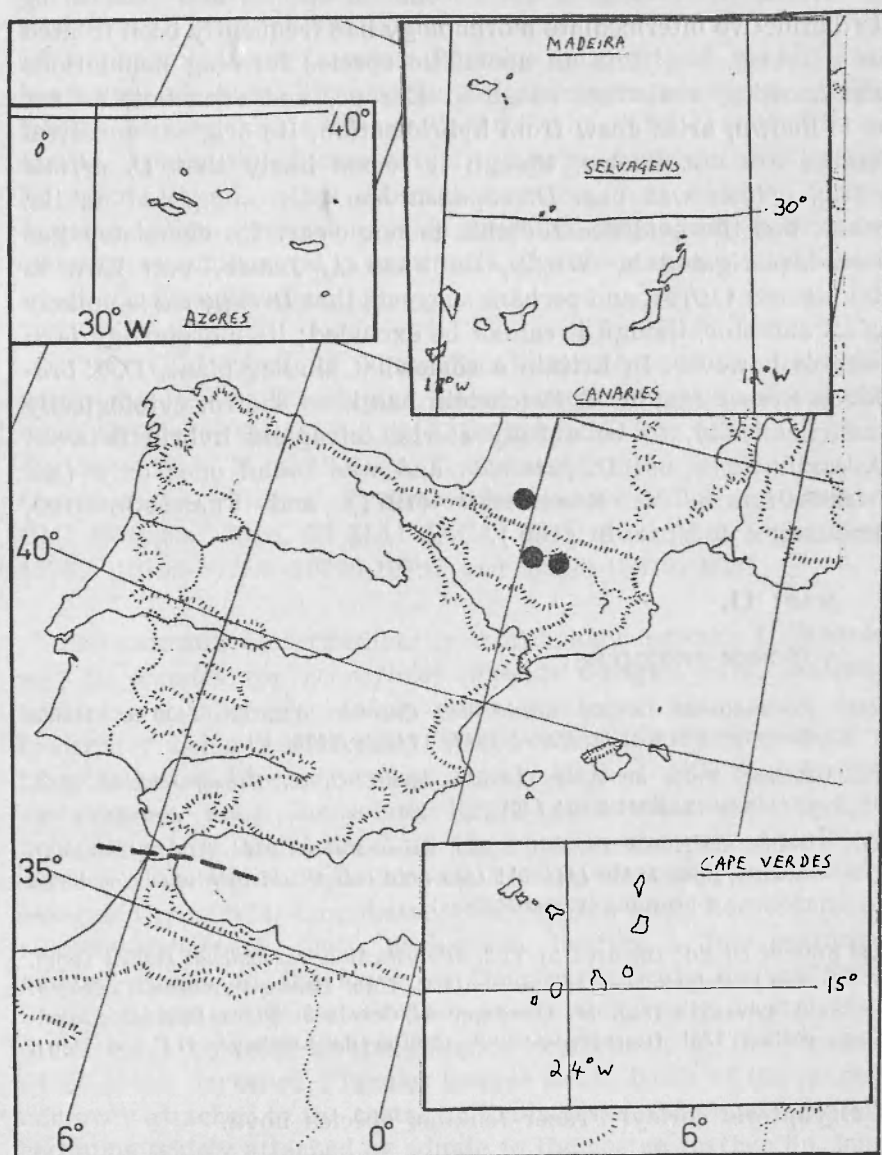
TYPE (Holotype): from West Germany, in B!

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

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

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

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



MAP 11.

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

MAP: 11.

VOUCHER SPECIMENS:

- BH4. Ruisseau de la Houradade, nr. Cascade d'Enfer, 1400 m., Haute Garonne, France. *F. Badré* 1547, 17/July/1975. P!
- CH2. Bosost, Valle de Aran, Lerida, Spain. *C. R. Fraser-Jenkins* 3586, 15/Jan/1972. BM! TBI! LE!
- DG1. Montes de Nuria, Pirineo, Spain. *Rivas-Mateos* 2264 (Herb. Trémóls), 22/July/1892. MAF (44489)! (see note sub *D. cristata* under excluded species, concerning Rivas-Mateos).

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

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

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

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

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

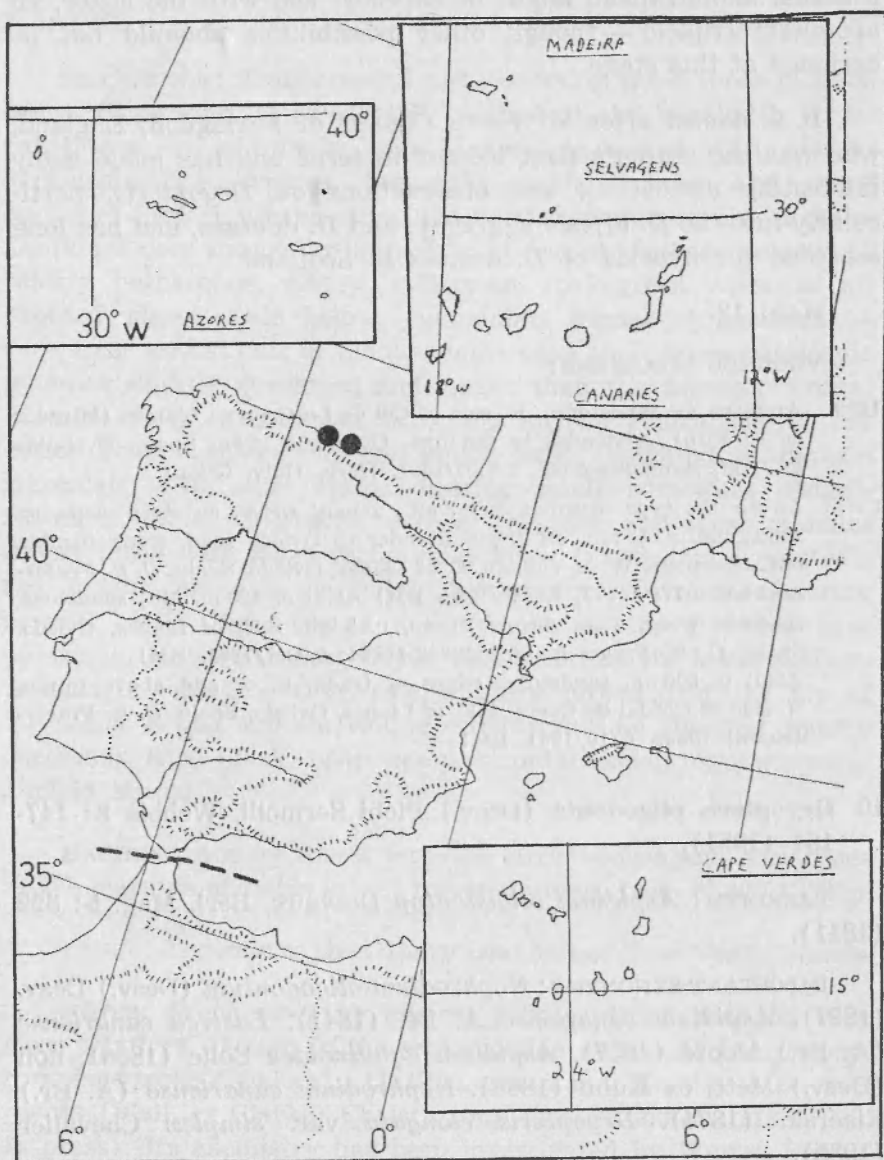
DESCRIPTION: Intermediate in morphology between *D. aemula* and *D. oreades* (or *D. affinis*). Fronds upright, twice pinnate, becoming a third time deeply pinnatifid below. Stipe very long, frequently being considerably longer than the lamina, with a purplish-brown base, somewhat densely clothed with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

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

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

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

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



MAP 12.



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

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

MAP: 12.

VOUCHER SPECIMENS:

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

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

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

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

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

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

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

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

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

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

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

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

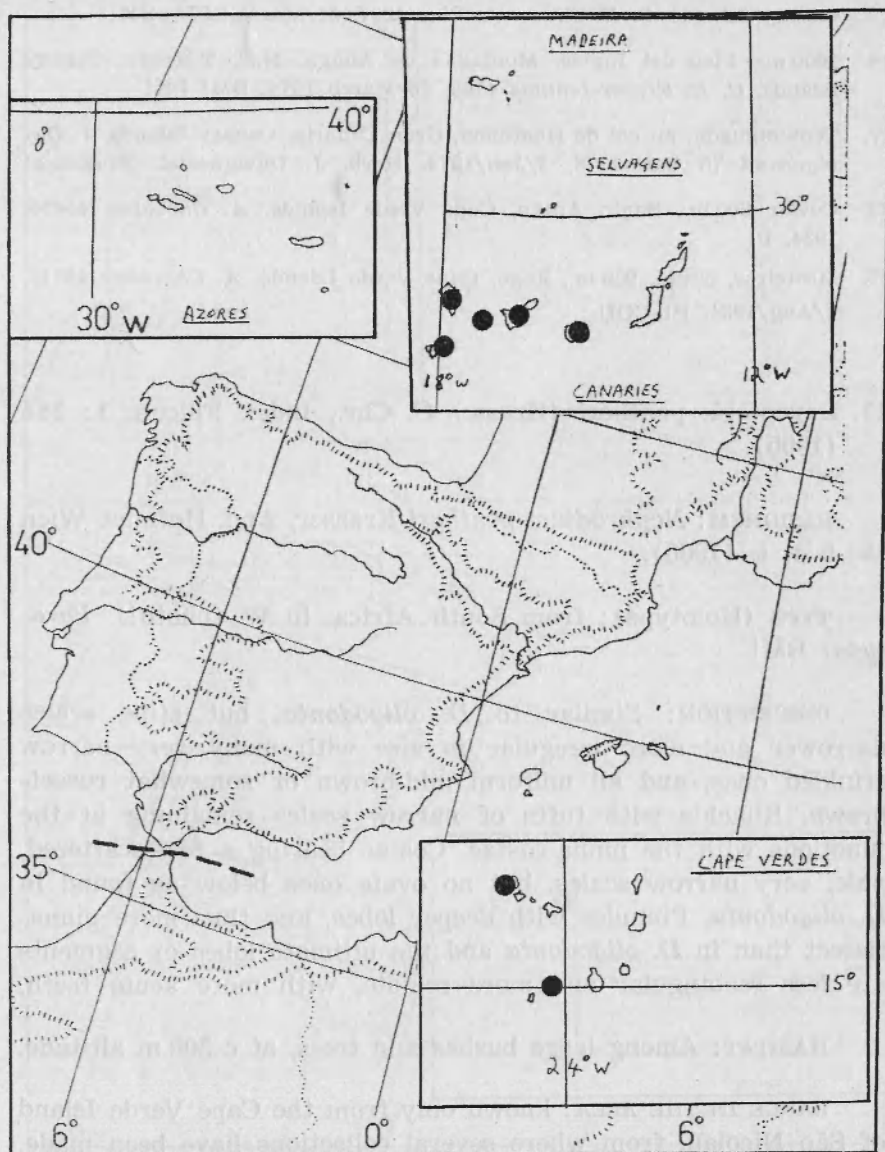
PICHI SERMOLLI (1951) has shown that the correct name for this species is *D. oligodonta* and not *D. oligantha* (Desv.) C. Chr., as CHRISTENSEN (1905 and 1934) and others had thought. *D. oli-*

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

MAP: 13.

VOUCHER SPECIMENS:

13. 1100 m., Cumbre Nueva, S.W. of Brena Alta, La Palma, Canary Islands. C. R. Fraser-Jenkins 4184, 23/March/1974. BM!
14. Valverde to Frontera road, 19 km. from Valverde, Hierro, Canary Islands. Jarvis & Murphy 311, 12/April/1977. BM!



MAP 12.

15. 1000 m., S. de N.S. de Guadalupe, Mna. Quemada, El Cedro, La Gomera, Canary Islands. *C. R. Fraser-Jenkins* 4207, 31/March/1974. BM!
16. 1000 m., Pico del Inglés, Montanas de Anaga, N.E. Tenerife, Canary Islands. *C. R. Fraser-Jenkins* 4193, 26/March/1974. BM! PE!
17. Tenteniguada, au col de Hontanon, Gran Canaria, Canary Islands, *J. Duvigneaud* 75 Can 1178, 2/Jan/1976. Herb. J. Duvigneaud, Bruxelles!
20. Covão, 900 m., Santo Antão, Cape Verde Islands. *A. Chevalier* 45476. 1934. P!
27. Mosteiros, Espia, 900 m., Fogo, Cape Verde Islands. *A. Chevalier* 45113, 1/Aug/1934. P! COI!

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

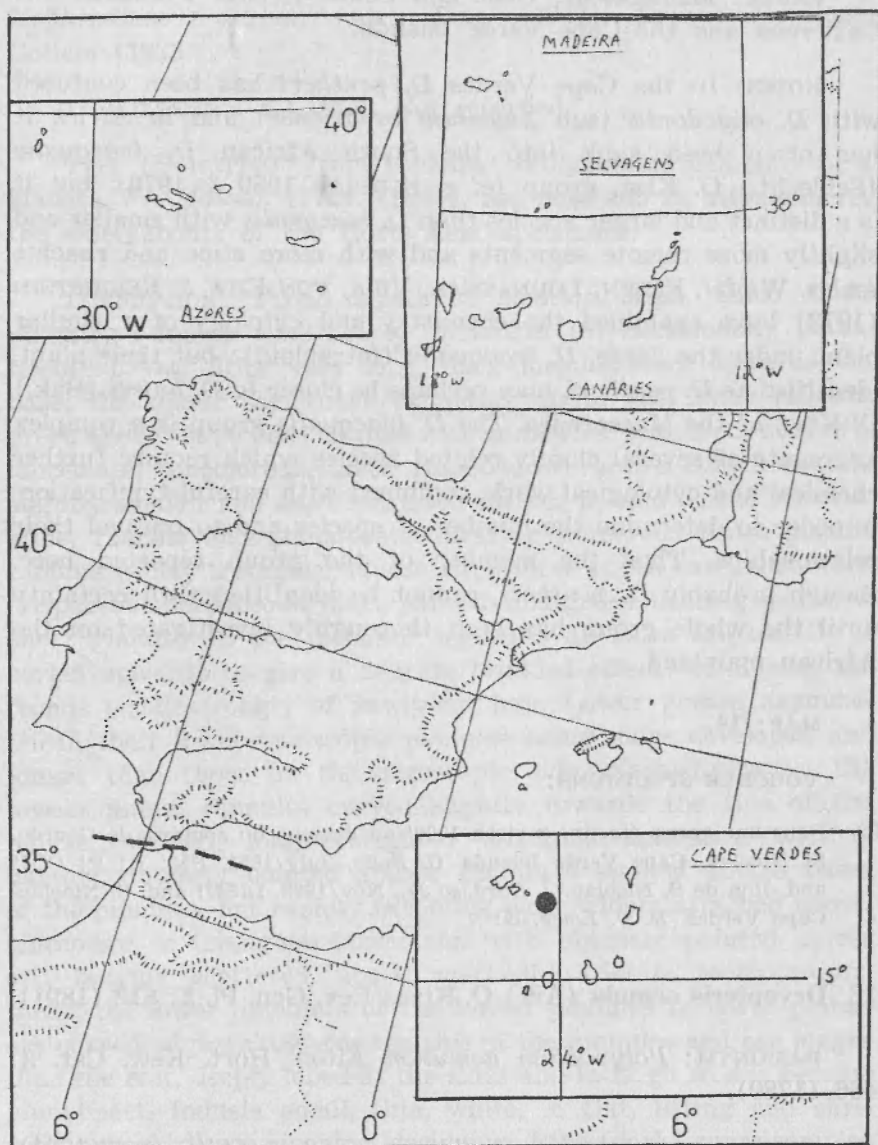
BASIONYM: *Nephrodium pentheri* Krasser, Ann. Hofmus. Wien 15: 5 et t. (1900).

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

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

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

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



MAP 14.

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

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

MAP: 14.

VOUCHER SPECIMENS:

22. Dans une gorge étroite, environ 1000' au dessous du sommet de Gourdo, St Nicolau, Cape Verde Islands. *C. Bolle*, July/1851. BM! B! P! COI! and, Ilha de S. Nicolau. *J. Cardoso Jr.*, Nov/1893. LISU! and, S. Nicolau, Cape Verdes. *R. T. Lowe*. K!

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

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

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

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

IN WILLKOMM & LANGE: Not recorded.

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

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

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

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

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

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

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

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

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

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

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

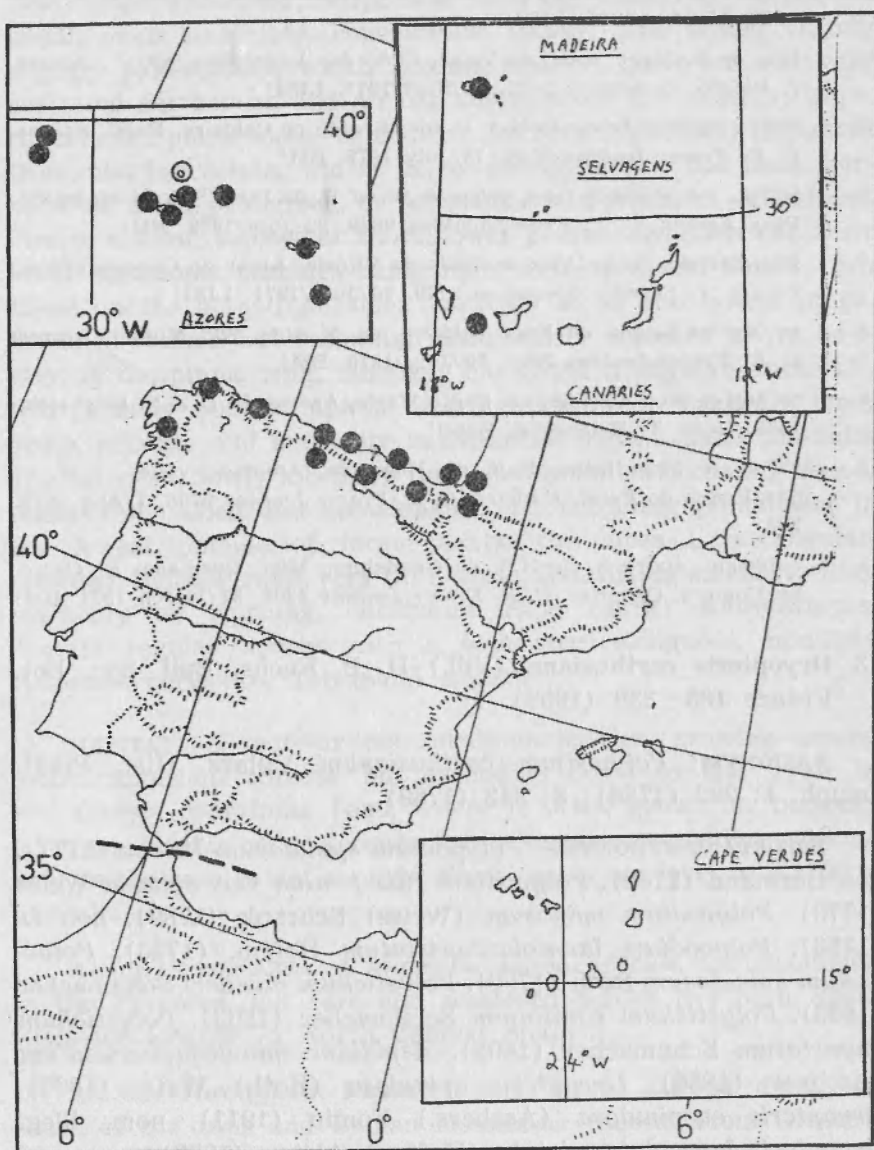
It appears that LÜDI probably did not make a herbarium specimen for his record of *D. aemula* from square PH1 (below) as there is no such specimen at BERN (R. SUTTER, pers. comm. 1981), nor at ZT, where his herbarium was deposited. The record could refer to *D. aemula* or *D. guanchica* (or other species),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

MAP: 15.

VOUCHER SPECIMENS:

- NJ4. Caaveiro (Capela, La Coruna), locis nemorosis apricis, 50 m., Spain. Lainz, 17/Sept/1976. Herb. Gijón! (with *D. guanchica*).
- PJ2. Jalas & Suominen (1972); the report in Merino (1909), from Galdo referred to *D. guanchica*, specimen in P!

- PJ4. [Oberhalb Luarca, Sierra de Adrades], Quercion roboris, Luarca-Lugo, ca. 200 m., Spain. *Oberdorfer*, 10/July/1953. KR! and: wood between Vega do Ouria and Sta. Columba, 20 km. E. of Vegadeo on Boal road, Sierra de La Bobia, S.E. of Castropol, Oviedo, Spain. *C. R. Fraser-Jenkins* 10668-10669, 27/Sept/1981. BM!
- UP2. c 550 m, below and N.E. of «Mirador de El Fito», N. side of Col de La Cruz de Llames, Arriondas to Colunga, E. of Gijón, Oviedo, Spain. *C. R. Fraser-Jenkins* 10827, 4/Oct/1981. BM!
- UP4. c 500 m, S. of and above Puron, N. side of Cordal de Cuera, S.E. of Llanes, Gijón to Santander, Oviedo, Spain. *C. R. Fraser-Jenkins* 10836-10838, 5/Oct/1981. BM!
- VP2. *Jalas & Suominen* (1972).
- VP4. W. side of Col de La Granja, between Castro Urdiales and Gouriezo, S.W. of Castro Urdiales, c 300 m., Spain. *C. R. Fraser-Jenkins* 10569, 17/Sept/1981. BM!
- WP4. c 150 m., Mt. Jaizquibel, between San Sebastian & Hendaye, Spain. *J. Vivant, H. & K. Rasbach* and *H. L. & T. Reichstein* 3615, 23/Sept/1973. Herb. T. Reichstein, Basel!
- NH1. *Jalas & Suominen* (1972).
- PH1. Eichenwald in der Sierra de Meira, zwischen Ribadeo und Lugo, 450 m., Spain. *W. Lüdi*, 10/July/1953. Lüdi (1954) and Lawalrée (1956).
- UN1. Valle de Raicedo, Espinaredo, Termino de Pilona, Asturias, 5-600 m., Spain. *J. M. Argüelles-Saéz*, 13/Oct/1973. Herb. Gijón!
- VN1. Somahoz [S. of Los Corrales], prov. Santander, Spain. *Pereda*. Herb. Gijón!
- WN1. Barranco, Galdacano, Viscaya, Spain. *Ruiz de Azúa*, 24/Dec/1924. MA (332)!
- WN3. *Jalas & Suominen* (1972).
- XN1. Moulin d'Enfer, près Bidarray, Basses Pyrénées, France. *L. de Vergnes*, 14/Oct/1916. P! Also: Basses Pyrénées, Itxassou, ravin de Laxia, France. *J. Vivant, H. & K. Rasbach* and *H. L. & T. Reichstein* 3602, 22/Sept/1973. Herb. T. Reichstein, Basel! Also: ravine humide de La Rhûne, près de St Jean de Luz, Basses Pyrénées, France. *E. Walter* 26/July/1934. MPU! Also: ravin d'Ascain, Basses Pyrénées, France. *G. Higon* 4730, 7/Aug/1936. P!
- NH2. La Coruna, Portosin, Montes Barbanza, Spain. *M. Pastrana* AB 429, 30/Dec/1977 MA! BM! (with *D. affinis* ssp. *affinis*). Also: Noya (Coruna), Spain. *F. Bellot*, 21/Aug/1967. Herb. Fac. Cienc. Biol., Univ. Complutense, Madrid (no. 4808)!
- NG1. Teis [Vigo], Spain. *J. Ruiz de Azúa*. *Ruiz de Azúa* (1930).
1. Ilha de Corvo, 450 m., Azores. *I. Botelho Gonçalves* 1593, 12/June/1964. LISI!



MAP 15.

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

2. Ribeira da Cruz, Ilha das Flores, 150 m., Azores. *I. Botelho Gonçalves* 1892, 17/May/1965. LISI!
4. Ilha de S. Jorge, conc. de Velas, Chão das Lagoinhas, 800 m., Azores. *I. Botelho Gonçalves* 3495, 15/Sept/1971. LISI!
5. 800 m, ravines below Cabeço Gordo, S. side of Caldeira, Faial, Azores. *C. R. Fraser-Jenkins* 9598, 18/July/1979. BM!
6. 550 m., longitudinal road, below & W. of P. do Pico, S.E. of Madalena, Pico, Azores. *C. R. Fraser-Jenkins* 9629, 22/July/1979. BM!
7. Ilha Terceira, conc. Vila de Praia da Vitória, Algar do Carvão, 570 m., Azores. *I. Botelho Gonçalves* 3179, 10/July/1971. LISI!
8. nr. top of Lagoa do Fogo caldeira, on N. side, São Miguel, Azores. *C. R. Fraser-Jenkins* 9691, 29/July/1979. BM!
9. nr. top of Pico Alto, 587 m., Santa Maria, Azores. *H. L. & T. Reichstein*, 1973. Herb. T. Reichstein, Basel!
11. 850 m., c 2 km below Fajã da Nogueira, Ametade valley, S.W. of San Roque do Faial, Madeira. *C. R. Fraser-Jenkins* 9708, 1/Aug/1979. BM!
15. c 1000 m, above S. de N.S. de Guadalupe, Mna. Quemada, El Cedro, La Gomera, Canaries. *C. R. Fraser-Jenkins* 4208, 31/March/1974. BM!

