

THE MACARONESIAN REPRESENTATIVES OF THE *ASPENIUM*
AETHIOPICUM COMPLEX (ASPENIACEAE, PTERIDOPHYTA):
A. AETHIOPICUM SUBSP. *BRAITHWAITII*, SUBSP. NOV., AND *A.*
FILARE SUBSP. *CANARIENSE*, COMB. ET STAT. NOV.

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With 4 Figures

ABSTRACT: Earlier cytological studies of *Asplenium aethiopicum* complex from the Macaronesian Islands have shown that the Madeiran representatives are sexual dodecaploids while the Canarian ones are apomictic hexaploids. The results of a previous morphological study of rhizome scales, fronds, abaxial epidermal cells and spores have shown that two taxonomic entities occur in those islands. The apomictic hexaploids are found in the Canarian islands of La Palma, Hierro and Tenerife, while the sexual dodecaploids are found in the islands of Madeira and La Palma, as well as in the islands of Santo Antão, São Vicente, São Nicolau, Santiago and Fogo, all of which from the Cape Verde Islands. The former are considered to belong to *A. filare* subsp. *canariense*, while the latter are referred to *A. aethiopicum* subsp. *braithwaitii*, a Latin diagnosis of which is presented.

RESUMO: Estudos citotaxonómicos efectuados por diversos autores em plantas do complexo *Asplenium aethiopicum* revelaram que as da Madeira são dodecaplóides e de reprodução sexuada, enquanto que as das Canárias são hexaplóides e apogâmicas. Os resultados obtidos em anterior estudo morfológico das escamas do rizoma, das frondes, das células da epiderme abaxial das pinas, assim como dos esporos, levam a admitir a existência de apenas duas entidades taxonómicas daquele complexo nas Ilhas Macaronésicas. As plantas hexaplóides e apogâmicas, que ocorrem apenas nas ilhas de La Palma, Hierro e Tenerife, das ilhas Canárias, são designadas por *A. filare* subsp. *canariense*, enquanto que as dodecaplóides e de reprodução sexuada, que existem nas ilhas da Madeira e de La Palma, bem como nas ilhas de Santo Antão, de São Vicente, de São Nicolau, de Santiago e do Fogo, todas do Arquipélago de Cabo Verde, devem ser atribuídas a *A. aethiopicum* subsp. *braithwaitii*, para a qual se apresenta uma descrição.

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INTRODUCTION

Earlier cytological studies in the *Asplenium aethiopicum* complex in Macaronesian Islands were undertaken by MANTON (1950, 1959), PANIGRAHI (1963), BRAITHWAITE (1964; in WALKER, 1985; in MANTON *et al.*, 1986; 1986) and MANTON *et al.* (1986). Their results have shown that the Madeiran plants are sexual dodecaploids, while the Canarian ones are apomictic hexaploids.

In order to determine which taxonomic entities occur in the Macaronesian Islands we have undertaken other previous morphological studies of the rhizome scales, fronds, abaxial epidermal cells and spores. These studies have shown that two taxonomic entities occur in those islands. The apomictic hexaploid forms are found only in the Canarian islands of La Palma, Hierro and Tenerife, while the sexual dodecaploid ones may be found in Madeira and La Palma, as well as in the islands of Santo Antão, São Vicente, São Nicolau, Santiago and Fogo, all of which from the Cape Verde Archipelago.

NOMENCLATURE

In his biosystematic study on the *A. aethiopicum* complex in South Africa, BRAITHWAITE (1986) included the sexual and apomictic forms from the African mainland and offshore islands in a single species, *A. aethiopicum* (N. L. Burm.) Becherer.

Nevertheless, we think that the sexual forms must correspond to *A. aethiopicum*, while the apomictic ones must belong to *A. filare* (Forssk.) Alston. The former species presents oblong-lanceolate to triangular-lanceolate fronds, rarely narrowly lanceolate, usually acuminate at the apex, obtuse to acute pinnae, and ellipsoidal spores. The latter species usually has the narrowly lanceolate fronds more caudate at the apex, usually elongately caudate pinnae, and subspheroidal spores.

Thus, the plants of sexual propagation, which are dodecaploids and occur in the Macaronesian Islands, are to be referred to:

Asplenium aethiopicum subsp. *braithwaitii* J. Ormonde, subsp. nov.