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

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

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

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

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

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

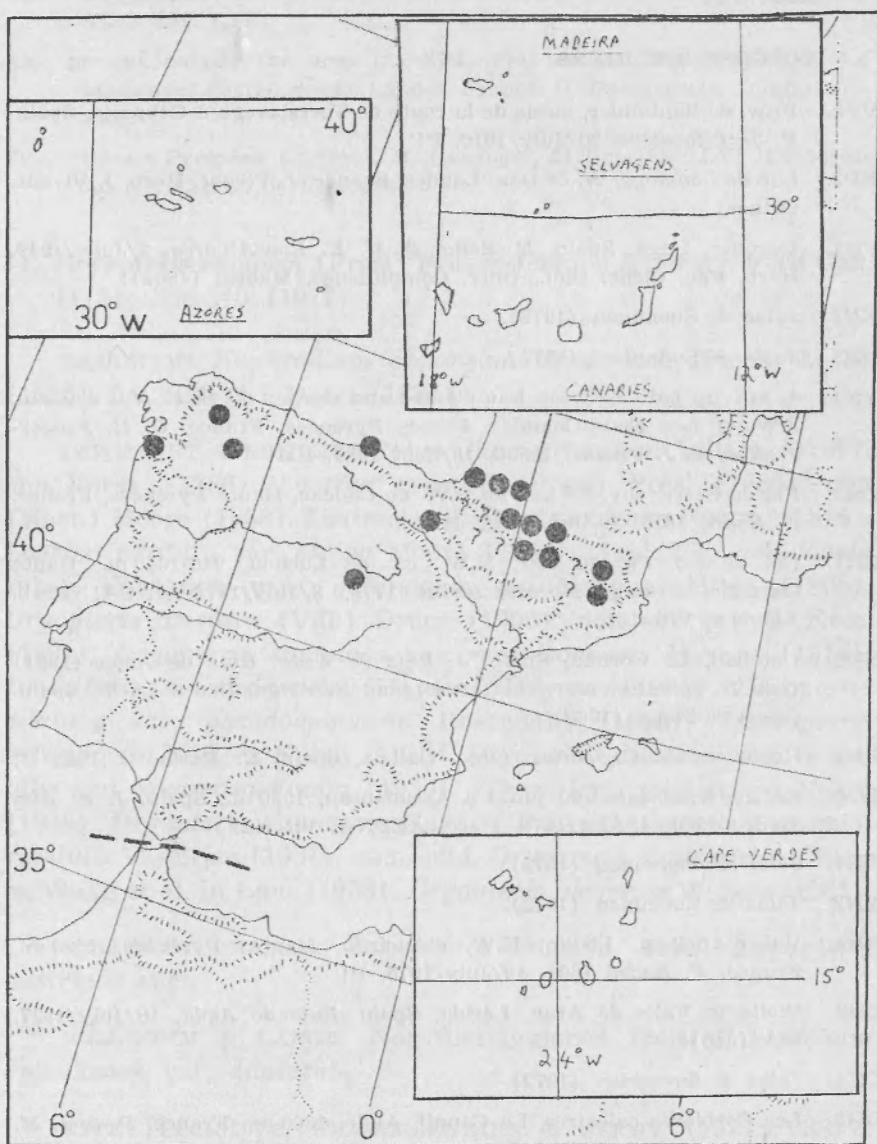
HABITAT: A more-or-less subalpine species, growing among moist, luxuriant forests, but extending down to low levels in wet forests containing bogs, where it often grows on tussocks of grass. Shows no preference for calcareous or acidic rocks as long as the area is wet enough. From nearly sea-level to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

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

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

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

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



MAP 16.

MAP. 16:

VOUCHER SPECIMENS:

- VP2. Prov. de Santander, bords de la route de Torrelavega à Cóbreces, Spain. *R. de Litardière*, 30/July/1910. P!
- XP2. Lac de Soustons, W. of Dax, Landes, France. *J. Vivant*. Herb. J. Vivant, Orthez!
- PH1. Begonte, Lugo, Spain. *F. Bellot & M. E. Ron-Alvarez*, 2/June/1969. Herb. Fac. Cienc. Biol., Univ. Complutense, Madrid (4802)!
- XN1. Jalas & Suominen (1972).
- XN3. Jalas & Suominen (1972).
- YN1. ½ km. up path between Lac d'Isabe and Gorges du Bitet, Val d'Ossau, S.W. of Les Eaux-Chaudes, Basses Pyrénées, France. *C. R. Fraser-Jenkins & J. Vivant*, 10556, 15/Sept/1981. BM!
- BH3. Pla de Serre, env. 1.5 km. au S.W. de Cadeac, Haute Pyrénées, France. *F. Badré* 1615, 19/July/1975. P!
- CH1. Col de Hô, Pic du Gar, N.W., ca. de Luchon, 940-1050 m., Haute Garonne, France. *P. Montserrat* 1778, 8/July/1978. JACA! Herb. AEPNA, Vitoria!
- NH2. Cotobad, La Coruna, Spain. *J. Ruiz de Azúa*. Ruiz de Azúa (1931) (sub *D. spinulosa* var. *excitatum*) and Santiago, Santa Lucia, Spain. Casaseca-Mena (1960).
- PH4. Regio vocata Cervantes, Lugo, Galicia, Spain. *B. Merino* 3, 1903 P!
- WN4. Entzia, zona aclarado junto a Assudantan, 1020 m., Spain. *J. A. Alejandro* 1280, 13/Oct/1979. Herb. AEPNA, Vitoria!
- XN4. Jalas & Suominen (1972).
- YN2. Jalas & Suominen (1972).
- BH4. Val d'Ancizan, 1.5 km. N.W. d'Ancizan, Hautes Pyrénées, 1620 m., France. *F. Badré* 1621, 19/July/1975. P!
- CH2. Viella to Valle de Aran, Lérida, Spain. *Ruiz de Azúa*, 18/July/1927. MA (345)!
- CH4. Jalas & Suominen (1972).
- DH2. Les Corbières calcaires, Le Caunil, Aude, 1300 m., France. *P. & J. M. Montserrat & L. Villar* 1566, 4/July/1978. JACA!
- NG1. Pontevedra, Vilaboa, S. Adrian, 2 m. alt., Spain. *E. Valdes-Bermejo & S. Castroviejo* 20/76, 1976. MA! BM (Fraser-Jenkins no. 10142)!
- CG3. Jalas & Suominen (1972).
- DG1. Vall de Ribas, Bosc de Ribas, bai 1500 m., Spain. *J. Vigo*, Aug/1962. BC (no. 596459)!

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

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

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

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

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

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

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

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

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

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

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

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

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

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

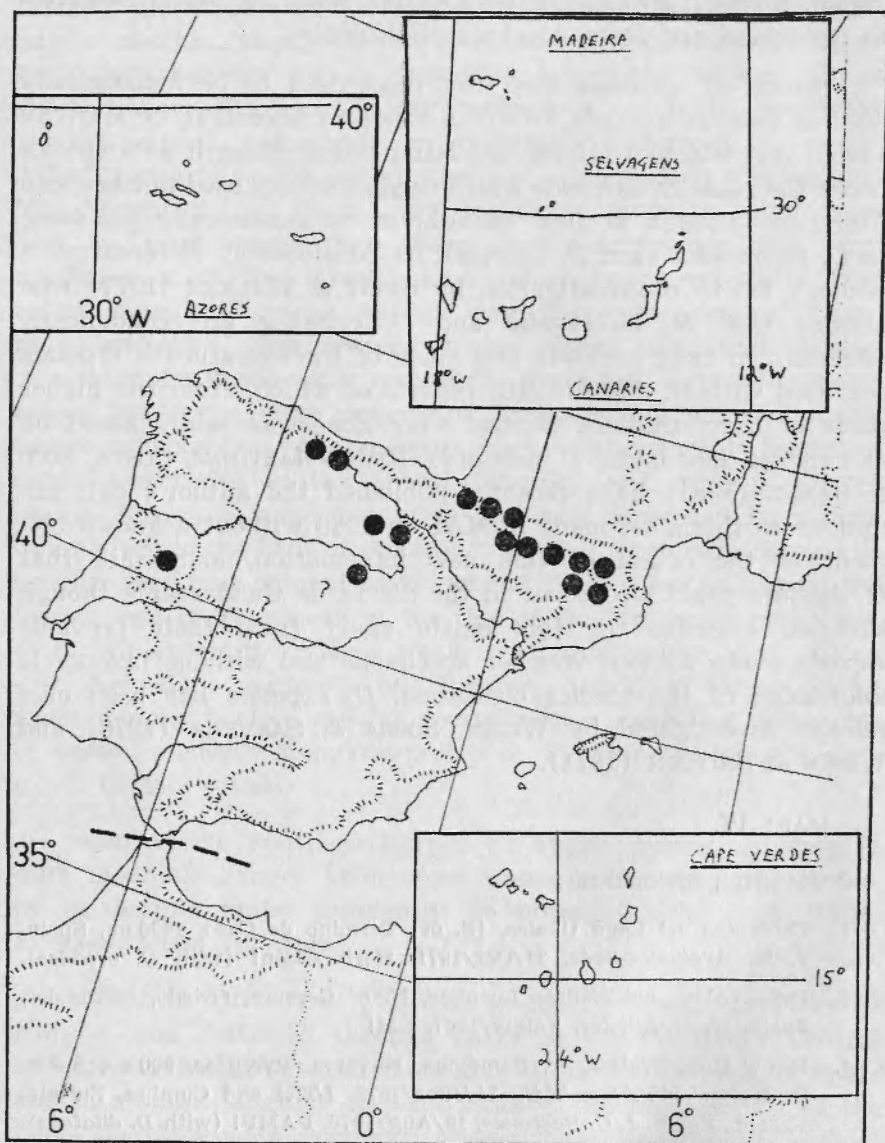
Japan, Korea, Taiwan and the Aleutian Isles. Across N. America to Greenland and from Alaska to California.

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

MAP: 17.

VOUCHER SPECIMENS:

- UN1. Cercanías del Lago Ubales, [S. of] Termino de Caso, 1690 m., Spain. *J. M. Argüelles-Saéz*, 31/Oct/1971. Herb. Gijón! (with *D. oreades*).
- UN3. Pena Labra, nr. Piedras Luengas, N. of Cervera, Oviedo, Santander, Spain. *H. McAllister*, 5/July/1967. BM!
- XN1. Below Roncesvalles, nr. Pamplona, Navarra, Pyrenees, 900 m., Spain. *B. Molesworth-Allen* 7648, 14/June/1972. LTR! and Cumbre, Zuriain, 1300 m., Spain. *J. C. Bascones*, 19/Aug/1976. PAMP! (with *D. dilatata*).
- XN3. Larra, Rio Belagua, 1400 m., Spain. *J. A. Alejandro, J. M. Lekuona & Ramon* 2426, 12/Aug/1980. Herb. AEPNA, Vitoria!
- YN1. Lac d'Isabe, Gorges de Bitet, vallée d'Ossau, 1000 m., France. *P. Montserrat* 5223, 3/Aug/1972. JACA!
- BH3. Lac d'Escoubas, Barèges, Hautes Pyrénées, France. *C. Rey-Pailhade*, 16/Aug/1913. MPU!



MAP 17.

- YN2. Refugio Calcillarruego, Ordesa, Huesca, 1850-1900 m., Spain. *P. Montserrat* 5763, 8/Aug/1974. JACA!
- BH4. Superbagnères de Luchon, c 1200 m, Haute Garonne, France. *E. K. Horwood*, 27/July/1961. LTR!
- CH2. Prov. de Lérida, Pyrénées Central., Espot, Ribera de S. Maurice, 1600 m, Spain. *W. Rothmaler*, 12/July/1934. JE! BCF (no. 309)!
- CH4. Andorre. *C. Bange* 79,133, 1979. LY!
- DH2. Pyrénées Orient., Lac de Pradeilles (Les Bouillouses), N. de Mont-Louis, 1950 m., France. *P. Berthet* 527, 7/Aug/1975. LY!
- VM3. Burgos, in montibus «Sierra de Neila», 1850 m., Spain. *J. F. Muñoz-Garmendia* (360), *Segura* et al., 17/Sept/1977. MA!
- WM1. Logrono, in montibus «Sierra de Urbion», pr. locum dictum «Laguna Negra de Viniagra de abajo», ad 2000 m., Spain. *J. F. Muñoz-Garmendia* (no. 266), *Segura* et al., 17/Sept/1977. MA!
- CG3. Vall de Judas & Vall del Riu, 2000-2300 m, Spain. *M. Losa & M. Montserrat*, 1948. BCF (4931)!
- DG1. Valle del Puigmal, Nuria, Ribas de Freser, 2,200-2,800 m., Gerona, Spain. *L. Villar* 5308, 3/Aug/1974. JACA!
- VL3. Puerto de la Quesara, Sierra de Ayllón, Spain. *A. Barra, B. Blanco, Temperano & R. Morales* AB679, 19/Oct/1978. MAF! BM (*Fraser-Jenkins* 10144)! and *S. Rivas-Martinez* et al., 11/6/1979. MAF!
- VL2. Pedriza Posterior, Sierra de Guadarrama, Risco Moreno, 1700 m., Spain. *S. Rivas-Martinez*. *Rivas-Martinez & Costa* (1975), sub *D. dilatata*.
- PE1. Serra da Estrela, Covão da Metade, Portugal, *M. Ferreira* 1305, June/1894. G! Z! WU! MPU! COI!
- UK1. 2300 m., Circo de la Laguna Grande de Gredos, al pie de Risco Moreno, Spain. *Rivas-Martinez & Saenz de Rivas* (1971), sub *D. dilatata*.

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

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

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

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

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

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

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

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

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

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

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

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

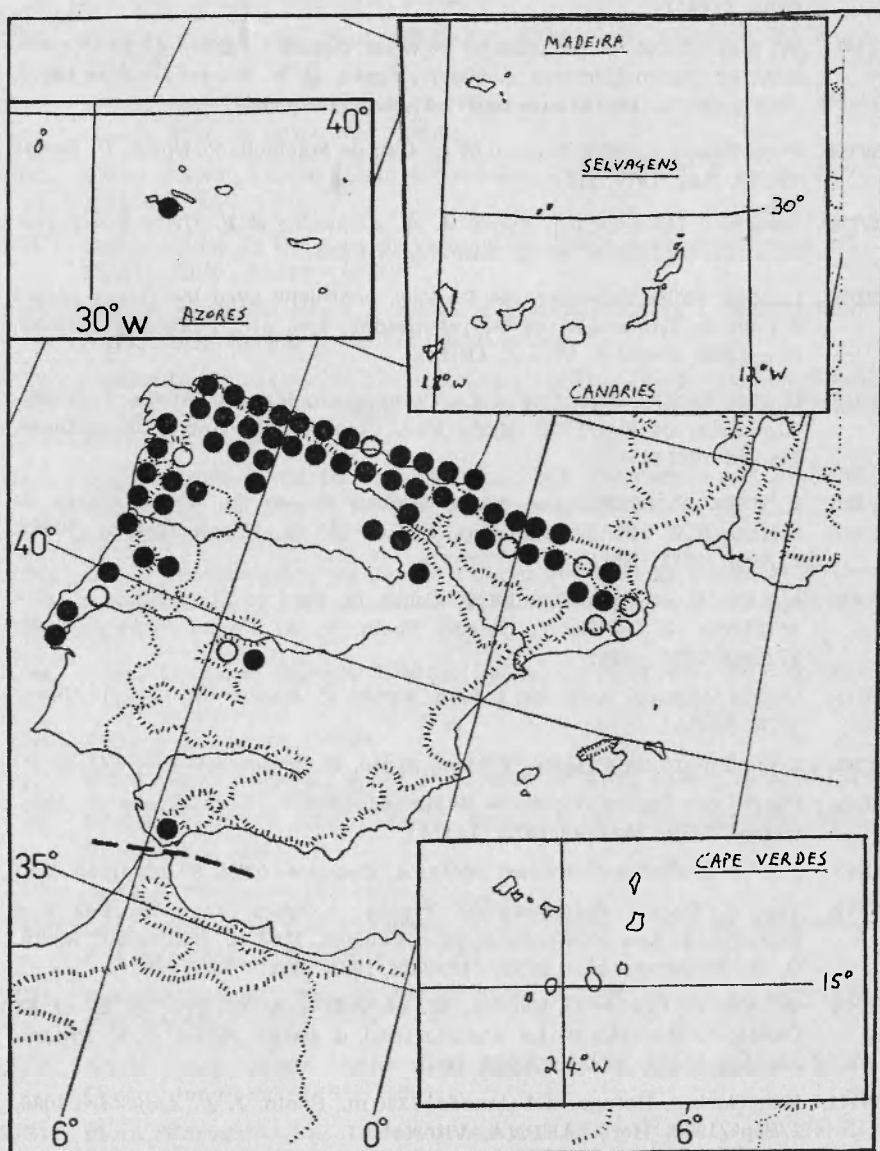
NOTES: Details of the nomenclature of this species are given by FRASER-JENKINS (1980b). The two names, *Polystichum pilidens* Touill. and *Polystichum thujaeforme* Pourret, given by COLMEIRO Y PENIDO (1899) and RUIZ DE AZÚA (1928) in synonymy for this species were manuscript names preserved in the Institute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

who was the first person to determine BOTELHO GONÇALVES' collection (in 1969, confirmed by J. SARVELA in 1971). This determination was overlooked by GIBBY, JERMY, RASBACH, RASBACH, REICHSTEIN & VIDA (1977), though tentatively reported by SJÖGREN (1973), as it was thought that it could refer to the then undescribed *D. crispifolia*. FRASER-JENKINS (1982) was also unfortunately unaware that FRANCO's report was based on this correct specimen, and reported it anew, based on SJÖGREN's specimen and report, which did not come to this notice until 1979. The Azores population consists of plants with rather narrow fronds and less foliose pinnae than in most of the mainland populations and is unusual in apparently being restricted to only a few craters in one locality on the North side of the island, in contrast to its commonness on the mainland; however its cytotype has now (July 1982) been investigated by GIBBY and will soon be reported. It has been shown (MANTON 1950, MANTON & WALKER 1955, and GIBBY & WALKER 1977) that *D. dilatata* is an allopolyploid species derived from *D. expansa* and either *D. intermedia* or, more likely (on morphological grounds), *D. azorica*. The chemistry of *D. dilatata* has been investigated by WIDÉN, SORSA & SARVELA (1970).

MAP: 18.

VOUCHER SPECIMENS:

- NJ4. La Coruna, Puentedeume, Caaveiro, Rio del Eume, 75 m., Spain. *E. Valdes-Bermejo* & *S. Castroviejo* 69/76, 1976. MA!
- PJ2. Orol, Lugo, Spain. *I. Barrera*, 17/July/1977. Herb. Fac. Cienc. Biol., Univ. Complutense. Madrid (4759)!
- PJ4. Wood between Vega do Ouria and Sta. Columba, 20 km. E. of Vegadeo on Boal road, Sierra de La Bobia, S.E. of Castropol, Oviedo, Spain. *C. R. Fraser-Jenkins* 10670-10672, 27/Sept/1981. BM!
- QJ2. La Cabruñana [Grado to Cornellana], Spain. *R. M. Simó*, 15/Oct/1970. FCO (no. 00191)!
- TP4. Ad fluminem Espana in ditone gegionensi, loco nemoroso. *Lainz* & *Sanchez-Ferrero*, 2/May/1975. Herb. Gijón!
- UP2. Monte Sueve, Asturias, El Fito, 550 m., Spain. *M. Lainz*, 19/Nov/1972. G (177/1)! JACA!
- UP4. La Franca [Riba de Deva], Asturias, non longe a mare, Spain. *M. Lainz*, 19/Nov/1972. Herb. Gijón! (with *D. guanchica*).



MAP 18.

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

- VP2. Santander, Cóbreces, bois, Spain. *R. Litardière*, 30/July/1910. *Litardière* (1911).
- VP4. W. side of Col de La Granja, between Castro Urdiales and Gouriezo, S.W. of Castro Urdiales, c. 300 m., Spain. *C. R. Fraser-Jenkins* 10570, 10571, 10573, 10576 and 10577, 17/Sept/1981. BM!
- WP2. Pays Basques, entre Bermeo et Le Cap de Machichaco, Spain. *C. Bange* 79,304, Aug/1979, LY!
- WP4. Jaizkibel, [Guipúzcoa], Spain. *J. A. Alejandro & P. Uribe-Echebarria* 3015, 21/Sept/1980. Herb. AEPNA. Vitoria!
- XP2. Landes, vallée inférieure de l'Adour, confluent avec les Gaves réunis a Port de Lanne [W. of Peyrehourade], 4 m. alt., France. *J. Vivant*, Dec/1972. Herb. J. Vivant, Orthez!
- NH3. Branás del Cruceiro, Curtis, La Coruña, Río Mandeo, Spain. *J. Dalda-González*, 24/Feb/1967. Herb. Fac. Cienc. Biol., Univ. Complutense, Madrid (00724)!
- PH1. c. 2 km. N. of Millares, N. of Fontao, Baleira to Meira, Sierra de Meira, N.W. of Lugo, Lugo, Spain. *C. R. Fraser-Jenkins* 10687, 27/Sept/1981. BM!
- PH3. c. 3 km. S. of Santa Eulalia de Oscos, on road to Fonsagrada, S. side of Sierra de La Bobia, Oviedo, Spain. *C. R. Fraser-Jenkins* 10683, 27/Sept/1981. BM!
- QH1. Puerto Ventana, Asturias, 1150 m., Spain. *P. Montserrat* 1824, 15/June/1975. JACA!
- TN3. León, Puerto de Pajares, 1990 m., Spain. *R. de Litardière* 4, 8/Aug. P!
- UN1. Puerto del Pontón, Oseja de Sajambre, 1230 m., León, Spain. *P. Montserrat* 2138, 16/June/1975. JACA!
- UN3. Puerto de Piedras Luengas, Spain. *A. Lawalrée* 5304, 5/July/1953. BR!
- VN1. Top of Puerto Estacasas de Trueba, between Vega de Pas and Espinosa de Los Monteros, Montes Valnera, 1160 m., Santander, Spain. *C. R. Fraser-Jenkins* 10598, 17/Sept/1981. BM!
- VN3. W. side of Col de la Escrita, W. of Villaverde de Trucios, E. of El Callejo on Ramales de La Victoria road, c. 400 m., Spain. *C. R. Fraser-Jenkins* 10579, 17/Sept/1981. BM!
- WN1. Mte. Gorbea, Refugio del Ganado, 1350 m., Spain. *J. A. Alejandro* 1086, 1/Sept/1979. Herb. AEPNA, Vitoria!
- WN3. Guipuzcoa, pr. oppidulum Oyarzun, in montibus «Penas de Aya», 800 m., Spain. *Munoz-Garmendia* 356, 357, 365 and 366, 21/Aug/1978. MA!
- XN1. Roncesvalles, 900 m., Navarra, Spain. *B. Molesworth-Allen* 5942, 14/June/1972. MGC!

- XN3. Txamantxoia, Belagua, Alto Roncal, Navarra, 1350-1500 m., Spain. *L. Villar* 458, 27/Aug/1973. JACA!
- YN1. Cauterets, route du Pont d'Espagne, France. *H. Vilmorin*, 12/Aug/1974. P!
- BH3. Mt. du Bedal, sobre Bagnères de Bigorre, 680-700 m., France. *P. Montserrat* 3226, 6/July/1975. JACA!
- CH1. Vallée d'Aran, 1200 m., Hautes Pyrénées, France. *D. F. Trémols*, July/1873. MPU!
- NH2. Proximidades de Santiago de Compostela, Spain. *Losa-Quintana & col.*, 15/Sept/1975. SANT (08247)!
- PH2. Folgoso de Caurel, Spain. *J. Amigo & J. Euilian* 800716/1, 16/July/1980. SANT! and 800722/3, 22/July/1980. SANT!
- PH4. Piedrafita de El Cebrero, Hayedo, Lugo, 1000 m., Spain. *Losa-Quintana*, 21/June/1975. MAF (93603)! Herb. Fernández-Casas, Fac. Cienc., Univ. Auton., Madrid!
- QH2. 3 ½ km. N.E. of Carbon del Sil, 5 km. N.E. of Paramo del Sil, S.W. of Palacios del Sil, N. W. side of Sierra de Jistredo, N.N.E. of Ponferrada, León, Spain. *C. R. Fraser-Jenkins* 10751, 30/Sept/1981. BM!
- WN2. Okina, La Txuparka, Montes de Vitoria, 800-1000 m., Spain. *P. Uribe-Echebarria & J. A. Alejandro* 1175, 6/June/1980. Herb. AEPNA, Vitoria!
- XN4. Gamueta, Anso, Huesca, 1400 m., Spain. *L. Villar* 537, 31/Aug/1973. JACA!
- YN2. *Jalas & Suominen* (1972).
- BH4. Val d'Anisclo, 1400 m., Spain. *P. Montserrat* 4407, 2/Aug/1975. JACA!
- CH2. Bosost, Valle de Aran, Lérida, Spain. *C. R. Fraser-Jenkins* 3588, 15/Jan/1972. BM!
- CH4. *Jalas & Suominen* (1972).
- DH2. Les Corbières, Le Caunil, 1300 m., Aude, France. *P. & J. M. Montserrat & Villar* 1567, 4/July/1978. JACA!
- NG1. Pontevedra, Bueu, Ermelo, 400 m., Spain. *S. Castroviejo*, 15/July/1970. MA (198360)!
- NG3. Anjão, marg. do rio Minho (Valladares), Minho, Portugal. *A. R. da Cunha*, June/1886. LISU (2206)!
- QG1. Flora Maragata, Sa. Teleno, Abedubol, 1500 m., Spain. *F. Bernis*, July/1946. MA (329)!
- VM3. San Millán, Sierra de la Demanda, Burgos, Spain. *A. E. Salvo-Tierra* 5708, 23/June/1979, MGC!
- WM1. Picos de Urbion, Vinuesa, Spain. *S. Rivas-Martinez & col.*, 15/July/1975. MAF (93198)!

- CG3. Vall de Riu, 2000-2200 m., Spain. *M. Losa & P. Montserrat*, 1948. BCF (4932)!
- DG1. Vall de Ribas, Baga de Siat, 1800 m., Spain. *J. Vigo & A. Anglada*, 14/July/1968. BC (605333)!
- DG3. Jalas & Suominen (1972).
- NG2. Pass below Extremo, S. of Monção, N. of Braga, Minho, Portugal. *C. R. Fraser-Jenkins* 4909, 6/June/1976. BM!
- NG4. E. side of Picos de Fonte Fria, N. of Pitões [das Júnias] (Portugal), S. of Muinos (Spain), Trás-os-Montes e Alto Douro, Portugal. *C. R. Fraser-Jenkins* 10698, 29/Sept/1981. BM!
- PG2. Larouco, 1300 m., Portugal. *A. M. Hernandez*, 25/July/1976. JACA!
- WM4. Moncayo, Spain. *B. Lazáro* 2265, July/1878. MAF (4461)! & July/1880. MAF (44552 & 66674)!
- DG2. Jalas & Suominen (1972).
- DG4. Jalas & Suominen (1972).
- NF1. Valongo, Portugal. *C. Bange* 79,205, 1979, LY!
- NF3. W. side of pass between Amarante e & Vila Real, E. of Porto, Douro, Portugal. *C. R. Fraser-Jenkins* 4911, 6/June/1976. BM!
- NF2. Vermoim, prox. Oliveira de Azeméis, Portugal. *J. Matos* 7587, 28/June/1960. COI! MA (195087)!
- NE3. E. side of Serra do Caramulo, Caramulinho peak, S.E. of S. João do Monte, Portugal. *C. R. Fraser-Jenkins* 10132, 5/Aug/1980. BM!
- PE1. Cântaros in Sa. da Estrella, Portugal. *Welwitsch*, Aug/1848. LISU!
- NE2. Marinha Grande, Mata do Engenho, Portugal. *G. de Barros Sá Nogueira*, March/1945. LISI!
- ND1. Jalas & Suominen (1972).
- TJ3. Jalas & Suominen (1972).
- UJ1. Arroyo de La Pedriza, Loreras, finca dei Hospital del Obispo, Sierra (Palomera) Carbonera, Navatrasierra, Cáceres, Spain. *M. Ladero-Alvarez*. 13/Aug/1966. MAF (80575)! and 8/April/1971. FCO (no. 00188)! GDA!
- MD4. Serra de Montejunto, Portugal. [Welwitsch] P-2198. LISU!
- MC3. Serra de Cintra, entre Guincho et Colares, Portugal. *C. Bange* 79,246, 1979. LY! (see comments under *D. guanchica*).
- TF4. «D'un herbier de Cadiz par Bedeau en 1828, comme exotique, sans indication de l'habitat». P! [introduced].
6. Mistério de St Luzia, Bocas de Fogo, in crater 1000 m., N.W. side of P. do Pico, Pico, Azores. *E. Sjögren* 680705-28a, b & c., 15/July/1968. UPS! and *I. B. Gonçalves* 2250, 5/July/1968. LISI! MGC! and, following

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

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

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

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

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

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

1) Subsp. *intermedia*.

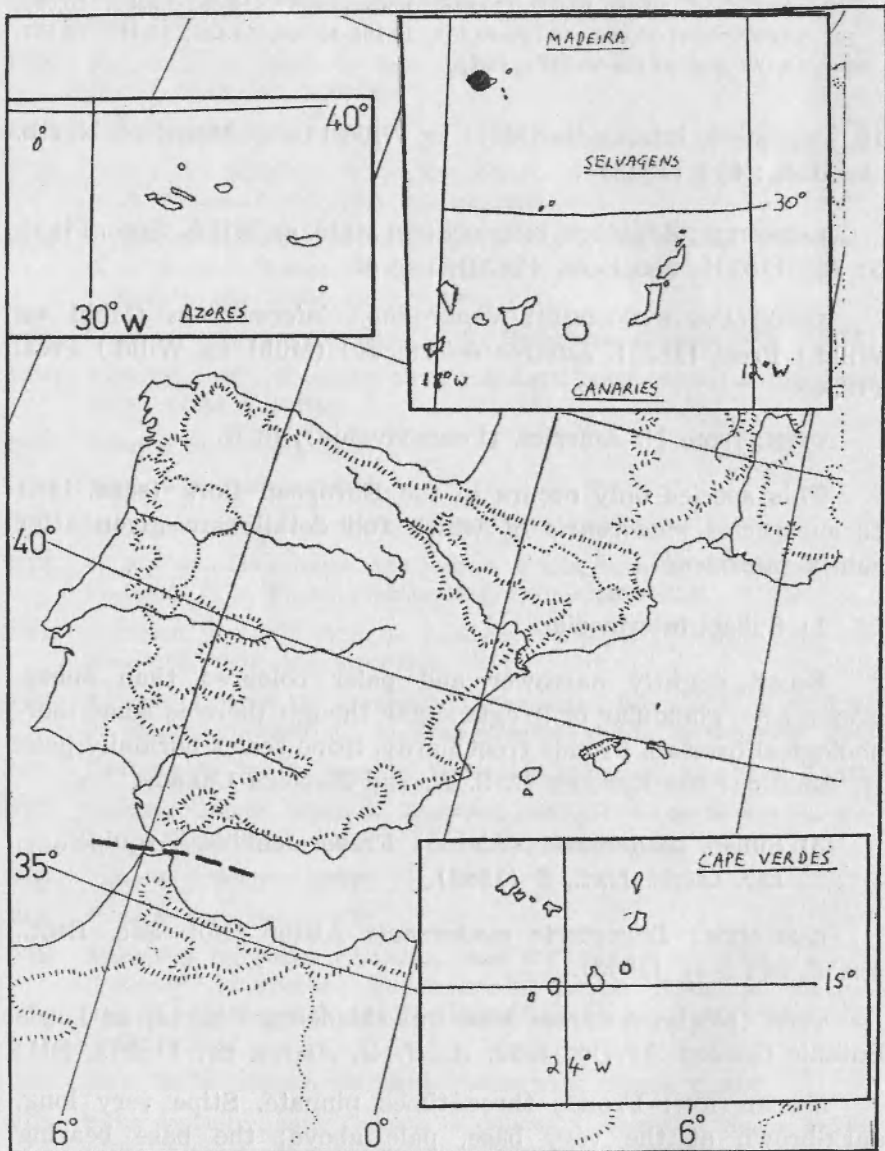
Fronde slightly narrower and paler coloured than subsp. *maderensis*, glandular or \pm eglandular though there is some morphological overlap. Fronds frost hardy. Stipe scales normally pale. N. America: the Eastern U. S. A. and Eastern Canada.

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

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

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

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



MAP 19.

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

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

RANGE: Confined to Madeira, as an endemic.

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

MAP: 19.

VOUCHER SPECIMENS:

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

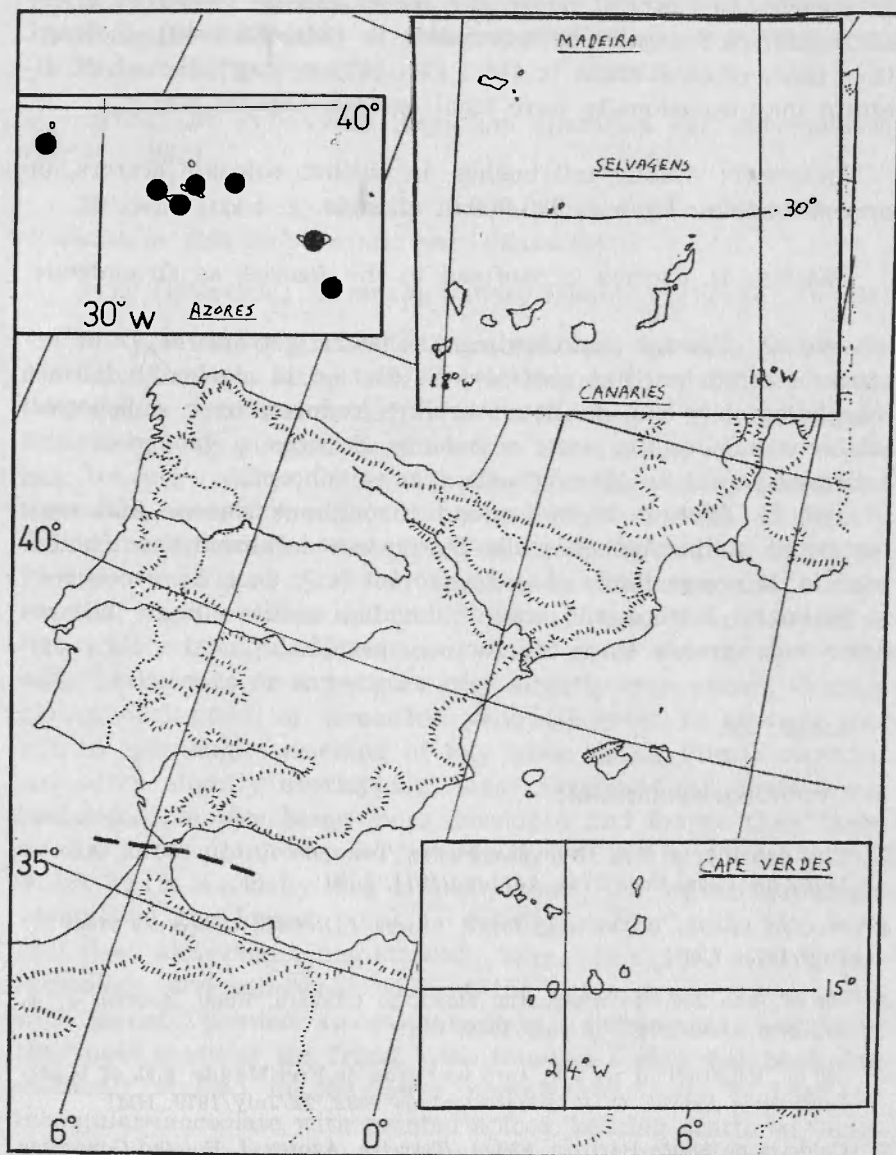
17. *Dryopteris azorica* (Christ) Alston, Bol. Soc. Broteriana, sér. 2, 30: 14 (1956).

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

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

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

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



MAP 20.

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

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

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

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

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

MAP: 20.

VOUCHER SPECIMENS:

2. Ilha das Flores, Sta. Cruz das Flores, Testa da Igreja, 500 m., Azores. *I. Botelho Gonçalves* 2726, 14/June/1971. LISI!
4. Pico do Areeiro, 900 m., São Jorge, Azores. *I. Botelho Gonçalves* 5156, 28/July/1973. LTR!
5. 425 m., São João to Abegoaria, Horta to Caldeira, Faial, Azores. *C. R. Fraser-Jenkins* 9587, 18/July/1979. BM!
6. 650 m., longitudinal road by turn to Furna de Frei Matias, S.E. of Madalena, Pico, Azores. *C. R. Fraser-Jenkins* 9632, 22/July/1979. BM!
7. Caldeira de Santa Bárbara, 830 m., Terceira, Azores. *I. Botelho Gonçalves* 5233, 8/Aug/1973. LTR!
8. nr. top of Lagoa do Fogo caldeira, on N. side, São Miguel, Azores. *C. R. Fraser-Jenkins* 9693, 29/July/1979. BM!
9. Ilha da Santa Maria, Vila do Porto, baldio, Azores. *I. Botelho Gonçalves* 2101, 23/Jan/1968. LISI!

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

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

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

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

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

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

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

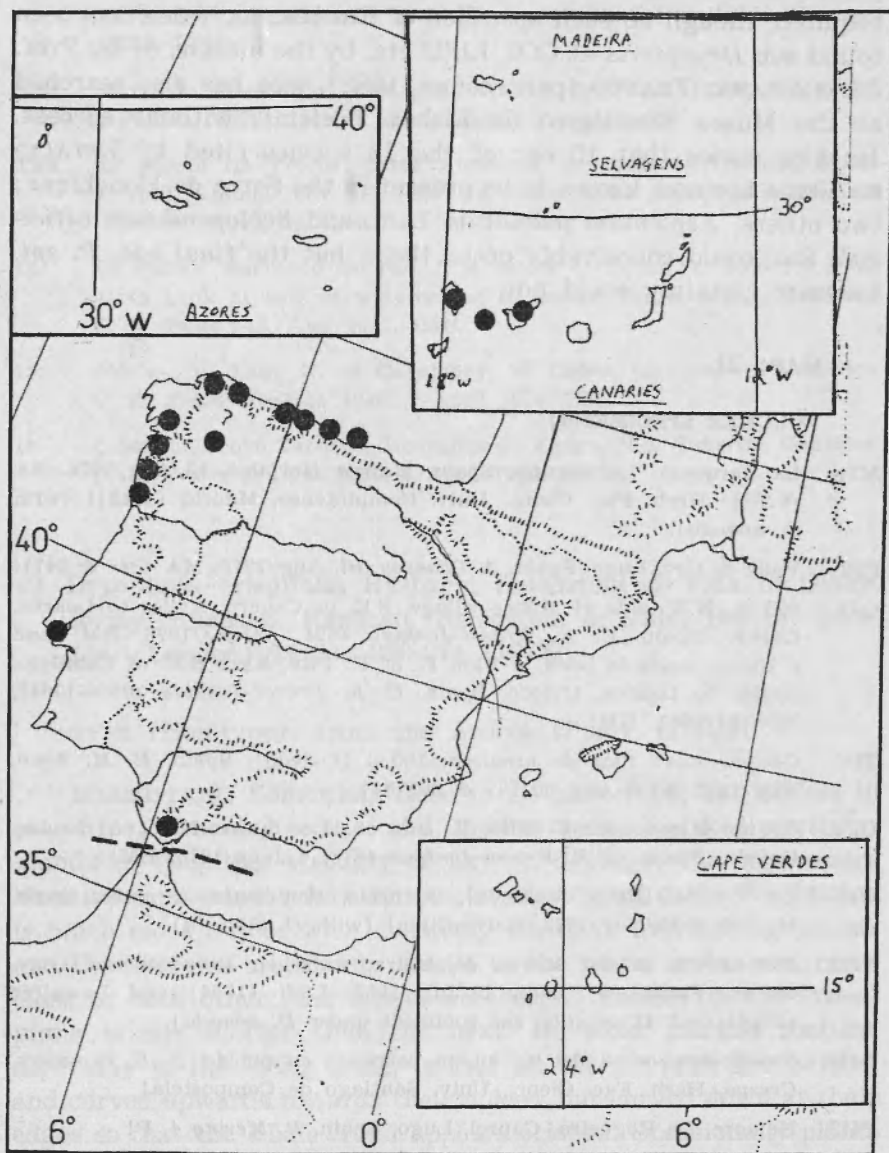
NOTES: CHRIST (1904) first recorded this species, as his *Aspidium dilatatum* var. *subaemulum*, with the observation that it was a curious form intermediate between *D. dilatata* and *D. aemula*, but this taxon was largely ignored. More recently, it was independently recognised as a species in the Canary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

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

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

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

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



MAP 21.

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

MAP: 21.

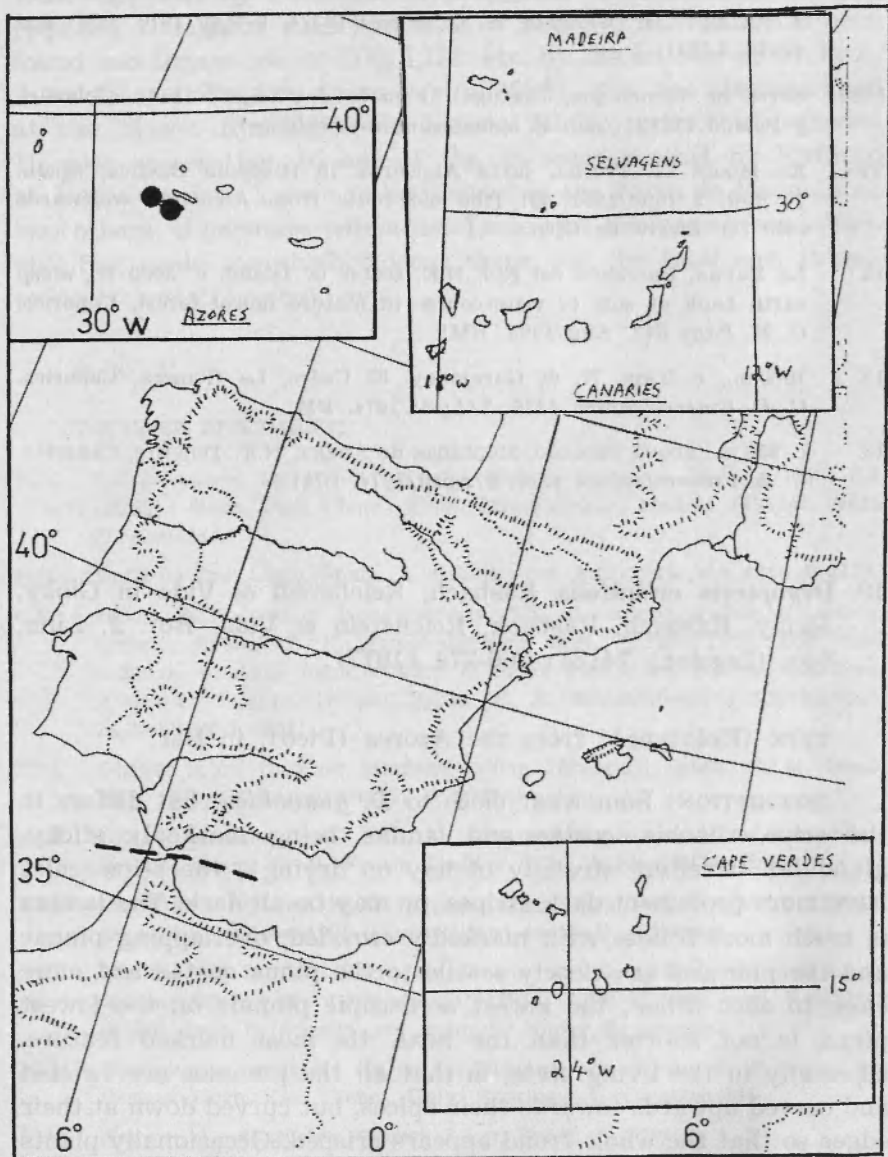
VOUCHER SPECIMENS:

- NJ4. La Barquera, La Coruna, Spain. *Marina Horjales*, 13/Aug/1976. SA (9263)! Herb. Fac. Cienc., Univ. Complutense, Madrid (4343)! (with *D. aemula*).
- PJ2. Valle de Oro, Lugo, Spain. A. Casares Gil, Aug/1915. MA (346 & 347)!
- QJ2. 400 m., N.W. side of Mones village, S.E. of Canero, Aviles to Luarca, Oviedo, Spain. C. R. Fraser-Jenkins 4894, 5/June/1976. BM! and c 200 m, roadside bank, c 1 km E. of El Pito, 5 km S.E. of Cudillero, Aviles to Luarca, Oviedo, Spain. C. R. Fraser-Jenkins 10646-10647, 26/Sept/1981. BM!
- TP4. Obaya, sobre roca de arenisca, 100 m [Oviedo], Spain. R. M. Simó, Aug/1973. FCO (no. 001177 & 00178)!
- UP2. 500 m., Mirador de El Fito, E. side of Mte. Sueve, N. of Arriendas, Oviedo, Spain. C. R. Fraser-Jenkins 4878, 4/June/1976. BM!
- UP4. La Franca [Riba de Deva], Asturias, non longe a mare, Spain. M. Lainz, 19/Nov/1972. Herb. Gijón! (with *D. dilatata*).
- PH1. Eichenwald in der Sierra de Meira, zwischen Ribadeo und Lugo, 450 m., Spain. W. Lüdi, 10/July/1953. Lüdi (1954) and Lawalrée (1956) (sub *D. aemula*, see comment under *D. aemula*).
- NH2. Toxosoutos, cerca del rio en un barranco en pinedo. S. E. Gonzalez-Crespo, Herb. Fac. Cienc., Univ. Santiago de Compostela!
- PH2. Nemore, La Rogueira, Caurel, Lugo, Spain. B. Merino 4. P!
- NG1. 650 m., Ermita des Angels, Gondomar to Porrino, Tuy to Vigo, Pontevedra, Spain. C. R. Fraser-Jenkins 4907, 6/June/1976. BM!
- NG2. Serra d'Arga, Cabreiro, Portugal. G. Sampaio 122, PO!
- NF1. Valongo, Santa Justa, ravin dernière la chapelle, Portugal. C. Bange 79,208, 1979. LY!

- MC3. Serra de Sintra, N. facing side, 450 m., S. of Pena Palace, Portugal. *J. W. Dyce, M. Gibby & A. C. Jermy* 12374, 5/May/1976. BM! and 12576. LISU!
- NB2. Serra de Monchique, Portugal. *Estácio da Veiga* (1868). Colmeiro y Penido (1889) (sub *P. spinulosum* var. *vulgare*).
- TF4. Ex Monte La Trocha, juxta Algeciras, in Hispania Baetica, Spain. *J. Ball*, 9/June/1851. B! [the old route from Algeciras westwards into the Sierra de Ojén].
13. La Palma, Barranco del Rio, N.E. sector of Island, c. 3000 ft., steep earth bank at side of watercourse in mature laurel forest, Canaries. *C. N. Page* 543, Aug/1963. BM!
15. 1050 m., c. 5 km. N. of Garajonay, El Cedro, La Gomera, Canaries. *C. R. Fraser-Jenkins* 4236, 7/April/1974. BM!
16. c. 950 m., above Taborno, Montanas de Anaga, N.E. Tenerife, Canaries. *C. R. Fraser-Jenkins* 4220, 2/April/1974. BM!
19. *Dryopteris crispifolia* Rasbach, Reichstein & Vida in Gibby, Jermy, Rasbach, Rasbach, Reichstein & Vida, Bot. J. Linn. Soc. (London) 74(3): 266-274 (1977).

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

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



MAP 22.

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

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

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

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

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

MAP: 22.

VOUCHER SPECIMENS:

- 5 800 m., ravines below Cabeço Gordo, S. side of Caldeira, Faial, Azores. *C. R. Fraser-Jenkins* 9597, 18/July/1979. BM!
- 6 700 m., 1 km. W. from Cabeço do Rondo, Pico, Azores. *H. & K. Rasbach* (T. Reichstein no. 3530), 8/May/1973. BM! G!

Excluded species

1. *Dryopteris cristata* (L.) Gray

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

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

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

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

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

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

Hybrids

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

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

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

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

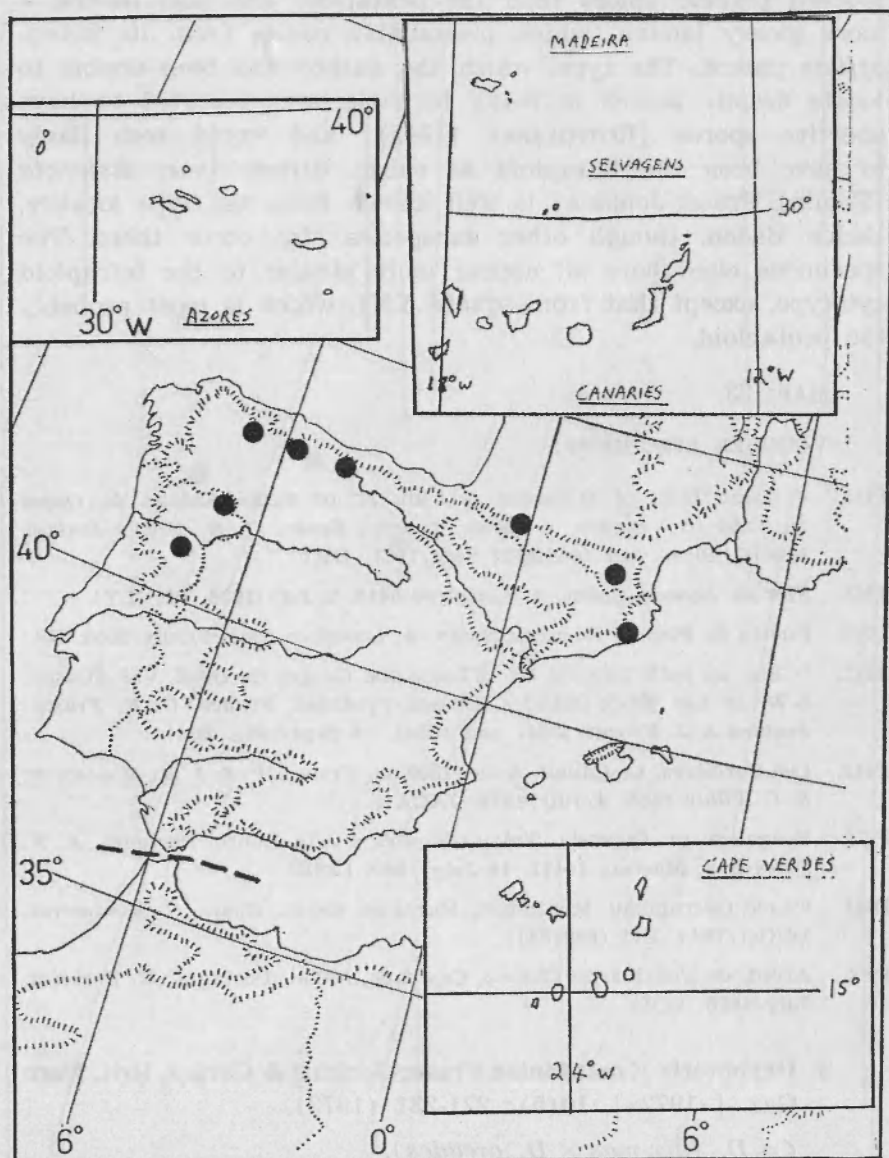
The hybrids are as follows; it has not been considered necessary to describe them all as all have intermediate morphology between the parents.

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

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

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

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



MAP 23.

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

MAP: 23.

VOUCHER SPECIMENS:

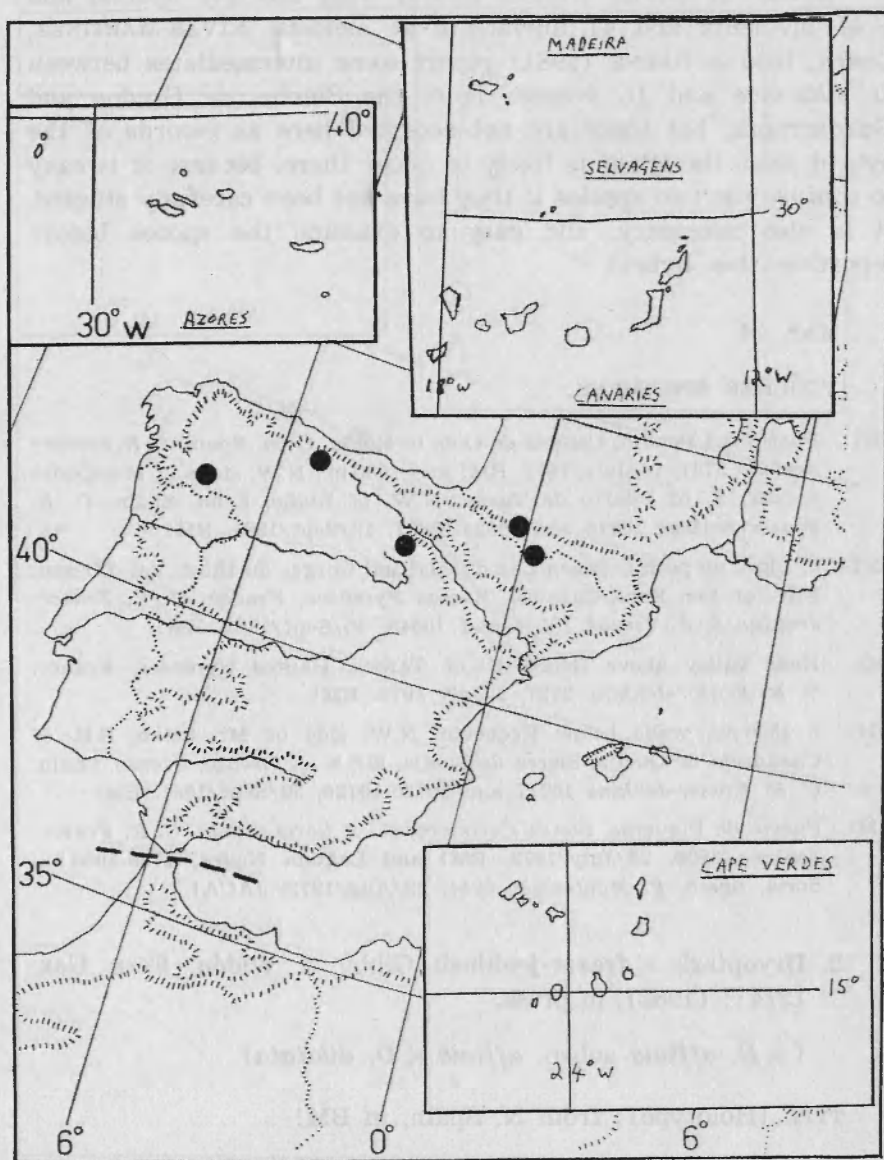
- PH3. c 1/2 km N.E. of Millardos, 1 1/2 km N. of Santa Eulalia de Oscos on road to Vegadeo, c 650 m., Oviedo, Spain. *C. R. Fraser-Jenkins* 106676, 10680 and 10682, 27/Sept/1981. BM!
- TN3. Flor de Acebos, Spain. *A. Lawalrée* 5446, 9/July/1953. BR! LY!
- UN3. Puerto de Piedras Luengas, Spain. *A. Lawalrée* 5301, 5/July/1953. BR!
- YN1. 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* 10547 and 10561, 15/Sept/1981. BM!
- DH2. Les Corbières, Le Caunil, Aude, 1300 m., France. *P. & J. M. Montserrat & L. Villar* 1565, 4/July/1978. JACA!
- PG4. Bragança, pr. Quintela, Trás-os-Montes e Alto Douro, Portugal. *A. N. Teles & J. Martins* 14471, 14/July/1969. LISE!
- DG4. Faudó Garrumbau, Montnegre, Maresme, 450 m., Spain. *P. Montserrat*, 18/Oct/1945. BC (622154)!
- PF2. Arred. de Penalva do Castelo, Castendo, 500 m, Portugal. *M. Ferreira*, July/1885. COI!