A. subspeciebus alteris A. aethiopici frondibus bipinnatifidis, pinnis subsessilibus et minus dissectis differt. Frondes (7-) 12-40 (-65) cm. longae et (1.8-) 2-9 (-11.5) cm. latae, stipites (3-) 4-17 (-23) cm. longi, sporae (37-) 40-53 (-60) µm. longae et (24-) 27-34 (-37) µm. latae. Chromosomatum numerus n = 216.

Habitat in Insulis "Madeira", "Canarias" et "Cabo Verde".

Typus: *Insula Madeira, loco dicto* "Lombo de Cima, estrada Ribeiro Frio - Faial", *ubi* 30.VII.1986 a ORMONDE *sub numero lectum* (COI, Fig. 1); *Isotypi:* AZU; B; BM; ELVE; FR; G; LISE; LISI; LISU; M; MA; MADJ; MADM; O; P; PO.

Paratypi:

MADEIRA: entre o Montado dos Pessegueiros e o Seixal, próximo da Ribeira de João Delgado, 13.VI.1957, MALATO BELIZ 1672 (ELVE; MA); Ribeira de São Jorge, 12.IX.1829, LOWE (M); *id.*, 1877, HILLEBRAND (B; MO); *id.*, 10.VIII.1970, G & U. BENL (M); Santana, 17.IV.1900, BORNMÜLLER 1556 (B - 020049; G; P; Z).

LA PALMA: Los Tilos, III.1906, PITARD 1210 (P, Fig.2).

SANTO ANTÃO: Covão, IX.1934, CHEVALIER 45478 (COI; P); *id.*, CHEVALIER 45530 (COI; P); Blockheld in Krater von Cova, 12.XI.1980, LOBIN 2143 (FR).

SÃO VICENTE: Monte Verde, 23.III.1853, BOLLE (B - 020076, Fig.3); *id.*, top, 21.X.1972, SUNDING 2614 (O); *id.*, 10.XI.1982, LOBIN 2458 (FR); *id.*, near the top, 4.XI.1976, SUNDING 3363 (O).

SÃO NICOLAU: Monte Gordo, VII.1851, BOLLE (B-020070; B-020071; B-020073; B-020074; P); *id.*, 1897, CARDOSO (COI); Umgebung des Monte Gordo und nach Osten angrenzendem Gipfel, 28.XII.1978, LOBIN CV-259 (FR); between Cachaço and Monte Gordo, 23.XI.1976, SUNDING 3793 (O).

SANTIAGO: Serra da Malagueta, zwischen Chão da Figueira und dem Pico da Malagueta, 1.X.1979, LOBIN 781 (FR); Serra da Malagueta, NW Pico da Malagueta, Chão do Espinho, 3.X.1979, LOBIN 848 (BM;FR).

FOGO: Chã das Caldeiras, Abstieg zum Monte Velha, 2.XI.1979, LOBIN 1350 (FR); Ribeira de S. Cristin beim Monte Velha, 24.X.1980, LOBIN 2010 (FR).

Rhizome long, creeping to ascending, much branched; rhizome scales (2.5-) 3.0-7.5 (-8.5) X 0.25-1.0 mm., blackish-brown, narrowly ovate-lanceolate, filiform at the apex. Fronds (7.0-) 12.0-40.0 (-65.0) cm. long, at tufts; stipe (3.0-) 4.0-17.0 (-23.0) cm. long, somewhat swollen at the junction with the rhizome, usually arching at the base, bright blackish-brown, sometimes greenish near the lamina, at first with blackish-brown scales similar to those on the rhizome and numerous smaller reddish-brown ovate-filiform scales basally and medianly lobate-filiform, fi-