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

(= *D. filix-mas* × *D. oreades*).

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

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



MAP 24.



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

MAP. 24.

VOUCHER SPECIMENS:

- UN1. Puerto del Pontón, Cangas de Onís to Riano, León, Spain. *C. R. Fraser-Jenkins* 3761, 14/July/1972. BM! and 1650 m., N.W. slope of Mampodre massif, S. of Puerto de Tarna, N.W. of Riano, León, Spain. *C. R. Fraser-Jenkins* 10615 and 10625-10627, 18/Sept/1981. BM!
- YN1. c. 1 km. up path between Lac d'Isabe and Gorges du Bitet, Val d'Ossau, S.W. of Les Eaux-Chaudes, Basses Pyrénées, France. *C. R. Fraser-Jenkins* & *J. Vivant* 10544 and 10545, 15/Sept/1981. BM!
- BH4. Heas valley above Gèdre, S. of Tarbes, Hautes Pyrénées, France. *C. R. Fraser-Jenkins* 3727, 8/July/1972. BM!
- PG1. c 1300 m., walls below Requeixo, N.W. side of Mt. Seixo, S.E. of Chandreja de Queija, Sierra de Queija, E.S.E. of Orense, Orense, Spain. *C. R. Fraser-Jenkins* 10717 and 10725-10726, 30/Sept/1981. BM!
- WM1. Puerto de Piqueras, Sierra Cebollera, N. of Soria, Spain. *C. R. Fraser-Jenkins* 3809, 28/July/1972. BM! and Laguna Negra, 1750-1950 m., Soria, Spain. *P. Montserrat* 6944, 23/Aug/1972. JACA!

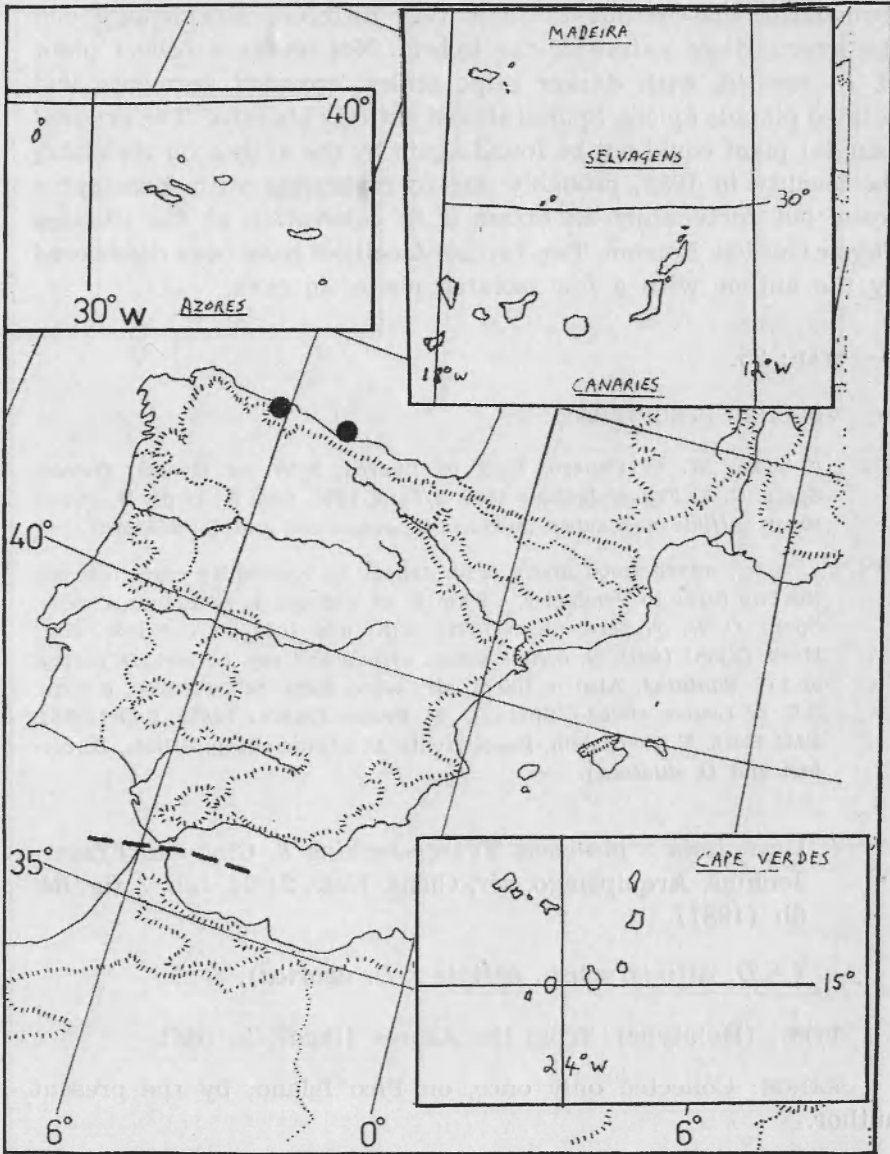
3. *Dryopteris* × *fraser-jenkinsii* Gibby & Widén, Fern Gaz. 12(4): (1982), in press.

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

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

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

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



MAP 25.

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

MAP: 25.

VOUCHER SPECIMENS:

- QJ2. c 1/2 km W. of Canero, East of Luarca, N.W. of Oviedo, Oviedo, Spain. C. R. Fraser-Jenkins 4899, 5/June/1976. BM! P! (with *D. affinis* subsp. *affinis* and subsp. *borreri*, *D. guanchica* and *D. dilatata*).
- UP4. c. 50 m., mixed wood above main Oviedo to Santander road, between the two turns to Pendueles, c 2 km E. of Vidiago, E. of Llanes, Oviedo, Spain. C. R. Fraser-Jenkins 10778-10781 and 10798, 3/Oct/1981. BM! Herb. Gijón! (with *D. affinis* subsp. *affinis* and ssp. *borreri*, *D. corleyi* and *D. dilatata*). Also: c 100 m. alt., wood 2 km. below Puron, c 7 km. S.E. of Llanes, Oviedo, Spain. C. R. Fraser-Jenkins 10835, 5/Oct/1981. BM! Herb. T. Reichstein, Basel! (with *D. affinis* subsp. *affinis*, *D. corleyi* and *D. dilatata*).

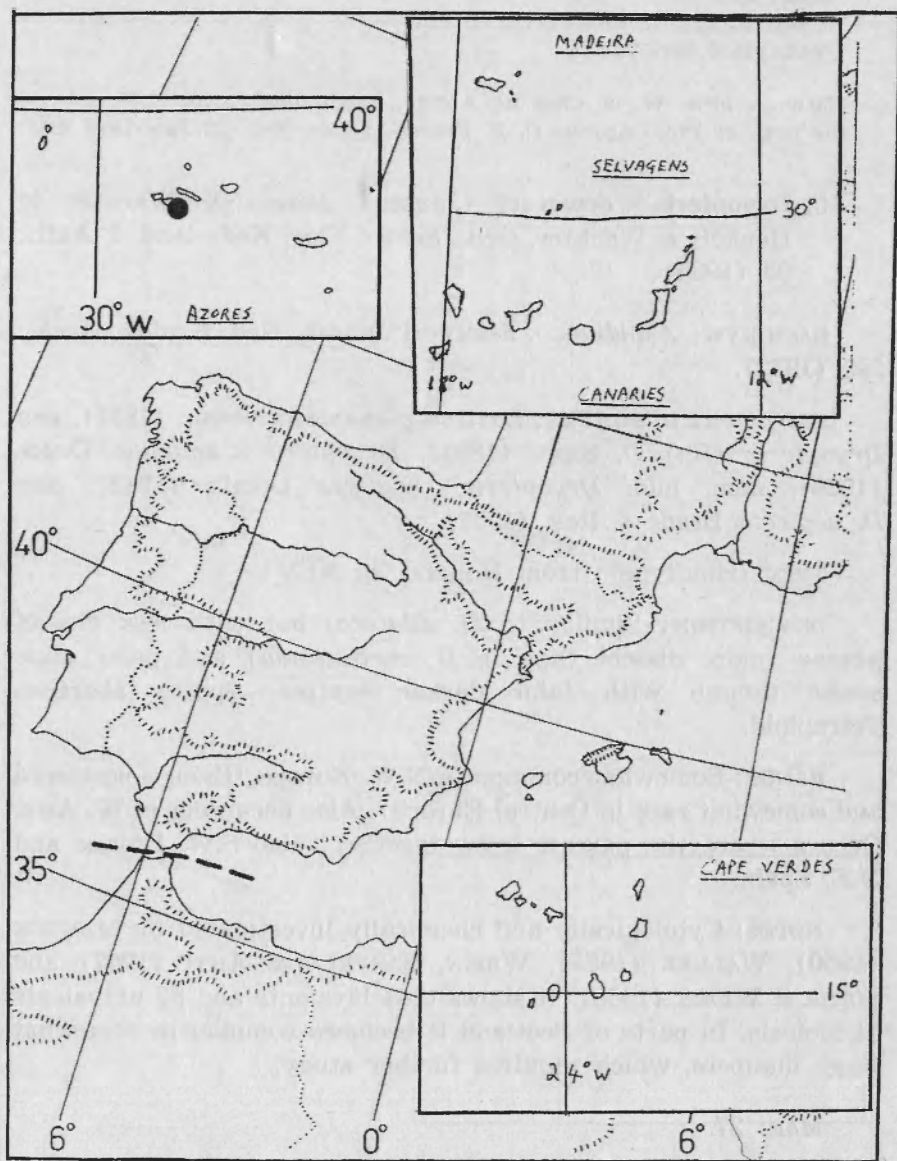
4. *Dryopteris* × *picoensis* Fraser-Jenkins & Gibby in Fraser-Jenkins, Arquipélago, sér. Ciênc. Nat., 2: 94, tab. 3 fig. 6a, 6b (1981).

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

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

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

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



MAP 26.

MAP. 26.

VOUCHER SPECIMENS:

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

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

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

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

TYPE (Holotype): from Holland, in NBV!

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

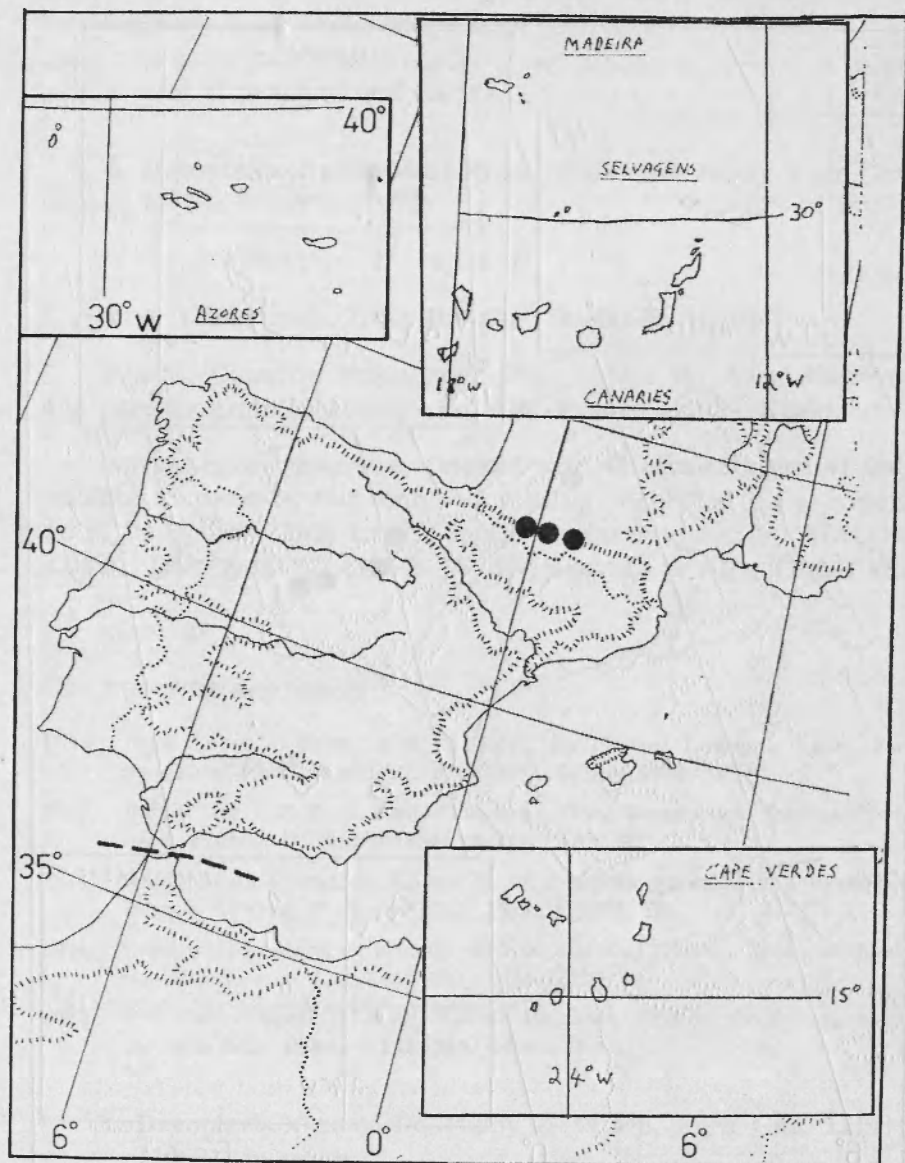
RANGE: Somewhat common in N.W. Europe (though scattered and somewhat rare in Central Europe). Also occurring in W. Asia. Occurs where the parents grow together; also S.W. France and N.E. Spain.

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

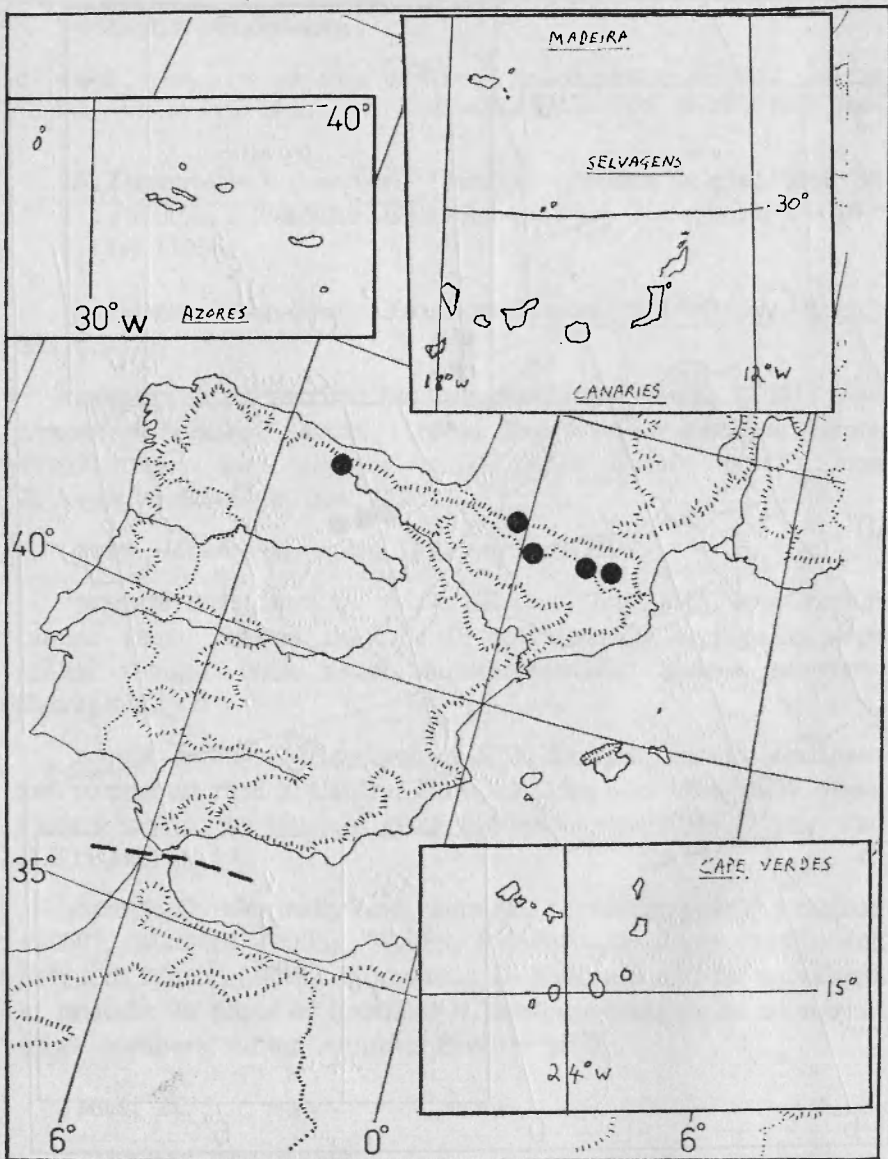
MAP: 27.

VOUCHER SPECIMENS:

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



MAP 27.



MAP 28.

- BH3. Pla de Serre, 1.5 km au S.W. de Cadéac, 1200 m., Hautes Pyrénées, France. *F. Badré* 1612, 19/July/1975. P!
- CH1. Col de Hô, Pic du Gar, Luchon, N.-W., 940-1050 m., France. *P. Montserrat* 1779, 8/July/1978. JACA!

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

(= *D. dilatata* × *D. expansa*)

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

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

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

MAP: 28.

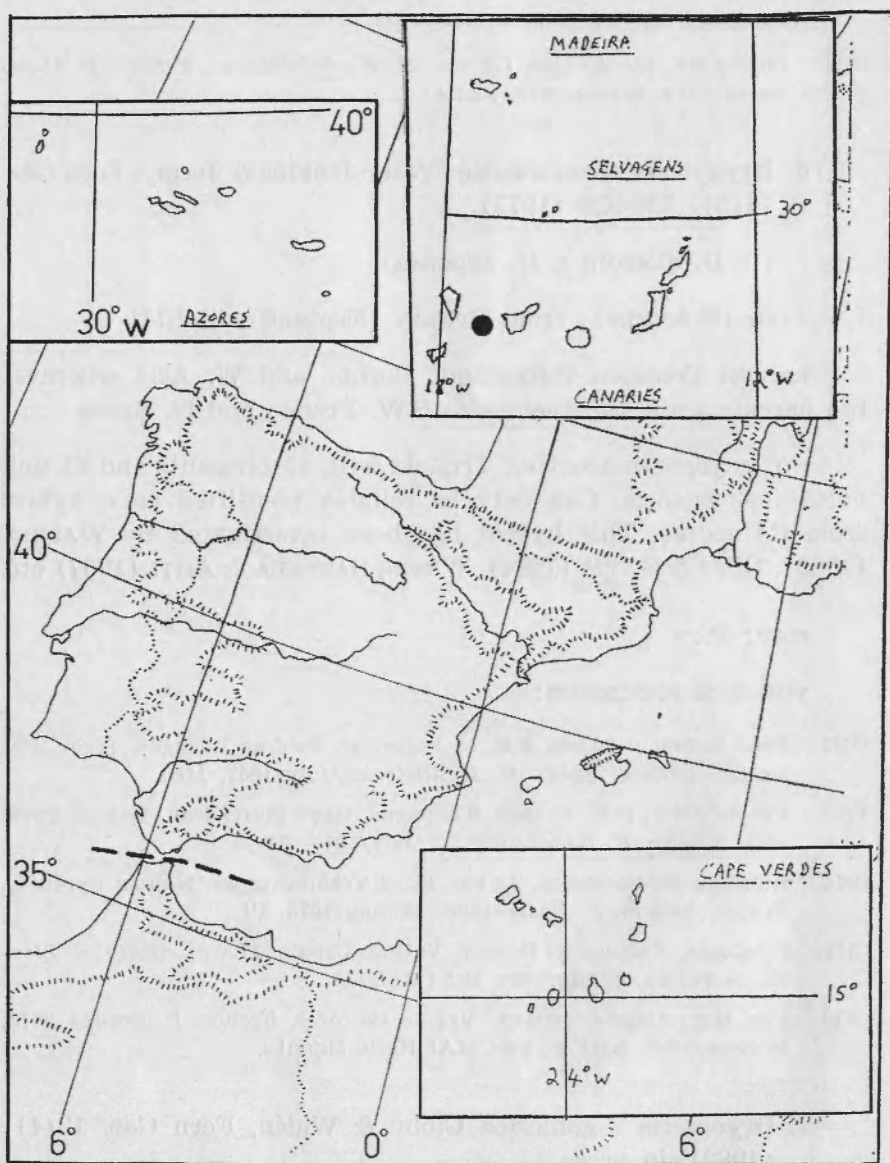
VOUCHER SPECIMENS:

- UN3. Pena Labra, c 30 km. S.E. of Potes, nr. Piedras Luengas, [prov. Palencia], c 7000', Spain. *H. McAlister*, 8/July/1967, MB!
- YN1. Val de Jéret, N.E. of Pont d'Espagne, Gave Marcadeau, Hautes Pyrénées, France. *F. Badré* 1690, 23/July/1975. P!
- BH4. Ruisseau du Riomajou, 7.5 km. S. of Tramezaygues, Hautes Pyrénées, France, 1400 m. *F. Badré* 1503, 15/July/1975. P!
- CH4. Catalonia, Avetora de Bolsabi, Vail de Cardós, 1700 m., Spain. *S. Lleuria de Felceu*, 8/Aug/1956. BC (145408)!
- DH2. Pyr. Ost.: Capcir, 1800 m., Val de Balcères, France. *F. Sennen* 2373, 10/Sept/1915. BM! P! PC! MA! Herb. Gijón!

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

(= *D. aemula* × *D. guanchica*)

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



MAP 29.

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

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

MAP: 29.

VOUCHER SPECIMENS:

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

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

(= *D. aemula* × *D. crispifolia*)

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

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

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

MAP: 30.

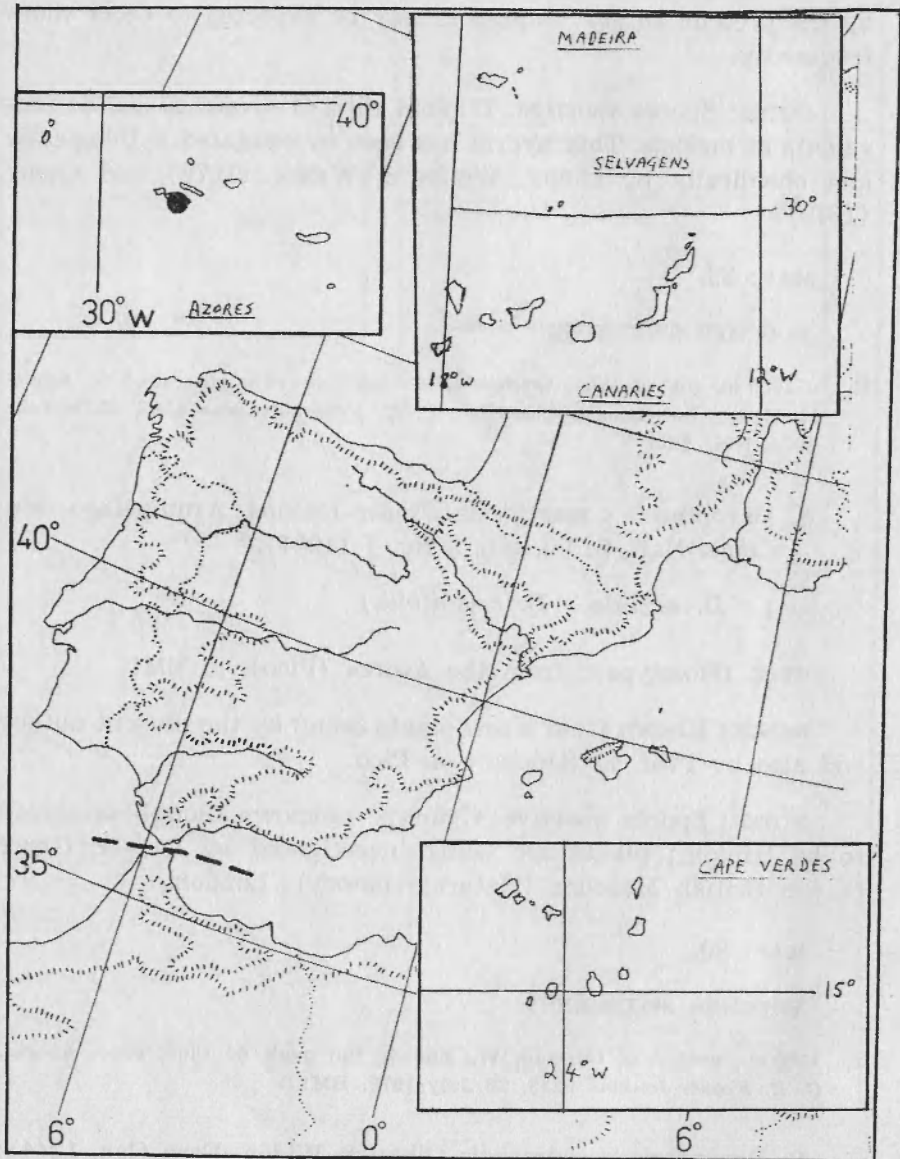
VOUCHER SPECIMENS:

6. 1100 m., crater of Capitão, W. side of the peak of Pico, Pico, Azores. *C. R. Fraser-Jenkins* 9653, 22/July/1979. BM!