nally glabrous, with two lateral and abaxial coriaceous narrow greenish wings near the lamina; lamina (3.5-) 6.0-25.0 (-48.5) X (2.0-) 3.0-10.0 (-21.5) cm., usually bipinnatifid, oblong-lanceolate to triangular-lanceolate, rarely narrowly lanceolate, usually acuminate at the apex, dark green on adaxial face, pale green on abaxial face, thinly coriaceous, at first with numerous small reddish-brown ovate-filiform scales similar to those on the stipe, finally with sparse scales on abaxial face; rhachis bright green, sometimes brownish-green towards the base on abaxial face, at first with numerous scales similar to those on lamina, finally with sparse scales, with two lateral and adaxial coriaceous green wings, brownish-green near the base; pinnae (3-) 5-17 (-19) on each side of the rhachis, usually 1-pinnate acroscopically at the base, usually lanceolate-trapeziate, obtuse to acute at the apex, rarely caudate, sometimes extensively attenuated towards the base, usually subsessile, subopposite, patent; median pinnae the longest; lower acroscopic pinnule oblong to obovate-truncate with 2 to 3 irregular inciso-dentate lobes; lower basiscopic, median and upper pinnules linear-truncate, always decurrent and adnate, irregularly inciso-dentate at the apex; parallel veins, 1-2 furcate, ending each one of them at the base of a tooth. Sori long, near the costule, linear, finally confluent; indusium entire, usually whitish. Spores (37.0-) 40.0-52.0 (-62.0) X (24.0-) 27.0-34.0 (-37.0) μm ., ellipsoidal, costate-alate, sparsely ridged, not areolate. Sexual, n=216.

A. dentex R. Br. (L. v. Buch, Phys. Cans. Ins.: 189, 1825) and *A. maderense* Penny (Loud., Suppl. Hort. Brit.: 494, 1850) are binomina which were not published validly, and are consequently *nomina nuda*. Unfortunately, the *dentex* epithet was used for other species by KUNTZE in 1850. On the other hand, the epithet *maderense* must not be used for our taxon, because it also occurs in La Palma of the Canaries, and in the Cape Verdes.

This subspecific name pays homage to Dr. A. F. BRAITHWAITE, of the University of Nottingham, since he has studied the *A. aethiopicum* complex for a long time, and because it was he who has elucidated us about the validity of *A. maderense* via Dr. MARY GIBBY, of the British Museum (*in litt.*, 1989).

The plants which are apomicts could be hexaploids, and the ones that occur in The Canaries are to be referred to:

Asplenium filare (Forssk.) Alston subsp. *canariense* (Willd.) J. Ormonde, comb. *et* stat. nov.

Basion.: *Asplenium canariense* Willd., Sp. Pl. 5(1): 339 (1810). - Fée, Gen. Fil.: 191 (1852). - Schmidt, Beitr. Fl. Cape Verd. Ins.: 131 (1852) pro parte. - Bunbury in J. Proceed. Linn. Soc. London, 1: 12 et 15 (1857). - Tard-Blot in Mém. Soc.

Biogéogr., Paris, 8: 328 (1946).

Syn.: *Asplenium furcatum* auct. [Milde, Fil. Eur.: 74 (1867) pro parte. - Hooker & Baker, Syn. Fil., ed. 2: 214 (1874) pro parte. - Christ in Bot. Jahrb. 6 (5): 513 et 520 (1885) pro parte], non Thunb. (1800).

Asplenium furcatum var. *canariense* (Willd.) Milde, Fil. Eur.: 74 (1867) pro parte.

Asplenium furcatum subsp. *canariense* (Willd.) Bornmüller in Bot. Jahrb. 33 (3): 393 (1903) pro parte.

Asplenium praemorsum auct. [C. Chr., Ind. Fil.: 127 (1905) pro parte. - Chevalier in Rev. Bot. Appl. 15: 1056 (1935) pro parte. - Lid. in Skr. Norske Vid. - Akad. Oslo I. Mat. - Naturv. Kl., N.S., 23: 12 (1967)], non Sw. (1788).

Asplenium aethiopicum auct. [Dansereau in Agron. Lusit. 23 (3): 164 (1961) pro parte. - G. Benl in Nova Hedwigia 14 (1): 91 (1967). - Hansen in Bol. Mus. Mun. Funchal 24: 9 (1969) pro parte. - G. Benl & Sventenius in Nova Hedwigia 20 (3/4): 445 (1970) pro parte. - Kunkel in Cuad. Bot. Canar. 13: 35 (1971). - Ron Álvarez in Anales Inst. Bot. Cavanilles 30: 126 (1973). - Eriksson, Hansen & Sunding, Fl. Macaron. Checklist Vasc. Pl.: 1 (1974) pro parte. - Nogueira in Garcia de Orta, Sér. Bot., 2 (2): 82 (1975) pro parte. - Santos & Fernández in Sem. Hort. Acclimat. Pl. Arautapae 1976: 50 (1976). - Hansen & Sunding in Eriksson, Hansen & Sunding, Fl. Macaron. Checklist Vasc. Pl., 2 rev. ed., 1: 1 (1979) pro parte; *ibid* 2: 6 (1979) pro parte. - Schmid in Monogr. Biol. 30: 246 (1976); Kunkel in Paralelo 37º, 8/9: 339 et 340 (1985) pro parte. - Braithwaite in Bot. J. Linn. Soc. 93: 375 (1986) pro parte. - Brochmann & Rustan in Garcia de Orta, Sér. Bot., 81 (1/2): 13 (1986) pro parte. - G. Benl & U. Benl in Farnblätter 18: 6 (1988) pro parte] non (N. L. Burm.) Becherer (1936).

Asplenium praemorsum Sw. var. *canariense* (Willd.) Edtman & Sorsa, Pollen Sp. Morph./Pl. Taxon. IV Pterid.: 26 (1971), *nom. nud.*

Asplenium aethiopicum subsp. *filiare* (Forssk.) Braithwaite in Bot. J. Linn. Soc. 93: 362 (1986) pro parte.

EXAMINED SPECIMENS

PAL: Bco del Agua, Los Sauces, 30.VIII.1965, LEMS 5789 (G); Bco del Rio, 24.IX.1854, BOLLE (B-020066; B-020076, Fig. 4); *id.*, 24.IV.1901, BORNMÜLLER 3121 (B); *id.*, 21.IV.1901, ENGLER (B); Bco Gallegos, 7.VIII.1968, G. & U. BENL (M); La Garafía, 16.IV.1963, KUNKEL 6722 (G); s. loc., 1877, HILLEBRAND (B; MO).

HIE: El Golfo, 2.V.1855, PERRAUDIÈRE (G); Cumbre d'El Golfo, 3.V.1855, PERRAUDIÈRE (P); El Golfo wall between Frontera and Jinama, 20.XI.1975, ELVEN 13042 (O); Lomo de los Baras, bei La Frontera, 27.VIII.1969, U. BENL (M); Weg von Jinama nach Frontera, 6.IV.1983, LOBIN 755 (FR); Risco de Jinama, alt. 800-

900m., 15.V.1901, BORNMÜLLER 3120 (B-020036; G; MO; P; Z); *id.*, 1100 m. alt., 15.IV.1901, BORNMÜLLER 3120 (B-020027); *id.*, 1.IV.1905, PITARD 432 (G; MO; P); *id.*, V.1924, BURCHARD 384 (B; G; Z).

TEN: Burghang über Arafo, 28.VIII.1965, G. BENL (FR; M); Pinars über Arafo, 27.XII.1966, G. & U. BENL (M); Lavafeld bei Las Cuevecitas, 520 m., bei Arafo, 31.XII. 1966, G. & U. BENL (M); Guimar, 1845, BOURGEAU 144 (G; P); *id.*, 24.II.1855, BOURGEAU 1548a (B-020030; B-020031; COI-WILLK; G; MA; P); *id.*, VI.1866, HUSNOT 3 (B; COI; P); Ladera de Guimar, 29.XII.1968, G. BENL (M); Bco de Badajoz, 14.I.1898, HINTZ (Z); Bco de Badajoz, Guimar, 12.XII.1851, BOLLE (B-020066); *id.*, 3.VI.1901, BORNMÜLLER 3122 (B); *id.*, BURCHARD 10 (O); *id.*, 16.V.1907, RETZDORFF (B); *id.*, 6.I.1913, ROSENDAHL (M); *id.*, 24.XII.1966, G. & U. BENL (M); *id.*, 19.III.1977, LOBIN TF-77-054 (FR); *id.*, 19.III.1977, KEWEJOHANN TF-77-034 (FR); Bco del Rio, bei Guimar, 18.IV.1895, KUEGLER (B); *id.*, II.1906, PITARD 734 (B; G; P); *id.*, BURCHARD 10 (B); *id.*, 10.IV.1968, P. & M. VILLARET (M); Bco de la Cruzita, II.1904, BURCHARD 10 (P).