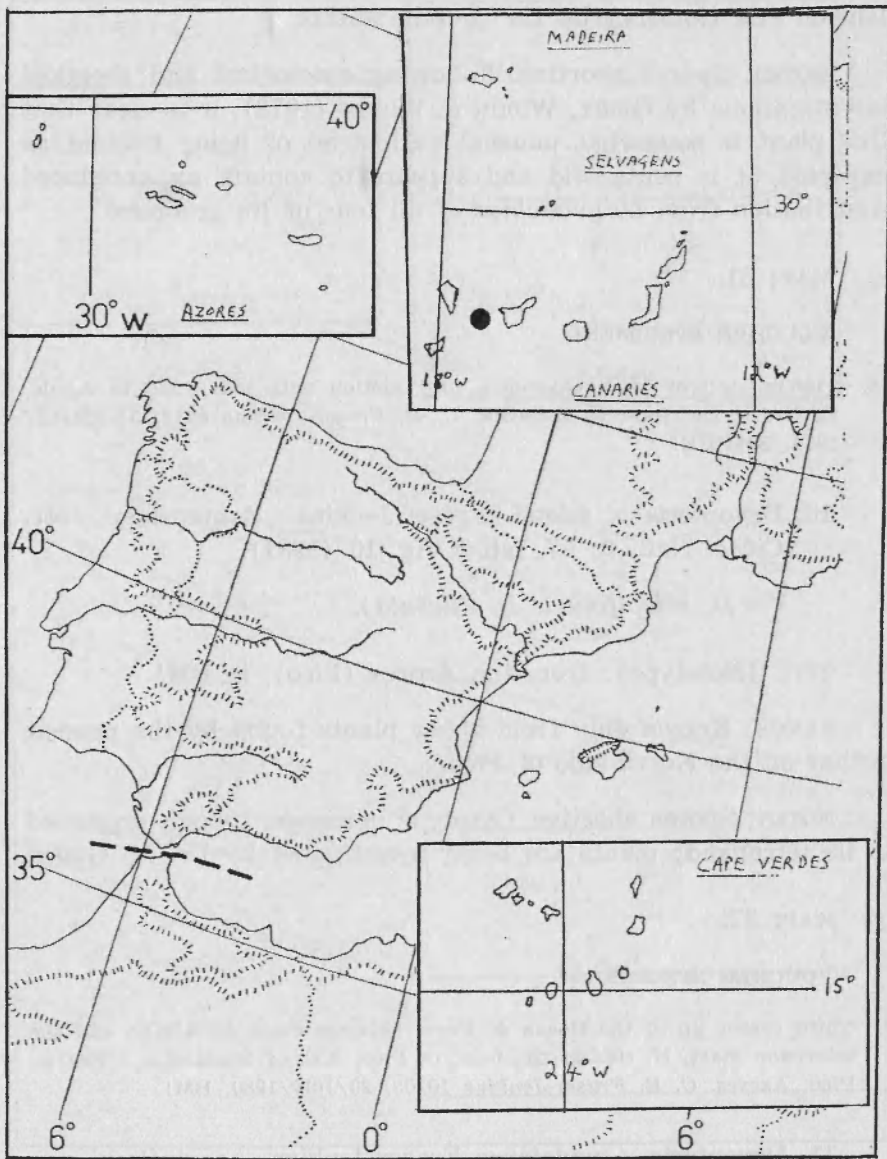
9. *Dryopteris* × *cedroensis* Gibby & Widén, *Fern Gaz.* 12(4): (1982), in press.

(= *D. guanchica* × *D. oligodonta*).

TYPE (Holotype): from the Canaries (La Gomera), in BM!



MAP 30.



MAP 31.

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

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

MAP: 31.

VOUCHER SPECIMENS:

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

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

(= *D. crispifolia* × *D. dilatata*).

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

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

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

MAP: 32.

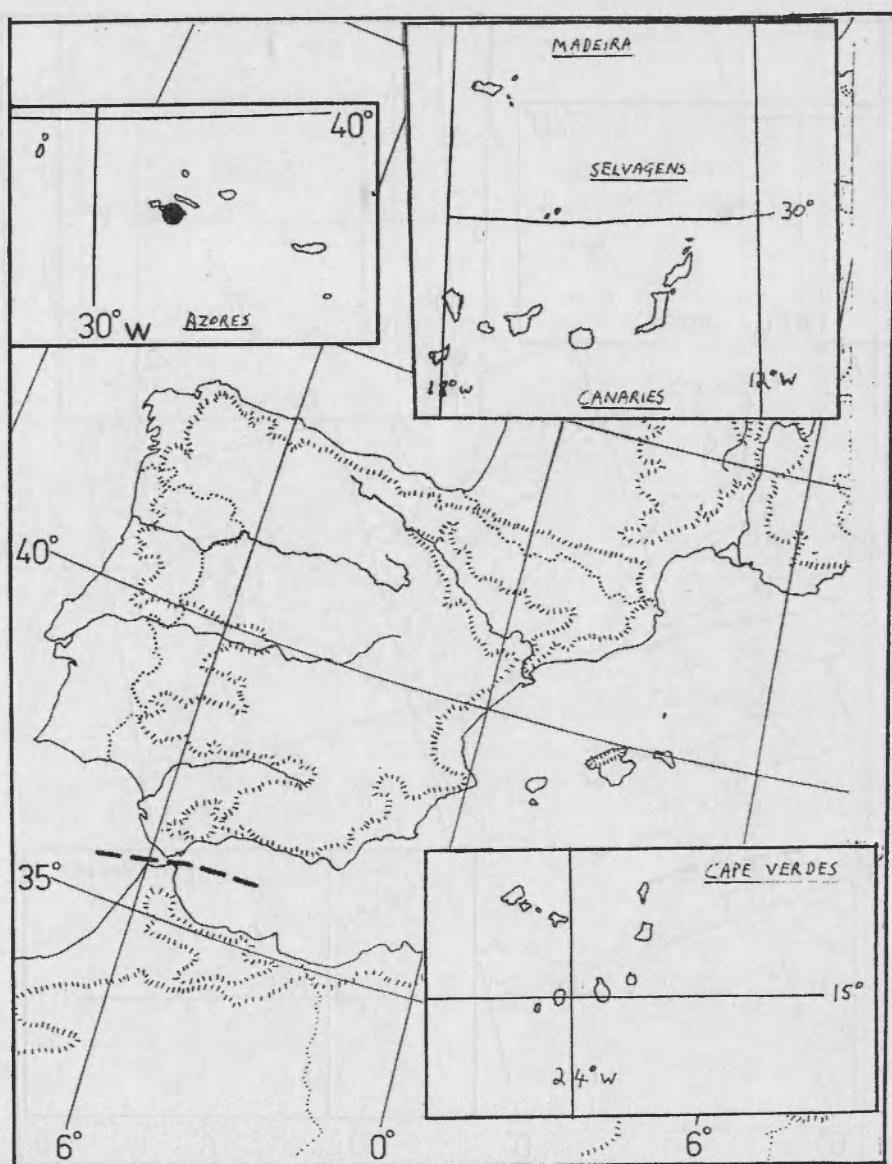
VOUCHER SPECIMENS:

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

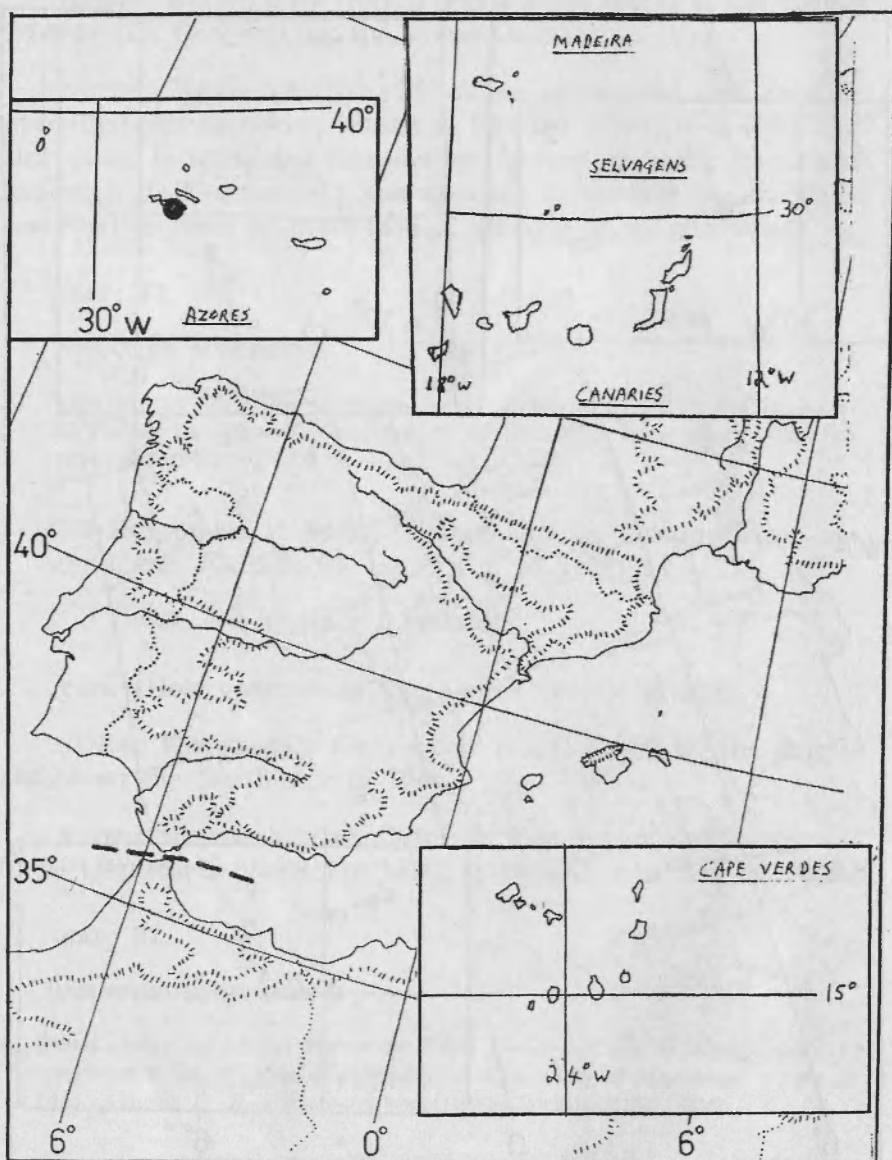
11. *Dryopteris* × *madalena*e Fraser-Jenkins, Arquipélago, sér. *Ciênc. Nat.*, 2: 96, tab. 3 fig. 9 (1981).

(= *D. azorica* × *D. crispifolia*)

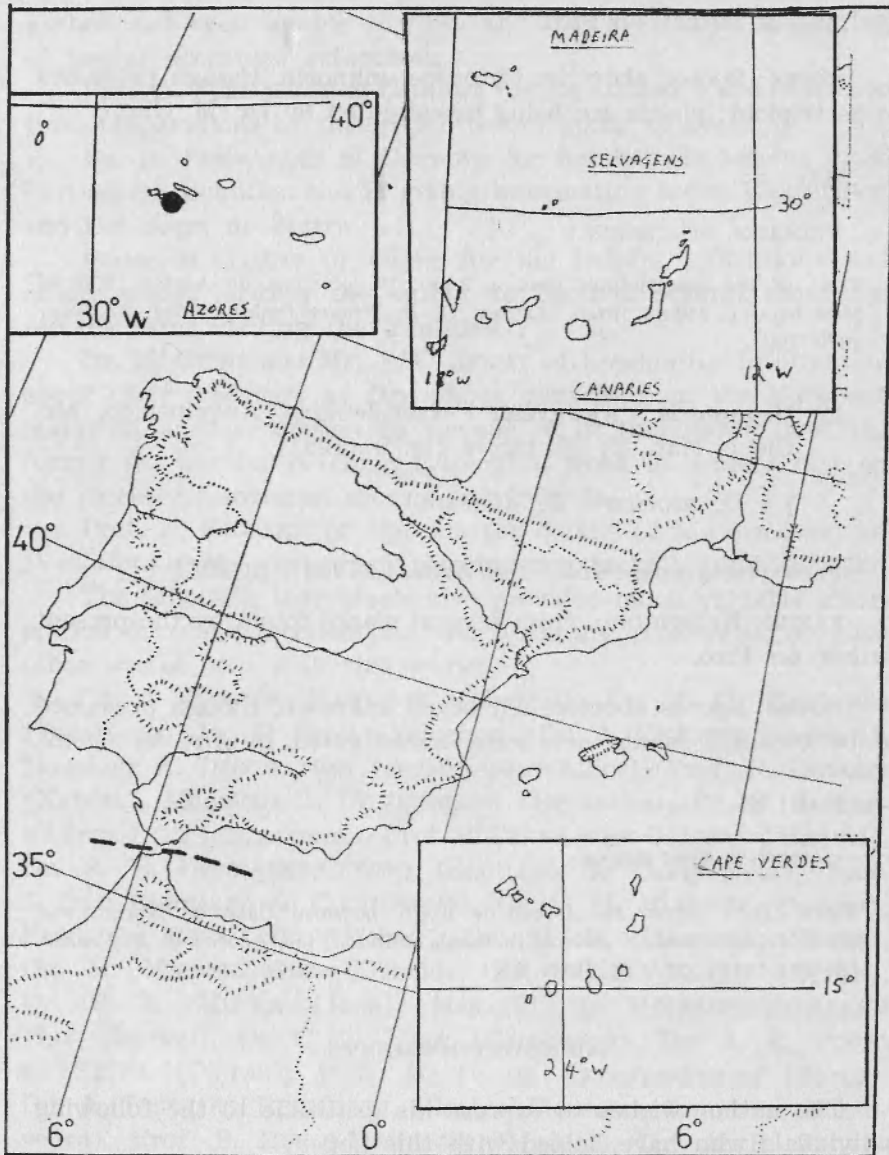
TYPE (Holotype): from the Azores (Pico), in BM!



MAP 32.



MAP 33.



MAP 34.

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

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

MAP: 33.

VOUCHER SPECIMENS:

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

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

(= *D. azorica* × *D. dilatata*)

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

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

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

MAP: 34.

VOUCHER SPECIMENS:

- 6 Third crater up of the Bocas de Fogo, between Casa de Abrigo and the television mast, N. side of the peak of Pico, Pico, Azores. *C. R. Fraser-Jenkins* 10108, 20/July/1980. BM!

ACKNOWLEDGEMENTS

The author wishes to express his gratitude to the following individuals who have helped with this paper:

Prof. J. DO A. FRANCO of Lisboa for his very helpful and thorough revision and very many useful suggestions concerning the final draft of this paper.

Prof. P. MONTERRAT of Jaca, who with the help of his colleague, Dr. L. VILLAR, has given invaluable help in tracing a

large number of Spanish localities (c 70 localities) that the author had been unable to find, and has also found a number of useful literature references.

Prof. A. FERNANDES of Coimbra for his extensive and exhaustive final preparations of this paper before going to press.

Dr. R. FERNANDES of Coimbra for her help in tracing c. 20 Portuguese localities and in giving information about WELWITSCH and the Serra de Sintra.

Padre M. LAÍNZ of Gijón for his helpful indications and advice which enabled the author to confirm several important records after visiting the localities.

Dr. M. GIBBY and Mr. A. C. JERMY of London for information about their discovery of *Dryopteris guanchica* on the European mainland and permission to include it in this paper, and the former for her far reaching cytological work in process now on the recently discovered species and hybrids.

Prof. E. SJÖGREN of Uppsala for details of his discovery of *D. dilatata* on Pico Island and permission to include it in this paper.

The following individuals also provided much valuable information concerning collections and literature references, or gave other useful help with this work:

Dr. I. BARRERA-MARTINEZ (Madrid), Dr. J. C. BASCONES (Pamplona), Dr. G. BENL (München), Dr. A. CHARPIN (Geneva), Monsieur R. DESCHATRES (Bellerive-sur-Allier), Prof. P. DUPONT (Nantes), Monsieur J. DUVIGNEAUD (Bruxelles), Dr. F. J. FERNÁNDEZ-DIEZ (Salamanca), Prof. E. FERNÁNDEZ GALIANO (Madrid), Dr. S. E. GONZÁLEZ-CRESPO (Santiago de Compostela), Prof. J. IZCO (Santiago de Compostela), Dr. C. M. JUARISTI (Madrid), Prof. A. LAWALRÉE (Meise), Dr. H. R. MARTINS (Horta), Dr. M. MAYOR-LOPEZ (Oviedo), Dr. D. E. MEYER (Berlin), Dr. F. K. MEYER (Jena), Mrs. E. A. MOLESWORTH-ALLEN (Los Barrios), Dr. C. N. PAGE (Edinburgh), Dr. A. R. PINTO DA SILVA (Oeiras), Prof. M. C. DE REZENDE-PINTO (Porto), Dr. A. RIGUEIRO RODRIGUEZ (Centro Florestal, Lourizan, Pontevedra), Prof. S. RIVAS-MARTINEZ (Madrid), Dr. A. E. SALVO-TIERRA (Málaga), Dr. R. SUTTER (Bern), Dr. P. URIBE-ECHEBARRIA (Vitoria), Prof. B. VALDÉS (Sevilla), Prof. E. VALDÉS-BERMEJO (Madrid), Monsieur J. VIVANT (Orthez).

The staff of the various herbaria listed in the introduction, particularly in Spain and Portugal, who have provided considerable

time and help during the author's visits, or have sent material, are also thanked.

Special thanks are due to Prof. T. REICHSTEIN of the Institute of Organic Chemistry, University of Basel, Switzerland. During the course of this study he has taken an active interest in all the new discoveries and has been ready to carry out further study of various types, including chemical analysis. He has also most kindly provided the author with funds to cover the major part of his expenses on a number of collecting excursions to Spain, Portugal and various parts of Macaronesia.

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

APPENDIX

Unlocated specimens are as follows:

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

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

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* = not consulted in full.

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

por

MARIA DA LUZ DA ROCHA AFONSO

Investigador-auxiliar do Departamento de Botânica
do Instituto Superior de Agronomia, Lisboa

SUMMARY

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

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

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

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

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

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

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

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

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

correcta a identificação do material insular como *C. fragilis* (L.) Bernh.

Quanto aos exemplares colhidos no Continente, verificámos a existência de dois grupos no que se refere à morfologia dos dentes foliares e à terminação das ramificações das nervuras. Num deles, as folhas são idênticas às do material acima descrito para as Ilhas Adjacentes, enquanto no outro grupo as ramificações das nervuras terminam no ápice de dentes inteiros ou mais raramente de dentes ligeiramente emarginados. Segundo o critério de BLASDELL (l. c.), que nos parece definir uma divisão natural do género, este último grupo pertenceria à sect. *Cystopteris*, pelo que teríamos desde já pelo menos dois táxones distintos.

Em abono desta conclusão e no que diz respeito ao material do Continente português, verificámos ainda haver, quanto à distribuição geográfica, tendências altitudinais diferentes nos exemplares de cada uma das secções mencionadas. Com efeito, enquanto os da sect. *Cystopteris* se distribuem em cotas bastante elevadas, frequentemente acima dos 500 m, os da sect. *Emarginatae*, mais plásticos quanto à adaptação à variação da altitude, encontram-se com maior frequência em regiões de baixa ou média altitude, podendo, no entanto, aparecer em regiões montanhosas elevadas.

Admitida a existência em Portugal das sect. *Cystopteris* e *Emarginatae*, procedemos à observação, no microscópio de varrimento, de esporos de grande número de exemplares, quer de herbário, quer colhidos para o efeito nos sítios que nos pareceram mais representativos.

Desde logo se notou haver dois tipos diferentes de esporos no que se refere à ornamentação da sua superfície: esporos muricados e esporos com a parede apenas granulosa. Os exemplares com a parede espinhosa variam quanto à densidade e dimensões dos espinhos, verificando-se, no entanto, ainda dois grupos relativamente distintos: espécimes com esporos em que os espinhos são densos, parecendo muitas vezes coalescentes, e espécimes em que os espinhos, menos densos, aparecem relativamente isolados, podendo facilmente observar-se, entre eles, a parede sublísa do esporo.

Na grande maioria, os esporos de parede granulosa apresentam-se enrugados, mais ou menos ruminados. Observaram-se, no entanto, dois exemplares da zona elevada da Serra da Estrela (Lagoa Comprida e Penhas Douradas) em que os esporos, embora de parede granulosa, não mostravam qualquer rugosidade. Aliás,

segundo JERMY & HARPER (1971), a rugosidade deste tipo de esporos não é mais do que um artefacto da secagem, embora possivelmente relacionada com a estrutura da intina ou da exina.

Os esporos densamente muricados foram observados em exemplares cujas folhas apresentam segmentos com os dentes geralmente emarginados, terminando as ramificações das nervuras nos respectivos chanfros. Por outro lado, os espécimes, cujas folhas têm as nervuras de última ordem terminadas no ápice dos dentes, compreendem dois subgrupos quanto aos esporos: num os esporos são frouxamente muricados, enquanto no outro se apresentam granulados.

Em resultado destas observações, concluímos estar agora em presença de três entidades taxonómicas diferentes. Pareceu-nos, por isso, conveniente rever todo o material estudado a fim de procurar outros caracteres distintivos que pudessem estar correlacionados com os até agora encontrados.

Verificámos que a forma geral do limbo varia de oblonga a largamente lanceolada e, embora não seja constante em qualquer dos três grupos encontrados, notámos um predomínio das formas mais estreitas nos exemplares da sect. *Cystopteris* e das formas mais largas nos da sect. *Emarginatae*.

Mais significativas nos pareceram as diferenças observadas no reticulado das escamas do rizoma. Embora sempre translúcidas e papiráceas, mostram contudo diferenças no reticulado celular. Assim, nos espécimes pertencentes à sect. *Emarginatae* há muito frequentemente escamas com o reticulado bem evidente, castanho e escuro, enquanto na sect. *Cystopteris* este reticulado é geralmente ténue e de cor amarelada, conferindo um tom estramíneo às respectivas escamas.

Também a duração das folhas constitue um carácter a tomar em consideração. Com efeito, as folhas são persistentes na sect. *Emarginatae* e caducas na sect. *Cystopteris*.

Finalmente, nos exemplares que considerámos da sect. *Cystopteris*, os indúsios são ovado-lanceolados, mais ou menos longamente acuminados, tornando-se na maturação frequentemente lacerados no ápice, ao passo que nos da sect. *Emarginatae* os indúsios são geralmente ovados ou raramente ovado-oblongos, com ápice obtuso ou arredondado.

Portanto, podemos afirmar em conclusão que existem em Portugal três táxones distintos¹, caracterizados da seguinte maneira:

- a) Esporos densamente muricados, com espinhos de dimensões e forma variadas, os maiores de base larga, frequentemente coalescentes e formando pequenas cristas, os mais pequenos muitas vezes com aspecto rudimentar; segmentos das folhas com as ramificações das nervuras terminando nas reentrâncias dos dentes emarginados ou a meio do ápice mais ou menos obliquamente truncado; escamas do rizoma geralmente com as membranas celulares castanhas, espessas e bem evidentes; indúcio ovado-obtuso.
- b) Esporos frouxamente muricados, com espinhos pouco desiguais, mais ou menos isolados, deixando ver distintamente a parede sublisa do esporo; segmentos das folhas com as ramificações das nervuras terminando no ápice mais ou menos agudo dos dentes; escamas do rizoma com as membranas celulares pálido-amareladas, finas e pouco evidentes; indúcio ovado-lanceolado, acuminado-esfacelado.
- c) Esporos granulosos, frequentemente ruminados; segmentos das folhas com as ramificações das nervuras terminando no ápice dos dentes, mais ou menos obtuso, por vezes levemente emarginado; escamas do rizoma e indúcio como em b).

Comparando exemplares representativos destes grupos com os espécimes arquivados, quer na Secção de Criptogamia do Departamento de Botânica do Museum of Natural History, Londres, quer no herbário dos Royal Botanic Gardens, Kew, pertencentes

¹ Num exemplar herborizado na garganta sul do Cântaro Magro acima de 1500 m, em solo granítico (LISU P-2136), os esporos são frouxamente muricados e idênticos aos de *C. fragilis*, mas os dentes das folhas apresentam-se com frequência emarginados, terminando as nervuras nas respectivas reentrâncias. O mesmo acontece com um espécime espanhol colhido a 1950 m nos Montes de León, em solo xistoso (LISE 53776), o que nos leva a admitir a hipótese da existência, no NW da Península Ibérica, duma vicariante de altitude das plantas alpinas do género, hipótese que tentaremos esclarecer oportunamente com observação de mais material.

ao complexo «*Cystopteris fragilis*», e estudando as descrições feitas por vários autores que se debruçaram sobre o assunto, parece-nos poder concluir que apenas o material português do grupo b) pode ser identificado como a típica *C. fragilis* (L.) Bernh. Quanto ao grupo c), os respectivos espécimes mostram que se trata da espécie *C. dickiana* R. Sim, que não tinha ainda sido referida para Portugal, embora se conhecesse já a sua existência na cordilheira central espanhola, segundo nos foi verbalmente comunicado por FRASER-JENKINS. Finalmente, no que se refere ao grupo a), que inclui material de Portugal continental, dos Açores e da Madeira, não há dúvida que existe perfeita identidade deste material com os exemplares que estudámos colhidos em várias ilhas do Arquipélago das Canárias, que correspondem ao *Aspidium viridulum* Desv., posteriormente transferido para o género *Cystopteris* Bernh. pelo próprio autor [*C. viridula* (Desv.) Desv.], de cujo tipo, preservado na Secção de Criptogamia do Muséum d'Histoire Naturelle de Paris, vimos fotografias mostrando, além da planta completa, alguns pormenores da folha e do esporo. A identidade desta espécie com *Polypodium diaphanum* Bory proposta por BLASDELL (1963) e aceite por vários autores modernos levanta-nos algumas dúvidas, quer por razões de ordem fitogeográfica (o tipo de *P. diaphanum* provém da ilha da Reunião, no Oceano Índico, com flora bem distinta da macaronésica), quer devido a diferenças que encontrámos na ornamentação da parede dos esporos ao compararmos os tipos de ambas as espécies.

De qualquer modo só um estudo mais desenvolvido, abrangendo designadamente a colecção de exemplares colhidos por Mr. F. BADRÉ na ilha da Reunião e que, segundo informação de FRASER-JENKINS, existe no acima referido museu de Paris, poderá esclarecer o problema já com alguma segurança. Propomo-nos fazer este estudo a mais longo prazo, pelo que, por ora, preferimos conservar o epíteto *viridula* para a espécie das Ilhas Canárias.

Apresentamos seguidamente umas chaves simplificadas para identificação das três espécies estudadas e a relação dos exemplares observados.

- 1 Segmentos das folhas com as ramificações das nervuras terminando geralmente nas reentrâncias dos dentes emarginados; esporos densamente muricados 3. *viridula*

- 1 Segmentos das folhas com as ramificações das nervuras geralmente terminando no ápice dos dentes inteiros; esporos frouxamente muricados ou ruminado-granulosos
- 2 Esporos frouxamente muricados; folhas com dentes mais ou menos agudos 1. *fragilis*
- 2 Esporos ruminado-granulosos; folhas com dentes geralmente obtusos, por vezes levemente emarginados 2. *dickiana*

1. *C. fragilis* (L.) Bernh. in Schrader, *Neues Jour. Bot.* 1(2): 27 (1805); Samp. *Man. Fl. Port.* 7 (1909) & ed. 2: 12 (1947); P. Cout., *Fl. Port.* 40 (1913) & ed. 2: 43 (1939); Crabbe in Tutin & al., *Fl. Eur.* 1: 18 (1964); Franco, *Nova Fl. Port.* 1: 27 (1971).

C. filix-fragilis Borbás, *Balaton Tav. Part.* 2: 314 (1900), *nom. illeg.*; Rothm. & P. Silva, *Agron. Lusit.* 1(2): 237 (1939).

Polypodium fragile L., *Sp. Pl.* 2: 1031 (1753); Brot., *Fl. Lusit.* 2: 397 (1804), p. p.

TRAS-OS-MONTES

Bragança, Vila Nova (Assureira), 800 m, xisto, 20-6-1968, P. Silva & A. N. Teles (LISE 67011) + [Macedo de Cavaleiros] Bornes, na estrada Macedo-Moncorvo, c. 750 m, xisto, 26-6-1955, A. Fernandes, J. Matos & A. Matos 5614 (COI; BM) + [Mogadouro] estrada entre a Barragem da Bemposta e a estrada principal, c. 700 m, xisto, 7-4-1963, A. Rozeira, K. Koepp & M. Araújo (PO 7141).

BEIRA ALTA

A 11 km a sul de Lamego [Bigorne, Chão da Cruz], c. 900 m, gr., 11-6-1958, A. & R. Fernandes & J. Matos 6235 (COI).

BEIRA TRANSMONTANA

Guarda: Torrião, c. 1120 m, gr., 2-7-1951, A. Fernandes, F. Sousa & J. Matos 3722 (COI) + [Almeida] Mido, c. 720 m, gr., Jul. 1884, A. R. da Cunha (COI).

2. *C. dickieana* R. Sim, *Gard. Farm. Jour.* 2(20): 308 (1848); Crabbe in Tutin & al., *Fl. Eur.* 1: 18 (1964).

C. fragilis auct. lusit., *p. p.*, non (L.) Bernh. (1805).

TRAS-OS-MONTES

Bragança, pr. Castrelos, marg. esq. do rio Baceiro, 600 m, rochas ultrabásicas, 12-7-1969, A. N. Teles & J. Martins (LISE 68458); monte de S. Bartolomeu, c. 800 m, 21-4-1943, Rozeira & J. Castro (PO 107) + Vimioso: S. Martinho d'Angueira, 700-750 m, [sobre enormes penedos], Jun. 1888, J. de Mariz (COI); Santo Adrião, Ag. 1917, J. A. Henriques (COI) + Miranda do Douro, margens do Douro, c. 500 m, gr., Jun. 1915, R. Palhinha & F. Mendes (LISU P-2135) + Mogadouro, a seguir à ponte sobre o ribeiro do Pontão, 650 m, quartzitos, 18-5-1944, G. Barbosa & F. Garcia 6702 (LISI) + Moncorvo, Roboredo, 800 m, quartzitos, Jun. 1915, R. Palhinha & F. Mendes (LISU P-2134) & 26-5-1925, J. R. dos Santos J.^{or} (PO 3476) + Carrazeda d'Ansiães, berma da estrada, 620-640 m, gr., 21-5-1970, A. Rozeira, D. Barreto, G. Costa & A. Serra (PO 27096); Amedo, c. 650 m, 10-6-1942, Rozeira & J. Castro (PO 108) & 24-5-1970, A. Rozeira, D. Barreto, G. Costa & A. Serra (PO 27097/8); Vilarinho da Castanheira, 750-800 m, gr., 29-5-1925, J. R. dos Santos J.^{or} (PO 3464).

ALTO DOURO

[Peso da Régua] Vilarinho de Freires, 255 m, xisto, exp. N, 24-4-1946, F. Mendonça & J. de Vasconcellos 8429 (LISI) + [Lamego] Parada do Bispo, a jusante da Quinta de Marrocos, 200 m, xisto, exp. N, G. Barbosa, F. Garcia & J. de Vasconcellos 7830 (LISI) + [Tabuaço] Adorigo, 400-500 m, xisto, exp. N, rariss., Mai. 1880, E. Schmitz, *Fl. Lus. n.º 49* (COI); Valença do Douro, 300-350 m, xisto, exp. NW, 6-4-1941, G. Pedro 1407 (LISI).

BEIRA TRANSMONTANA

Trancoso, azenhas da ribeira do Alcaide, 660 m, gr., exp. E, 19-6-1944, G. Barbosa & F. Garcia 7133 (LISI) + [Almeida] Junça, 700-750 m, gr., Jun. 1890, M. Ferreira (COI) + Guarda, Jul. 1885, M. Ferreira (COI); [Faia] Souto do Bispo, c. 750 m, gr., exp. NW, 17-6-1959, A. Fernandes, J. Matos & A. Sarmiento 6699 (COI) +

Manteigas, S. Pedro, a 100 m a E da Fonte de Paulo Luís Martins, c. 1300 m, gr., exp. N, 22-6-1982, *M. L. Rocha Afonso* (LISI); Fonte de Paulo Martins, 1300 m, gr., exp. N, 22-6-1956, *A. Fernandes, J. Matos & A. Santos 6063* (COI); a 1,5 km a NE da Fonte de Paulo Luís Martins, c. 1200 m, gr., exp. NW, 22-6-1982, *M. L. Rocha Afonso* (LISI); Penhas Douradas, 1450 m, gr., 19-6-1953, *A. & R. Fernandes & F. Sousa 4514* (COI); pr. Manteigas, na estrada para o Covão da Ametade, 800-1000 m, gr., 28-6-1966, *J. Matos & A. Dinis 9588* (COI).

BEIRA ALTA

[Seia], below Lagoa Comprida, 1550 m, gr., 7-6-1976, *C. R. Fraser-Jenkins 4914* (BM; LISI).

BEIRA BAIXA

Covilhã: no desvio sob o ramal para Sete Fontes, souto bravo, 850 m, gr., exp. E, 22-6-1982, *M. L. Rocha Afonso* (LISI); rio Zêzere, gr., Jul. 1881, *A. R. da Cunha* (LISU P-2137); prox. da estação de c. f., 530 m, gr., 25-6-1946, *B. Rainha* (LISE 22820).

3. *C. viridula* (Desv.) Desv., *Mém. Soc. Linn. Paris* 6: 264 (1827).

Aspidium viridulum Desv., *Ges. Naturf. Freunde Berlin Mag.* 5: 321 (1811).

Polypodium fragile sensu Brot., *Fl. Lusit.* 2: 397 (1804), *p. max. p.*; non L. (1753).

C. azorica Fée, *Gen. Fil.* 300 (1850/52), *nom. nud.*

C. fragilis auct., non (L.) Bernh. (1805); Samp., *Man. Fl. Port.* 7 (1909) p. p. & ed. 2: 12 (1947) p. p.; Menezes, *Fl. Arch. Madeira* 203 (1914); Palhinha, *Cat. Pl. Vasc. Açores*: 11 n° 42 (1966).

C. fragilis subsp. *diaphana* (Bory) Litard., *Bull. Géogr. Bot. (Le Mans)* 21: 20 (1911), quoad syn. & specim.; exclud. basion.

C. fragilis (L.) Bernh. var. *diaphana* sensu P. Cout., *Fl. Port.* 40 (1913) & ed. 2: 43 (1939), non *Polypodium diaphanum* Bory (1804).

C. diaphana auct., non (Bory) Blasdel (1963); Vida, *Acta Bot. Acad. Sci. Hung.* 20(1/2): 181 (1974); Fraser-Jenkins, *Willdenowia* 10: 230 (1980); Greuter, Burdet & Long, *Med-Checklist I. Pterid.* 052-90-380-28 (1981).

MINHO

Melgaço, nas muralhas, 165 m, gr., Jun. 1885, *A. R. da Cunha* (LISE 10008) & 28-4-1971, *D. Barreto, G. Costa & A. Serra* (PO 27102) + [Monção] Ponte do Mouro, Azenha do Campo, 20 m, gr., Jun. 1885, *A. R. da Cunha* (COI; LISU P-2142) + Viana do Castelo: Areosa, nos muros, gr., quase ao nível do mar, Jun. 1886, *A. R. da Cunha* (LISU P-2144; LISE 10007); pinhal de Santa Luzia, 150 m, gr., Jun. 1886, *A. R. da Cunha* (LISU P-2143); Darque, margem do Lima, na fonte, 5 m, gr., Jun. 1886, *A. R. da Cunha* (LISU P-2145; LISE 10009); Anha, lugar de Valada, c. 35 m, gr., 12-12-1967, *A. A. Mendes* (LISI) + [Terras de Bouro] Serra do Gerês, gr., Jun. 1885, *B. de Mello* (COI) & 15-5-1944, *J. G. Garcia & F. Murta* (COI); Caldas do Gerês, c. 350 m, gr., 9-7-1948, *R. Fernandes & F. Sousa 2677* (COI) + Braga: Monte do Crasto, gr., Ag. 1883, *A. Sequeira* (COI); Real, 80 m, gr., s/ data, *Jeronymo* (COI) + Póvoa de Lanhoso, 200 m, gr., Fev. 1882, *B. F. de Mello* (COI); Frades, 320 m, gr., Set. 1907, *G. Sampaio* (PO G. S. 109/10).

TRAS-OS-MONTES

Chaves, Samaiões, Quinta do Nóbrega, c. 500 m, xisto, 21-9-1966, *J. de Vasconcellos* (LISI) + Boticas, Covas de Barroso, 610 m, gr., 1-9-1968, *J. de Vasconcellos* (LISI) + [Vila Pouca d'Aguiar] Bornes, 620 m, gr., Set. 1886, *D. Sophia R. da Silva* (COI) + [Murça] entre Pópulo e Vila Chã, aos Combros, 700 m, gr., *G. Barbosa & F. Garcia 7343*, 11-10-1944 (LISI) + Vila Real, rio Sordo, 440 m, gr., 12-6-1958, *A. & R. Fernandes & J. Matos 6256* (COI) + Torre de Moncorvo, Cardenha, Quinta do Capitão, 200 m, gr., 18-6-1941, *G. Pedro 1660* (LISI); Felgar, 550-600 m, Mai. 1887, *J. de Mariz* (COI); Souto da Velha, 550-600 m, Mai. 1887, *J. de Mariz* (COI; LISU P-2122) + Vimioso, S.^{to} Adrião, Ag. 1917, *J. Henriques* (COI).

DOURO LITORAL

Fafe, Armil, 240 m, gr., 12-7-1942, *A. de B. Carneiro 208* (COI; PO 3761/2) + Matosinhos: Guifões, Regedoura, c. 50 m, gr., 17-6-

-1955, *J. Castro & G. Costa* (PO 7006); Guifões, 70 m, gr., 12-5-1961, *G. Costa & M. Araújo* (PO 27012); lanes S. Gens, near Leça road, 100 m, gr., *E. Johnston* (PO 2845); margens do Leça, 5 m, gr., 1-2-1950, *J. Castro* (PO 5135); Moalde, c. 100 m, gr., 8-4-1972, *A. Serra & J. Araújo* (PO 27102) + Marco de Canavezes, Vila Boa de Quires, Lage, 250 m, gr., 11-10-1970, *G. Costa* (PO 27101) + + Amarante, 100 m, gr., Ag. 1902, *G. Sampaio* (PO G. S. 108) + + Environs de Porto, c. 100 m, gr., s/data, *Schmitz, Herb° Dr. A. de Carvalho 2087* (COI); arr. Porto, 100 m, 18-8-1889, *E. Johnston* (PO 2844) + [Gondomar] Fânzeres, c. 100 m, gr., s/ data, *A. Luzo 48* (COI) + Vila Nova de Gaia: pr. ao Areinho, 10 m, gr., 17-6-1963, *G. Costa* (PO 7142); Sá, 20 m, gr., 30-7-1965, *G. Costa* (PO 7143); Oliveira do Douro, 60 m, gr., s/ data n/ col. (PO 27011).

BEIRA LITORAL

Ovar, Madria, 15 m, 28-9-1958, *Martins d'Alte & G. Costa* (PO 7142) + Vale de Cambra: Barragem Eng.º Duarte Pacheco, 350 m, gr., 22-11-1978, *A. Marques* (AVEIRO 1047; LISI); descida da Serra da Freita para norte, c. 300 m, gr., 18-4-1979, *A. Marques* (AVEIRO 1129; LISI) + Sever do Vouga, Rocas do Vouga, arr. Nespereira, subida da Serra do Arestal, c. 500 m, gr., 10-3-1980, *A. Marques* (AVEIRO 1638; LISI) + [Mealhada] Buçaco, 350-450 m, quartzitos: Jul. 1850, *Welwitsch* (LISU P-2125); s/ data, *J. Fernandes* (COI) & 23-5-1967, *J. Matos & M. C. Alves* s/ n.º (COI) + + Coimbra: Lordemão, 130 m, arenitos, Mar. 1878, *M. Ferreira* (COI) & Mai. 1888, *A. Moller* (COI; LISU P-1695); Dianteiro (Valbom), c. 300 m, xisto, 20-7-1948, *M. Silva* (LISE 24662); Pinhal de Valle de Cannas, 200 m, Mar. 1879, *A. Moller* (COI) + Lousã, Senhora da Piedade, 300 m, quartzitos, 8-3-1966, *A. Reis Moreira 342* (COI).

BEIRA ALTA

Castro Daire: a 6 km de Castro Daire para Pepim, 600 m, gr., 22-6-1955, *A. Fernandes, J. Matos & A. Matos 5347* (COI) + + Viseu, ribeiro de Santiago, gr., 3-8-1934, *J. Castro* (PO 4035); prox. Torredeita, c. 435 m, gr., 29-7-1961, *B. Rainha* (LISE 65757) + + Caramulo, 1-8-1944, *J. Castro* (PO 4283) + Santa Comba Dão, Tapada, 200-250 m, gr., 14-6-1954, *J. Matos, A. Matos & A. Marques 4938* (COI) + Fornos d'Algodres, Villa Chã, 550 m, gr., exp.

SSW, Ag. 1892, *M. Ferreira* (COI) + Gouveia: Nespereira, 500 m, gr., 28-6-1955, *A. Fernandes, J. Matos & A. Matos 5700* (COI; BM); Paços da Serra, 530 m, gr., 1-4-1980, *A. Marques* (AVEIRO 1753; LISI) + Seia: prox. do Hospital, Fonte do Marrão, c. 520 m, gr., 8-5-1961, *J. Matos, F. Cardoso & A. Matos 7869* (COI); estrada Seia-Paços da Serra, Santa Marinha, 510 m, gr., 23-5-1979, *A. Marques* (AVEIRO 1239; LISI); S. Romão, Ponte de Jogaes, 550 m, gr., Jul. 1894, *M. Ferreira* (COI); Central Hidroeléctrica de N.^a S.^{ra} do Desterro, 815 m, gr., 29-3-1970, *M. L. Caixinhas* (LISI); a 10 km de S. Romão para Loriga, junto a uma cascata [Sazes da Beira, Quinta], c. 700 m, gr., exp. WSW, 18-11-1975, *M. F. Correia & J. Cardoso* (COI; LISU P-69439) + Loriga, à ribeira, 700 m, gr.: 28-12-1967, *A. Rozeira, G. Costa & J. Araújo* (PO 27013) & 18-7-1979, *A. Marques* (AVEIRO 1239; LISI) + Oliveira do Hospital, Travanca de Lagos, c. 380 m, gr., 20-8-1958, *M. M. da Fonseca* (LISI).

BEIRA TRANSMONTANA

[Figueira de Castelo Rodrigo] Mata de Lobos, ribeira da Navarra, 420 m, gr., exp. NE, 13-4-1944, *F. Garcia & J. Pedrógão 6320* (LISI) + Arr. Castelo Bom, 650 m, gr., Jul. 1884, *A. R. da Cunha* (LISU P-2132) + Guarda, Ag. 1881, *J. Daveau* (COI; LISU P-2117); Torreão, gr., 25-7-1950, *A. Fernandes & J. Matos 3515* (COI); Pero Soares, 600 m, gr., Jul. 1885, *M. Ferreira* (COI); pr. Videmonte, c. 950 m, gr., 18-9-1954, *A. Fernandes, J. Matos & A. Matos 5169* (COI); Portelas, pr. Seixo Amarelo, 850-1000 m, gr., 17-6-1953, *A. & R. Fernandes & F. Sousa 4425* (COI) + Mantegias: abas da Serra da Estrela, c. 750 m, Jul. 1881, *A. R. da Cunha* (LISU P-2120) & Ag. 1881, *J. Daveau* (LISU P-2118).

BEIRA BAIXA

[Fundão] arr. Alcongosta, c. 630 m, gr., 21-6-1953, *A. & R. Fernandes & F. Sousa 4585* (COI); Alpedrinha, Pucarinha, 580 m, Jun. 1882, *A. R. da Cunha* (LISU P-2139) + Serra da Pampilhosa, xisto, Set. 1887, *J. Henriques* (COI); ca. 14,5 km do ramal para Álvaro, 730 m, xisto, 8-6-1962, *A. & R. Fernandes & J. Matos 8531* (COI) + Idanha-a-Nova: Monsanto, c. 650 m, gr., 18-6-1948, *B. Rainha* (LISE 24547); Idanha-a-Nova, rio Ponsul, c. 200 m, gr., Jul. 1883, *A. R. da Cunha* (LISU P-2131) + [Sertã] Ponte da Bairrada,

margem esq.^a do rio Zêzere, 130-150 m, gr., 21-6-1947, *F. Fontes & B. Rainha* (LISE 23580).

RIBATEJO

[Alcanena] Serra d'Aire acima de Minde, 350-400 m, 25-4-1939, *P. Silva* (LISE 5647).

ESTREMADURA

Mafra, 228 m, rariss., s/ data, *E. da Veiga* (COI); páteo do Convento, Set. 1885, *J. M. Z. d'Oliv^o Simões, Soc. Brot. 6^o anno n^o 740* (BM; COI; LISI; LISU P-2111 & P-2133; PO 107 G. S.) + Sintra: gr., Mar.-Mai., *Welwitsch* (LISU P-2124 p. p.), 1880, *H. de Mendia* (COI), estio de 1880, *P. Coutinho 35* (LISU P-2110), Mai. 1881, *J. Batalha Reis* (LISI); Parque da Pena, Lago dos Peixes, 440 m, gr., 8-7-1982, *M. L. Rocha Afonso* (LISI); Quinta da Regaleira, c. 230 m, gr., exp. N, 22-11-1839, *Valorado* (COI) & Mar. 1847, *Welwitsch* (LISU P-2127 p. p. & P-2128 p. p.); Quinta do Pombal, 160-180 m, gr., 27-5-1949, *B. Rainha* (LISE 39305); prox. Monserrate, 150-170 m, gr., Mar., *Welwitsch* (LISU P-2124 p. p.); Quinta de Monserrate, 150-170 m, gr., 3-1-1945, *B. Rainha* (LISE 8855); [Colares] Quinta da Cruz, 250 m, Mar. 1847, *Welwitsch* (LISU P-2127 p. p. & P-2128 p. p.); pr. dos Capuchos, gr., 2-1-1945, *B. Rainha* (LISE 8849); Almoçageme, Quinta do Alto, 2-1-1945, *B. Rainha* (LISE 8847).

ALTO ALENTEJO

Arr. Castelo de Vide, 500-600 m, gr., Jun. 1914, *M. Ferreira* (COI); caminho do Regal, 9-8-1970, *A. Rozeira, G. Costa & A. Serra* (PO 27101) + Marvão, Quinta Nova, 670-680 m, gr., Jun. 1882, *A. R. da Cunha* (LISU P-2129) + Portalegre, Tapada do Carteiro [= Carreteiro], 350-400 m, gr., Jun. 1882, *A. R. da Cunha* (LISU P-2130).

ALGARVE

Monchique, 450 m, sienitos nefel., Jun. 1887, *A. Moller* (COI); Picota, c. 700 m, sienitos nefel., Jun. 1887, *J. d'Ascensão Guimarães* (LISU P-498).

AÇORES

Azores, 1842, *H. C. Watson* (K); s/ data, *Th. C. Hunt* (K).

FLORES: Boca da Baleia, 350 m, 21-5-1965, *Botelho Gonçalves* 1908 (LISI).

FAIAL: Cedros, no baldio, 700 m, 20-8-1864, *Botelho Gonçalves* 1814 (LISI); Fundo da Caldeira, 500 m: 1842, *H. C. Watson* 321.2 (K); 10-6-1964, *Botelho Gonçalves* 1539 (LISI) & Ag. 1970, *H. Paveia* (LISU P-69086).

S. JORGE: Grota do Pico da Esperança, 21-8-1938, *Gonçalves da Cunha & Sobrinho* (LISU P-43638/9); Velas, estrada da Fajã do Ouvidor, 250 m, 6-9-1971, *Botelho Gonçalves* 3570 (LISI).

PICO: Pico, Jun. 1842, *H. C. Watson* 321.1 (K); s/ data, *H. C. Watson* (K); Madalena, Furna, 1200 m, 7-5-1965, *Botelho Gonçalves* 1873 (LISI).

TERCEIRA: Angra do Heroísmo, Pico da Bagacina, 530 m, 18-9-1973, *Botelho Gonçalves* 5398 (LISI).

S. MIGUEL: St Michael, 1865, *F. D. Godman* (K); Lagoa, *B. T. Carreiro* (COI); Furnas, 15-9-1938, *Gonçalves da Cunha & Sobrinho* (LISU P-43640/1).

MADEIRA

Madeira: s/ data n/ coll. (K; LISU P-41087); s/ data, *Dr Lindley* (K); s/ data, *Dr Welwitsch* (LISU P-41093); s/ data, *C. Roma Machado* (LISU P-41091); Jul. 1852: Rocks, *J. Mac Gillivray* 117 & wet rocks, *J. Mac Gillivray* 118 (K) + lugares húmidos no Monte, s/ data n/ coll. (LISU P-41089/90) + prox. Ribeiro Frio, s/ data, *B. de Castello de Paiva* (LISU P-41092) & Nov. 1941, *J. M. Carvalho* (LISE) + Ribeiro d'...ta, at the bottom of the torrent, 8-11-1827, *R. T. Lowe* (K) + about the Valle, 26-1-1832, *R. T. Lowe* (K) + Damp places, sides of streams and everywhere very common nearly always, 25-5-1922, *Miss A. M. Park* (K) + S. Vicente, Jun. 1850, *R. T. Lowe* (K) + Pico el Alto, 30-12-1859, *R. T. Lowe* (K) + Faial, Abr. 1868, *J. M. Moniz* (LISI) + Caldeirão Verde, Santana, Nov. 1941, *J. M. Carvalho* (LISI); Levada do Caldeirão Velho, 900 m, 3-5-1949, *C. Romariz* 633/42 (LISU P-41084) + Rabaçal, 900 m, 30-4-1949, *C. Romariz* 623/41 (LISU P-41088) + Ribeira de Santa Luzia passada a Ponte Funda, 19-5-1951: 300 m, *C. Romariz*, 705/1008 (LISU P-41083) & 350 m, *C. Romariz* 705/1001 (LISU P-41086 & P-64735) + Levada do Bom Sucesso, 280 m, 22-5-1951,

[*C. Romariz*] 709/1014 (LISU P-41085) + Machico, Porto da Cruz, Abr. 1968, *J. Marnier Lapostolle* 3, 8 & 15 (LISI).

CANARIAS

PALMA: in humidis umbrosis, s/ data, *B. de Castello de Paiva* (LISU).

GOMERA: La cumbrecita, on the northern slope in a humid forest, 850 m, 22-9-1924, *H. Czeczdtt* (K).

TENERIFE: ad muros inter Mataura et Laguna, *B. do Castello de Paiva* (LISU); Barranco de Montijo, 1861, *G. Mann* (K) + Barranco de Castro, 1884, *Christ* (K) + in umbrosis udis, 1845, *E. Bourgeau Pl. canar. n° 226* (K) + Barranco Rio, 1300-2000', Jun. 1903, *Th. J. Dinn 250* (K) + Agua Manza, 20-1-1921, *Dr F. Bøorgsen* (K) + Agua Garcia, in wood at bottom of ravine, s/ data, *T. A. Sprague & J. Hutchinson 86* (K).

GRAN CANARIA: In umbrosis in I. Grã Canaria, s/ data, *B. do Castello de Paiva* (LISU).

Antes de terminar, não queremos deixar de agradecer as sugestões e esclarecimentos que amavelmente nos foram dados, quer pelo Prof. Doutor J. DO AMARAL FRANCO, do Instituto Superior de Agronomia, quer pelos botânicos do British Museum (Natural History), Londres, A. C. JERMY e C. R. FRASER-JENKINS. Igualmente agradecemos ao Prof. Doutor M. TELLES ANTUNES ter-nos facultado o acesso ao microscópio de varrimento da Universidade Nova de Lisboa, e ao Doutor JOÃO CARDOSO PAIS toda a boa vontade com que sempre se prestou a colaborar na utilização deste microscópio.

Seguem-se, em páginas próprias, fotografias de alguns dos esporos por nós observados e escolhidas de modo a darem uma representação geográfica das áreas das espécies estudadas.

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BLASDELL, M. F.