Rhizome short, creeping, branched; rhizome scales 1.5-5.0 (-6.0) X 0.25-1.0 mm., blackish-brown, ovate-lanceolate, filiform at the apex. Fronds (6.0-) 8.5-35.0 (-45.0) cm. long, at tufts; stipe (1.5-) 2.0-7.5 (-12.0) cm. long, usually arching at the base, blackish-brown, sometimes dark green near the lamina, slightly bright, at first with numerous brownish narrowly ovate-lanceolate scales filiform at the apex and numerous ovate-filiform brownish-yellow scales, sometimes basally and medianly lobate-filiform, finally glabrous, with two lateral and adaxial coriaceous brownish-green wings near the lamina; lamina (4.0-) 7.0-25.0 (-36.5) X (1.5-) 2.0-6.0 (-8.0) cm., usually bipinnatifid, narrowly lanceolate, sometimes oblong-lanceolate, rarely ovate-lanceolate, caudate at the apex, dark green on adaxial face, pale green on abaxial face, thinly coriaceous, at first with numerous ovate-filiform scales similar to those on the stipe, finally glabrous on abaxial face; rhachis blackish-brown to blackish-green, slightly bright, at first with dense scales, similar to those on the stipe, finally glabrous, with two lateral and adaxial coriaceous green wings, sometimes brownish near the base; pinnae (3-) 6-17 (-19) on each side of the rhachis, usually 1-pinnate acroscopically at the base trapeziate-lanceolate, usually caudate at the apex, attenuated towards the base, shortly stipetate, usually oblique from the base to the apex; median pinnae the longest; lower and upper pinnae decrescent; lower acroscopic pinnule linear-truncate, with 2 to 3 lobes irregularly inciso-dentate at the apex, decurrent, often adnate; lower basiscopic, median and upper pinnules linear-truncate, always decurrent and adnate, irregularly inciso-dentate at the apex; parallel veins, 1-2-furcate, each one of them ending at the base of a tooth. Sori long, near the costule, linear, finally confluent; indusium entire, usually whitish. Spores (40.0-) 43.5-56.5 (1.5) X (35.5-) 37.0-50.0 (-53.0) μm ., subspheroidal, costate-

alate, densely rigid, not areolate. Apomictic, $2n = 216$.

ECOLOGY AND PHYTOSOCIOLOGY

These two Macaronesian taxa are not differentiated from each other by their ecological features. Both taxa grow in damp and more or less shady places, in rocky fissures and basaltic lava rocks, often on mossy stone walls and mossy stony places (BENL, 1967, 1971; BENL & SVENTENIUS, 1970; BROCHMANN & RUSTAN, 1986; CHEVALIER, 1935; NOGUEIRA, 1975; PAGE, 1977; SUNDING, 1980). The specimens of Los Tilos, from the island of La Palma, were found in a damp and shady place of vulcanic rocky fissures.

A. aethiopicum subsp. *braithwaitii* occurs usually between 200 and 600 m. altitude in Madeira (BENL, 1971; BORNMÜLLER, 1903), about 300 m. in Los Tilos of La Palma and between 700 and 1400 m. in the Cape Verde Islands (BROCHMANN & RUSTAN, 1986; CHEVALIER, 1935; NOGUEIRA, 1975; SUNDING, 1981); and *A. filare* subsp. *canariense* occurs between 400 and 1000 m. in the islands of La Palma, Hierro and Tenerife (BENL, 1967; BENL & SVENTENIUS, 1970; BORNMÜLLER, 1903).

These taxa show that they have not phytosociological preferences. They do not occur very frequently but abundantly, in disturbed communities of *Asplenietea rupestris* Br.-Bl. and of *Keinio-Euphorbietea canariense* RIVAS GODAY & ESTEVE in these three Macaronesian Archipelagos, in communities of *Pruno-Lauretea azoricae* OBERD. in Madeira and the Canaries, in communities of *Olea-Rhamnetea crenulatea* A. SANTOS in the Cape Verde Archipelago and in small communities of *Aeonio-Greenovietea* A. SANTOS in the Canaries (DEL ARCO & WILDPRET, 1983).

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Fig. 1 - *Asplenium aethiopicum* subsp. *braithwittii*. Holotypus - MAD: Lombo de Cima, estrada Ribeiro Frio-Faial, ORMONDE 2878 (COI).



Fig. 2 - *Asplenium aethiopicum* subsp. *braithwaitii*. Paratypus - PAL: Los Tilos, PITTARD 1210 (P).



Fig. 3 - *Asplenium aethiopicum* subsp. *braithwaitii*. Paratypus - VIC: Monte Verde, BOLLE (B-020076).



Fig. 4 - *Asplenium filare* subsp. *canariense*. Herbarium specimen - PAL: Bco del Rio, BOLLE (B-020076).

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