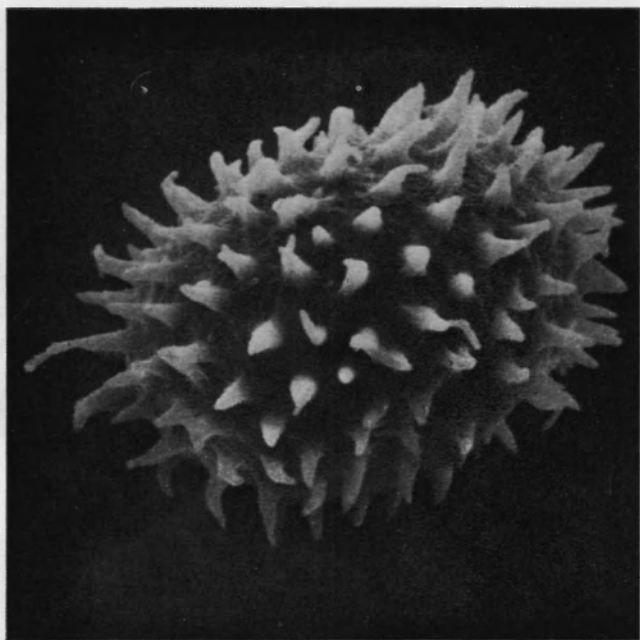
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BORY DE ST VINCENT

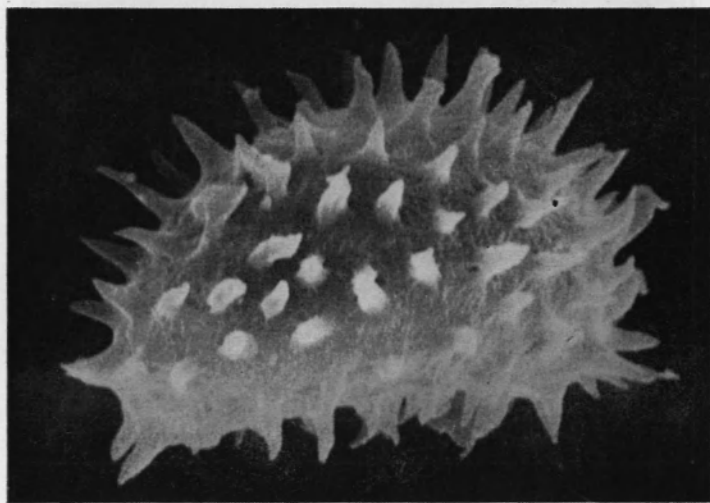
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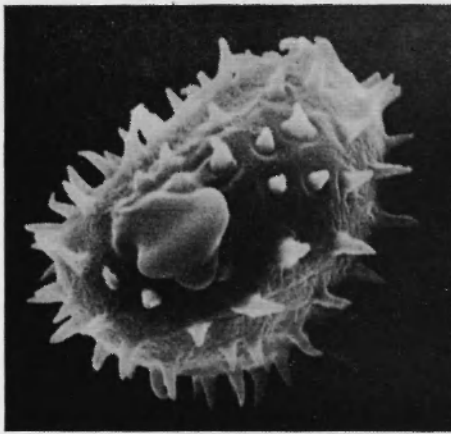


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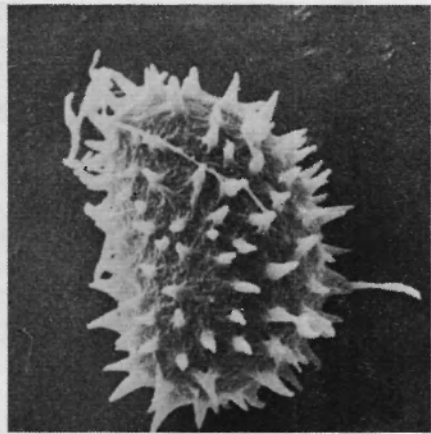
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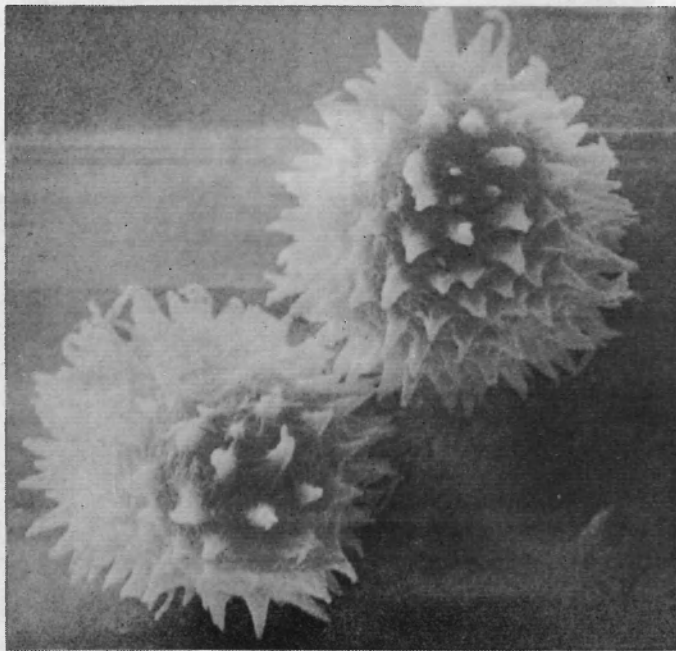




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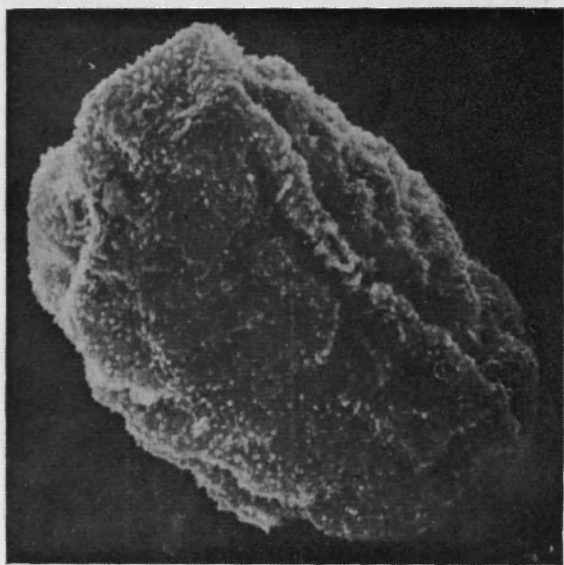


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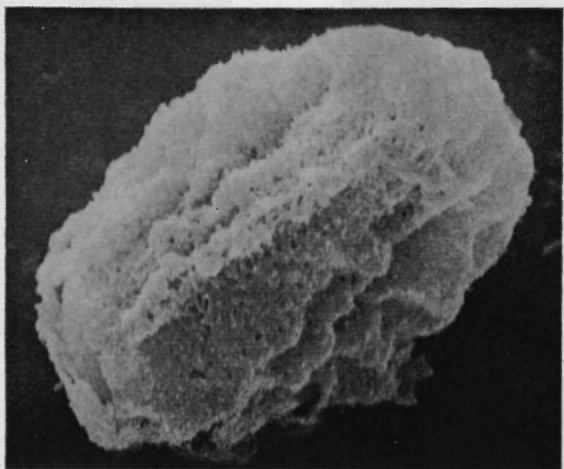
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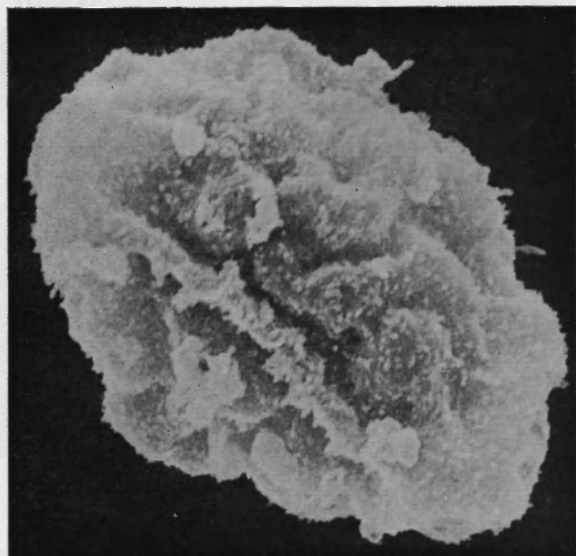


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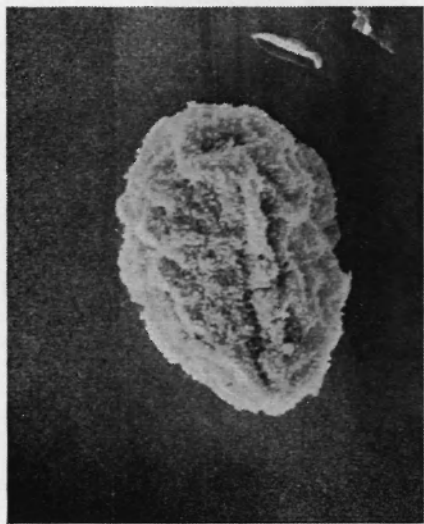
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Fig. 2. — *C. dickieana*: espora ($\times 1750$). Vimioso,
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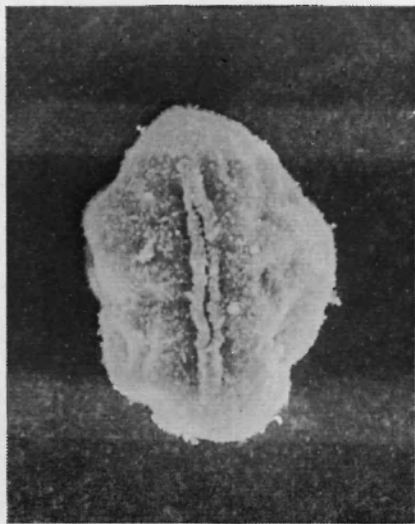




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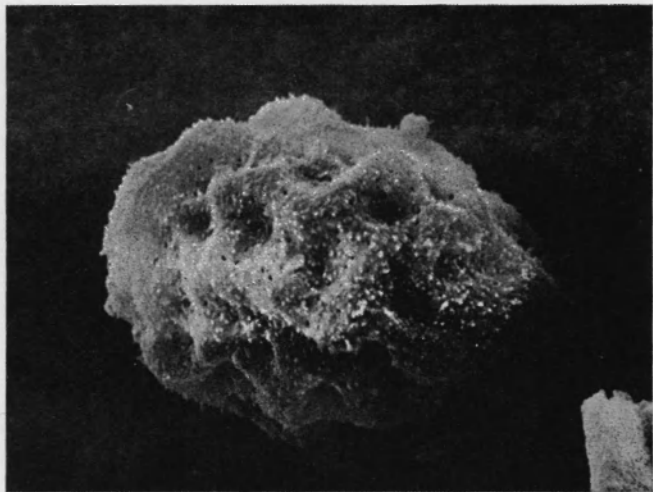


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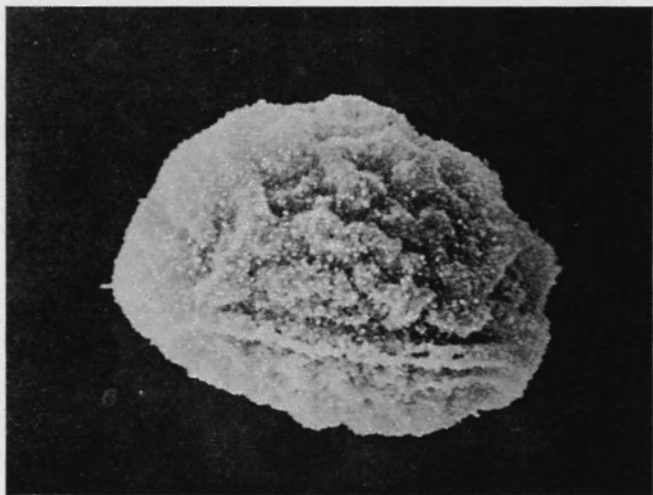
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Fig. 3. — *C. dickieana*: esporo ($\times 1050$). Valença do Douro, LISI 1407.



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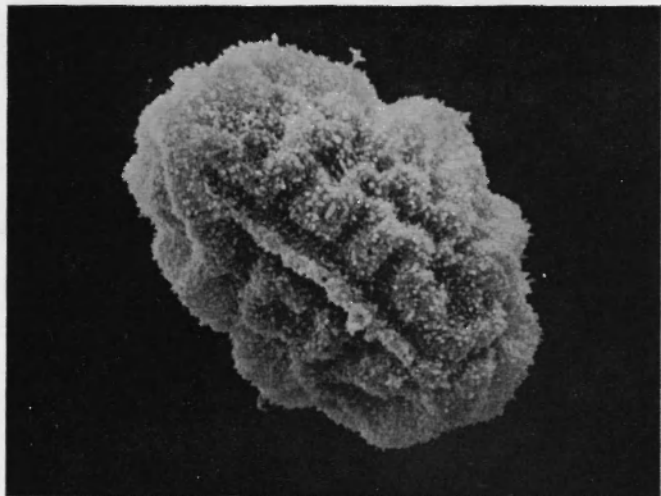


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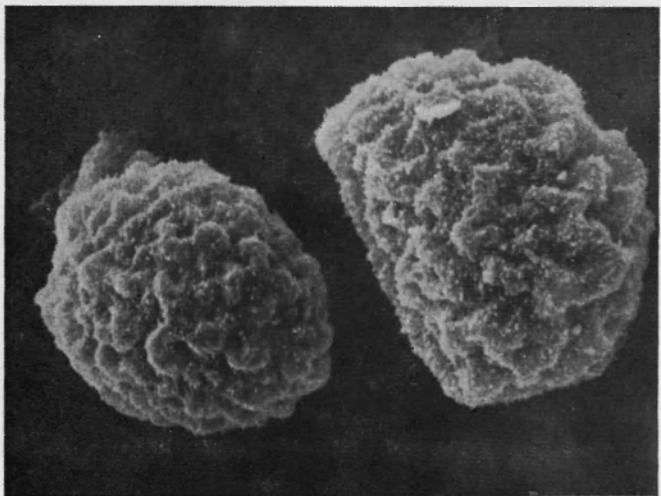
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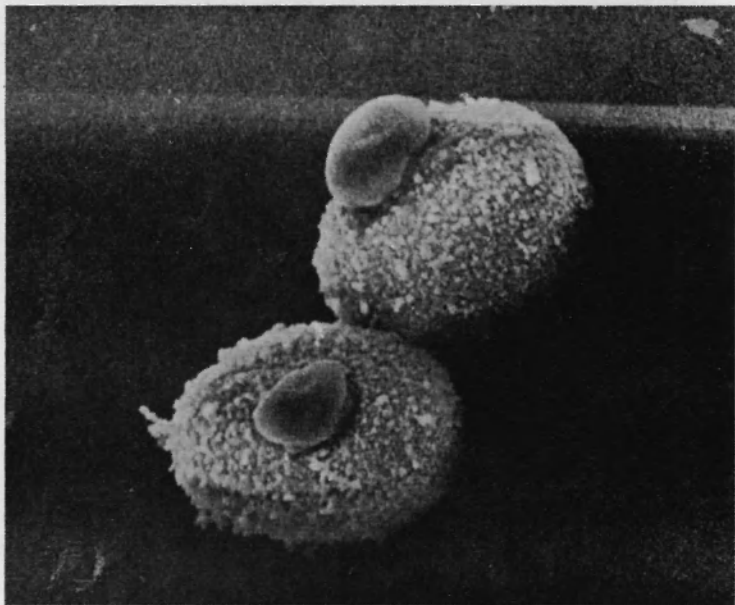
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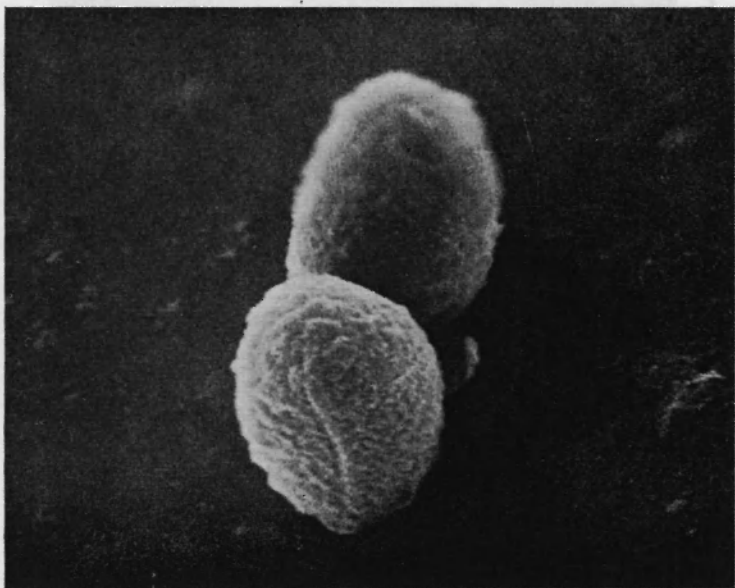
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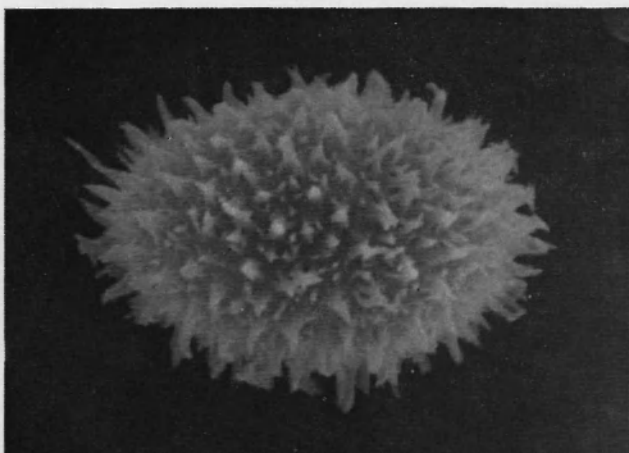
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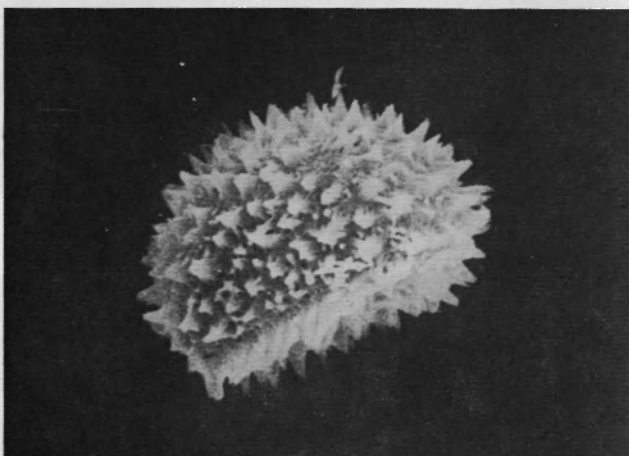
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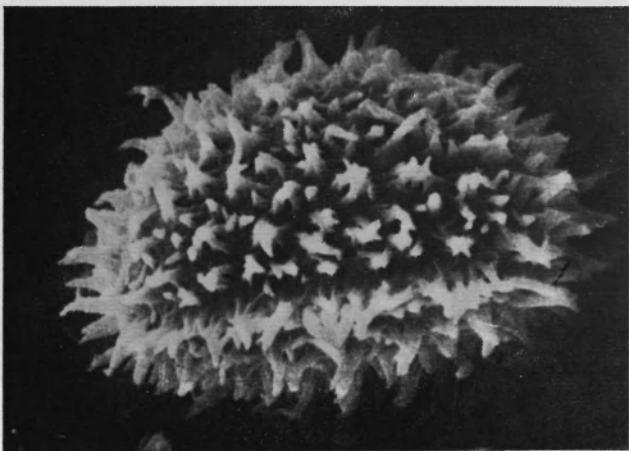
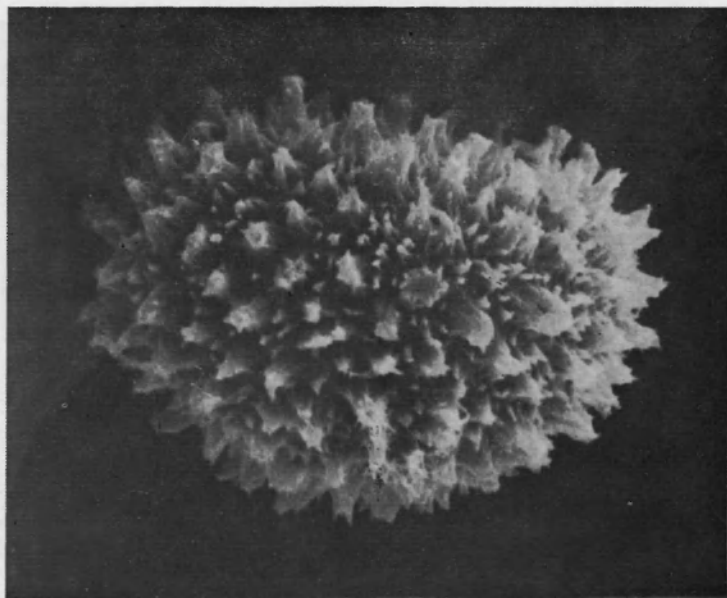


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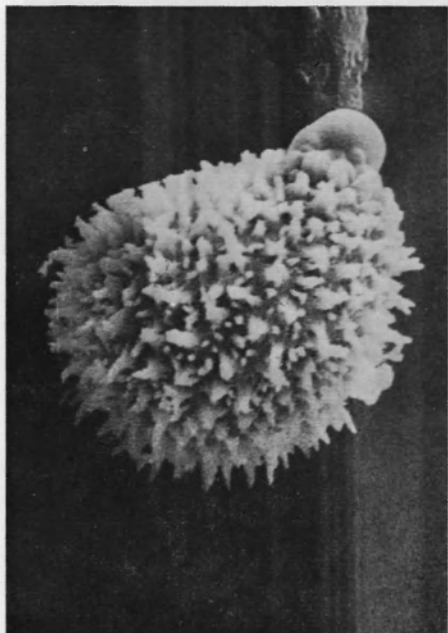
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Fig. 3. — *C. viridula*: esporo ($\times 1700$). Vila Real, rio Sordo, COI 6256.



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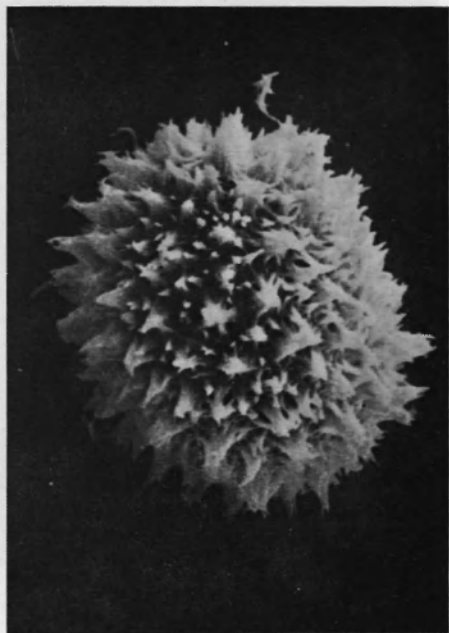
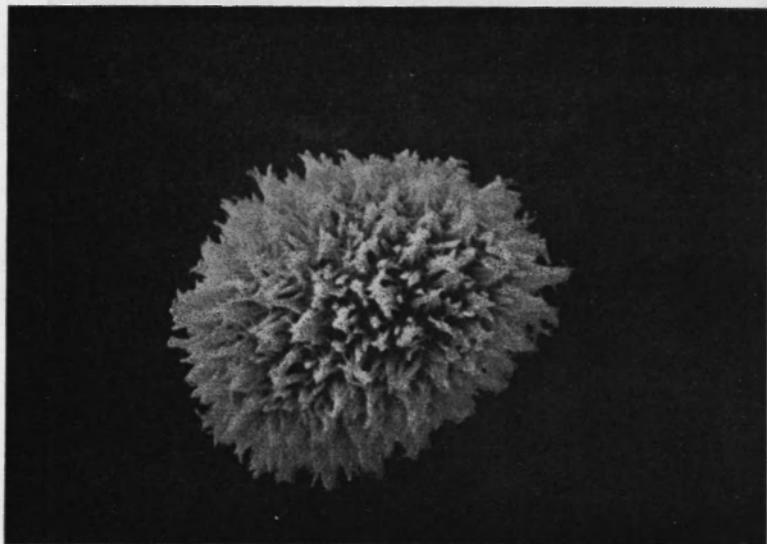
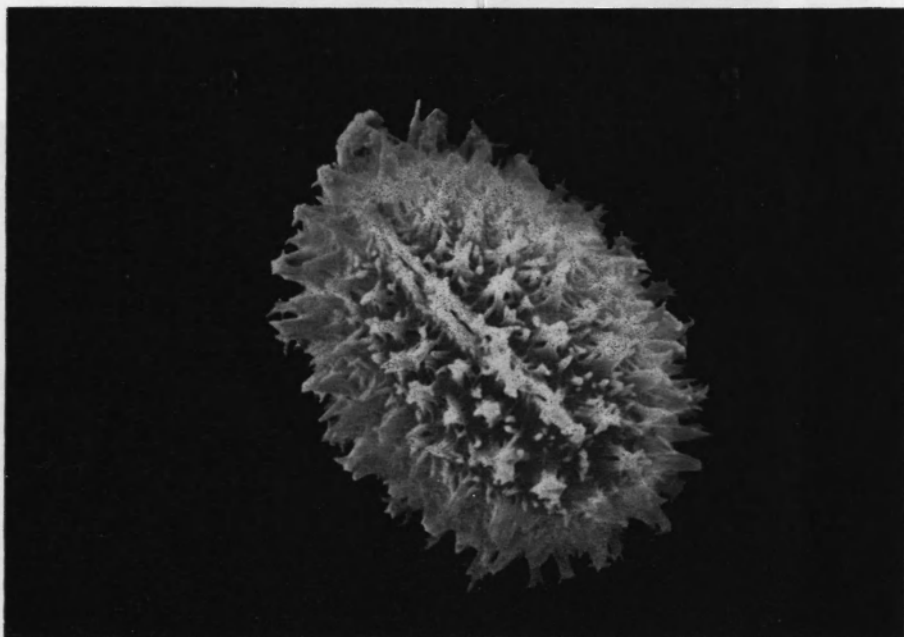


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 Fig. 2. — *C. viridula*: esporo ($\times 1150$). Portelas, pr. Seixo Amarelo, COI 4425.
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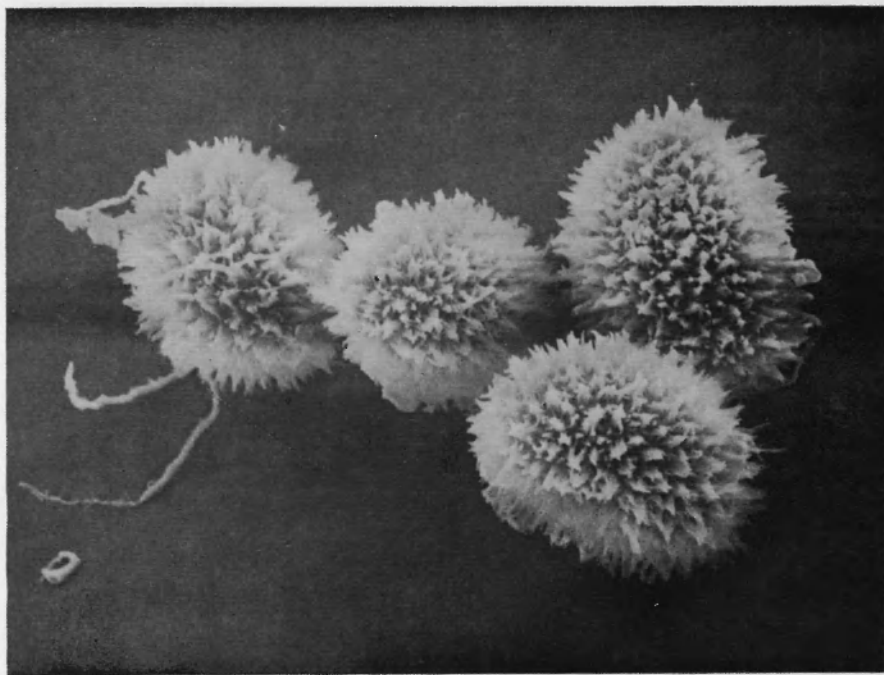
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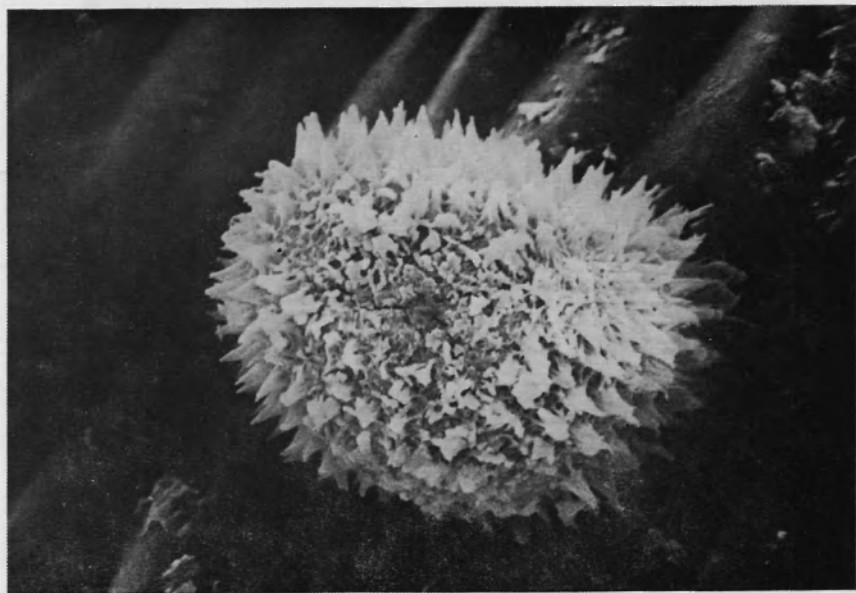
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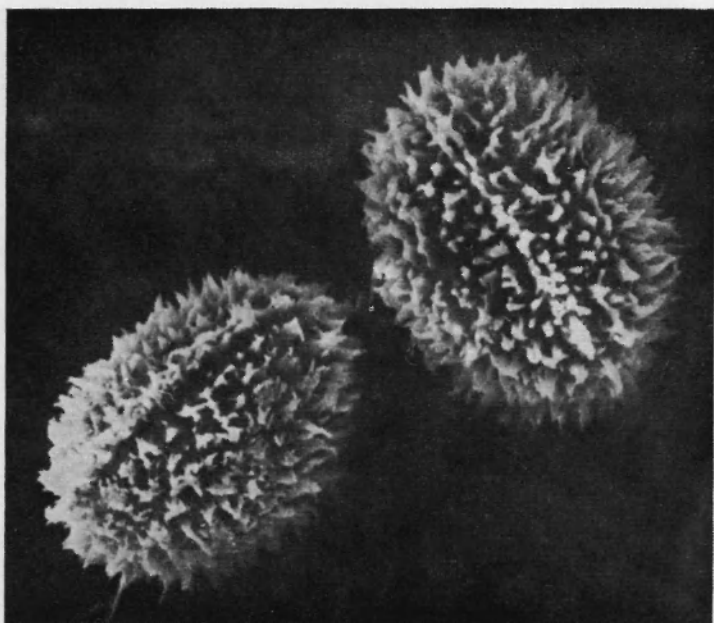


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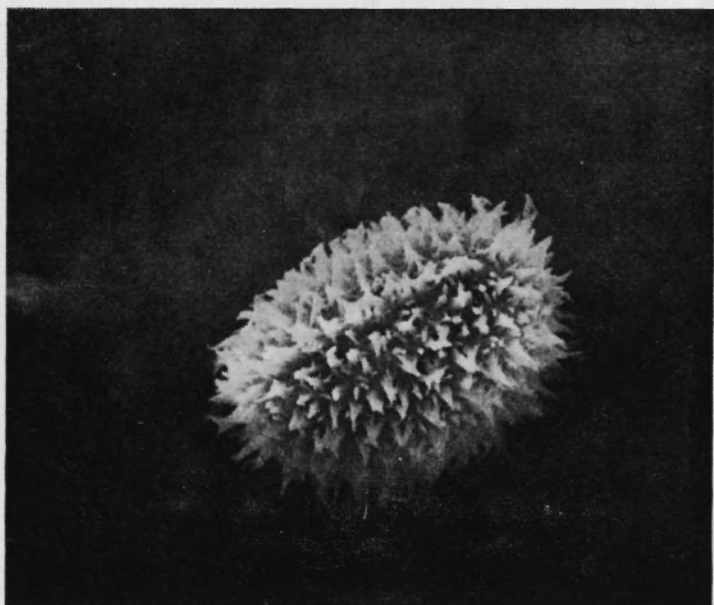
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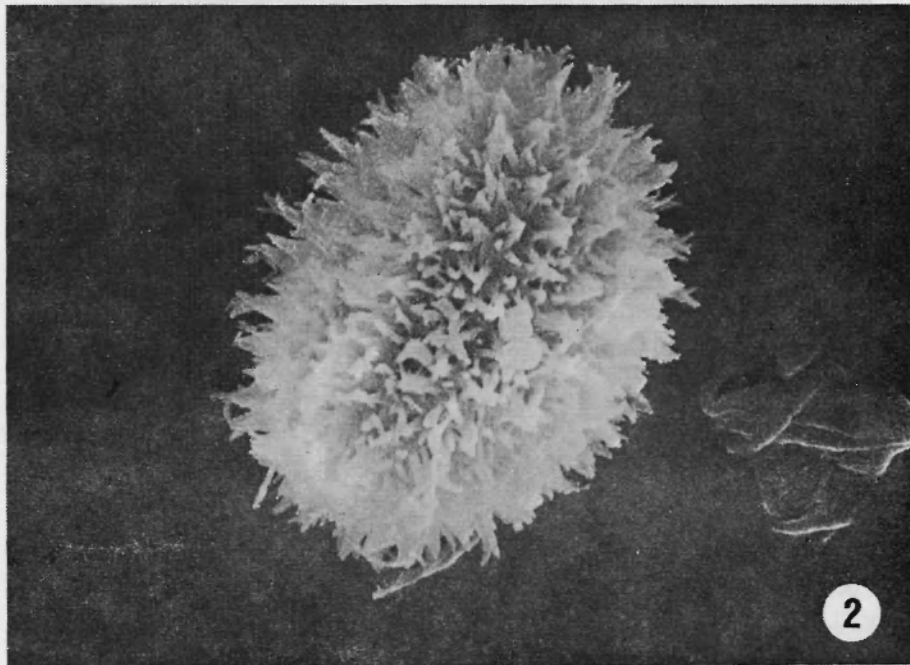
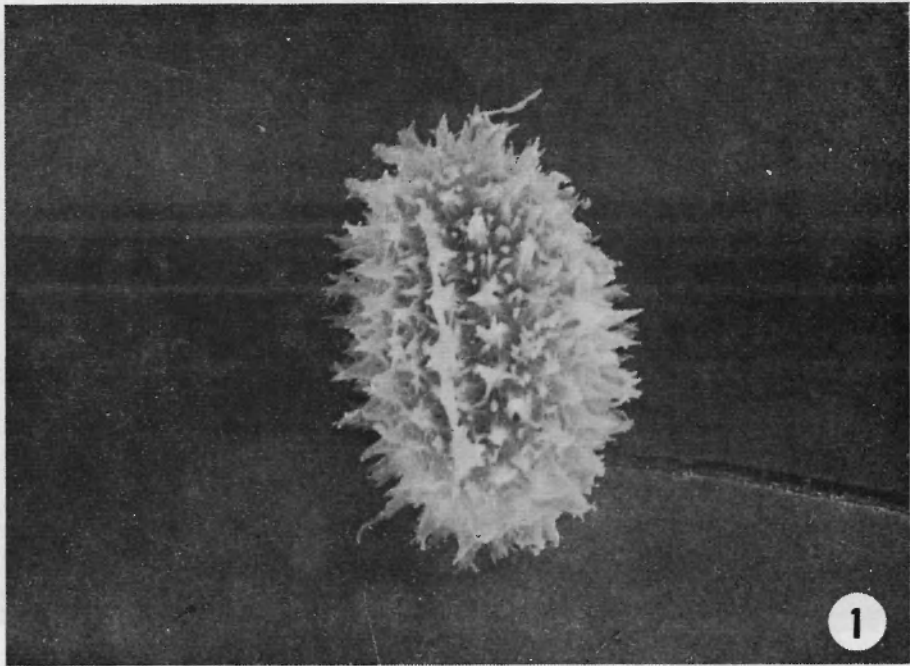
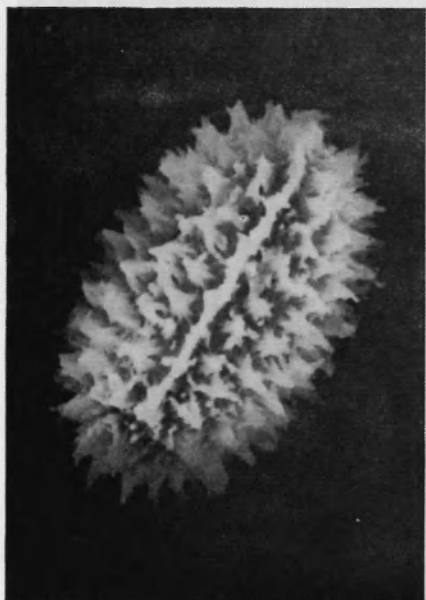


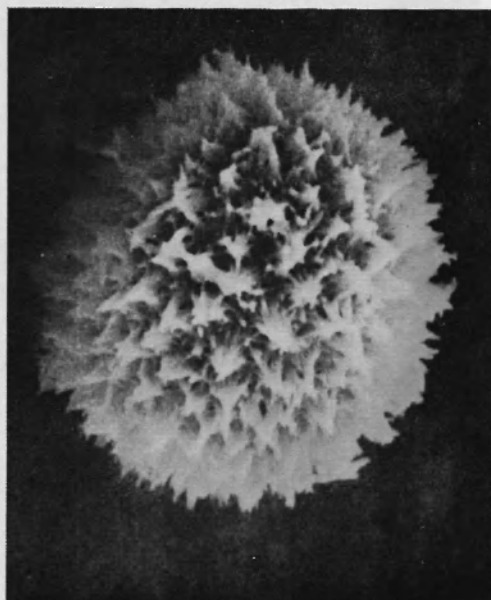
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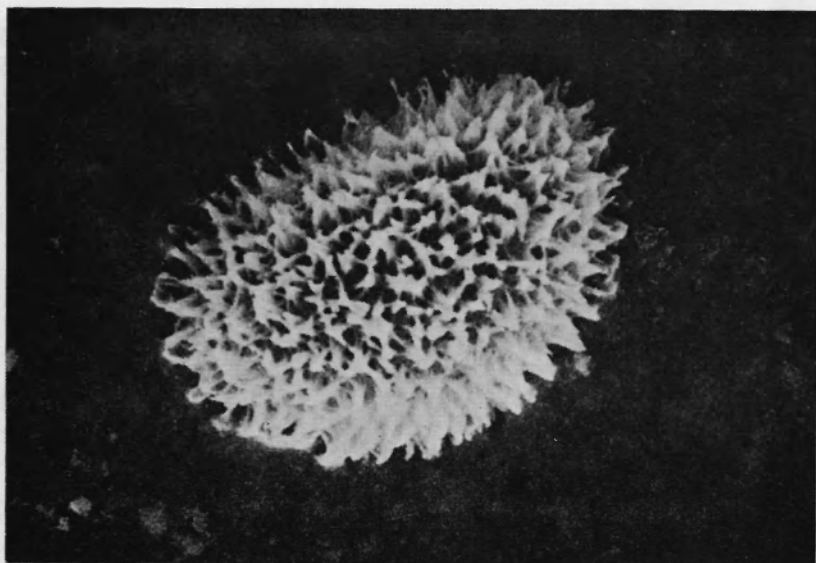




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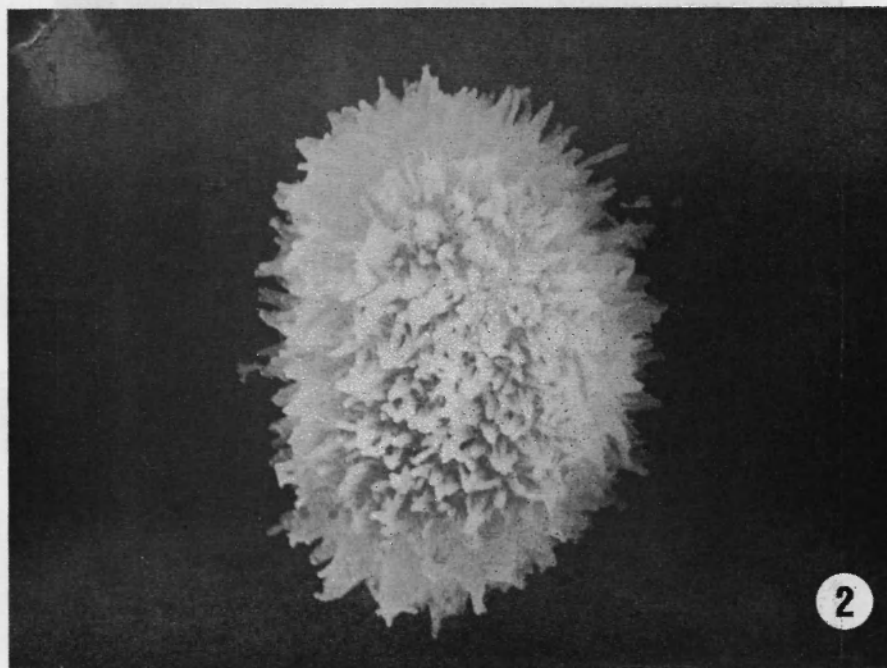


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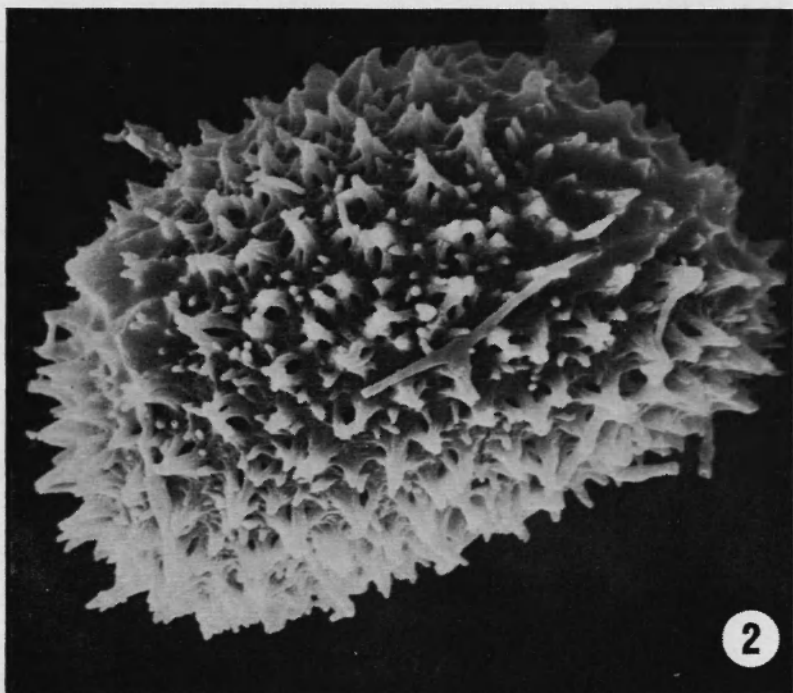
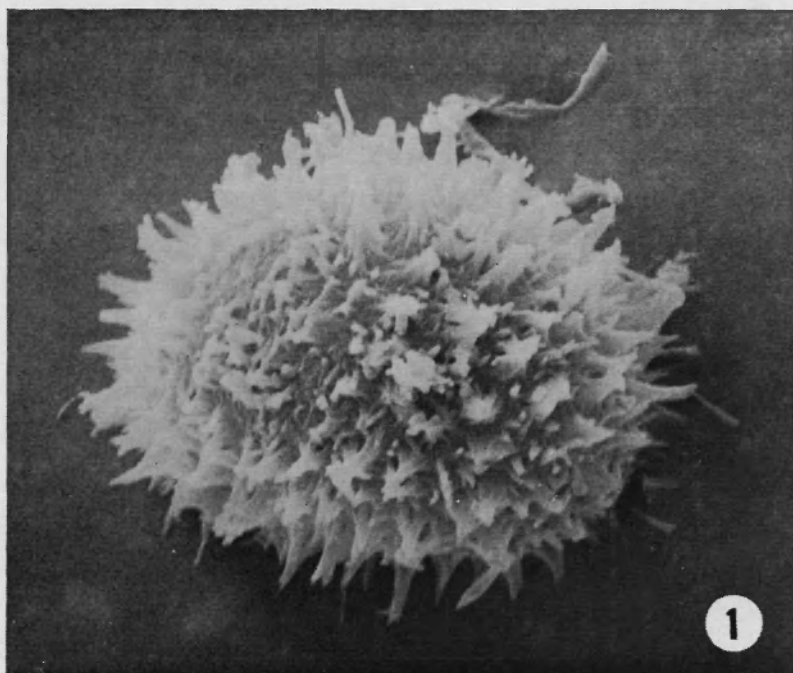


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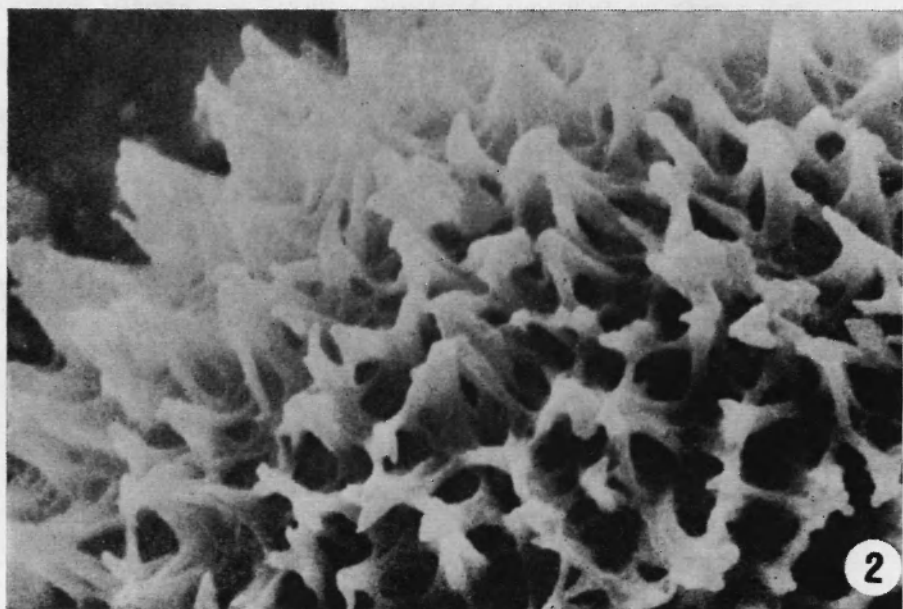
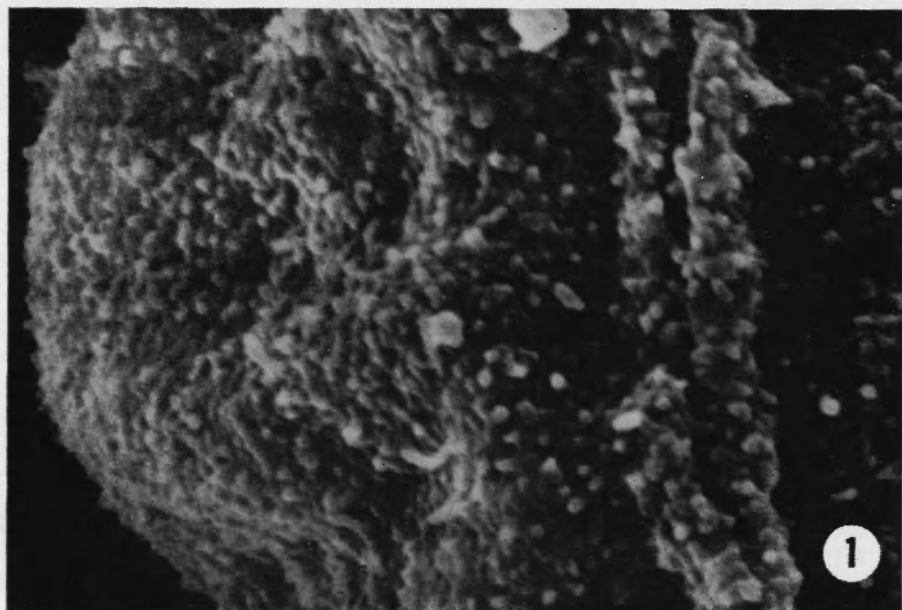
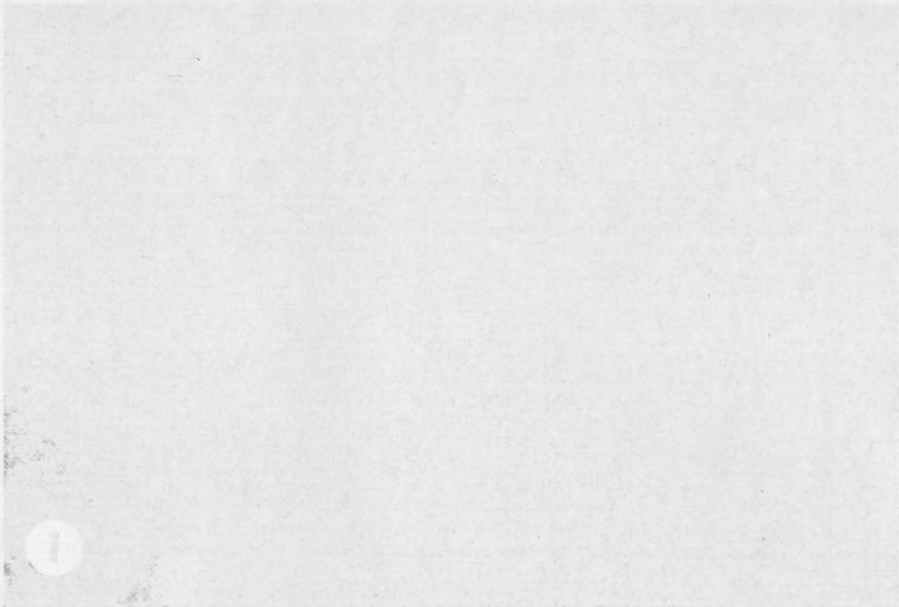
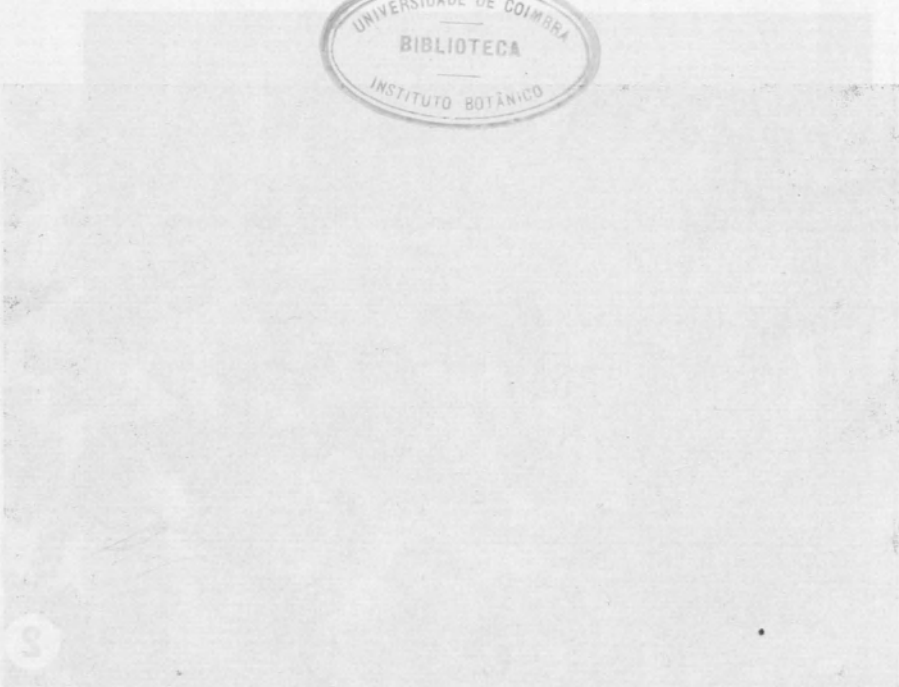


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INSTRUÇÕES AOS COLABORADORES

1. O *Boletim da Sociedade Broteriana* é uma revista destinada à publicação de artigos originais em todos os domínios da Botânica. No entanto, artigos muito extensos sobre florística, fitogeografia e fitossociologia são publicados geralmente nas *Memórias*, enquanto que os trabalhos de divulgação científica e os referentes à história da Botânica são reservados para o *Anuário* — as duas outras revistas da Sociedade.

2. Destinado principalmente à publicação dos artigos elaborados pelo pessoal científico do Instituto Botânico de Coimbra, nele se inserem todavia trabalhos da autoria de membros da Sociedade, bem como os de outros investigadores, quer portugueses, quer de outras nacionalidades. A publicação de qualquer artigo, porém, está na dependência da aprovação da Comissão Redactorial.

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6. Les figures du texte, en général des dessins à l'encre de Chine, ne doivent pas, avec les légendes, dépasser $10,5 \times 18$ cm. Les planches hors-texte ne devront pas dépasser 13×18 cm. Les figures à petites dimensions doivent être réunies dans des plaques aux dimensions ci-dessus mentionnées.

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BOLETIM
DA
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VOLUME LV — 2.ª SÉRIE

1981-82

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