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Observations on some ferns of Poros and adjacent parts of the Peloponnesus (Greece)

Abstract

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Fern material collected during an excursion in May 1992 has been critically investigated, with emphasis on the asplenioid and cheilanthoid taxa. In *Cheilanthes*, the existence in Greece of *C. guanchica*, *C. maderensis*, *C. acrostica*, and the hybrids *C. ×marchettiana* and *C. ×malacitensis* was confirmed, all five growing together in the same locality, an andesite ridge on the island of Poros, the protection of which is recommended to Greek conservationists. *Cosentinia vellea* is reported as new for Poros, and *Notholaena marantae*, as new for the Peloponnesus. A cytological study of *Anogramma leptophylla*, *Asplenium obovatum*, *A. trichomanes* subsp. *inexpectans*, *Cheilanthes guanchica*, *C. ×marchettiana*, and *C. ×malacitensis* confirmed earlier chromosome data for these taxa, based on non-Greek material.

Introduction

The results reported here are based on material collected during an excursion to the island of Poros, the Methana Peninsula and adjacent areas of the Peloponnesus, in May 1992, by the first three authors. The excursion concentrated primarily on the study of the cheilanthoid and asplenioid ferns, for the following reasons.

Nardi & al. (1978) had first reported the occurrence of *Cheilanthes guanchica* and *C. tinaei* on the island of Poros. Since these records were based on mixed material, allegedly collected by Heldreich in 1889 (P), the occurrence of both species in Greece was initially contested (Greuter 1980, Greuter & al. 1981). Later, Rasbach & Reichstein (1982), on the basis of a recent collection also from Poros (*Phitos* 1865 p.p., M), identified by HR in 1979, confirmed *C. guanchica* as a member of the Greek flora, and Greuter & al. (1984) and Zimmer (1991) accepted this record. Still, the present authors felt that field studies were needed, since neither was the cytology of the Greek *C. guanchica* population(s) known, nor had the presence of *C. tinaei* been confirmed for Greece.

The Mediterranean ancestral diploid *Asplenium obovatum* subsp. *obovatum* consists of three morphologically discrete varieties (Demiriz & al. 1990, Rasbach & al. 1990),

one of which cannot be distinguished in gross-morphology from the autotetraploid *A. obovatum* subsp. *lanceolatum* (Fiori) P. Silva. As Greek plants resembling the latter subspecies in leaf dissection had been reported from Greece (Poros and Kithira, Greuter & Rechinger 1967, as *A. billotii* F. W. Schultz), the authors decided to follow Greuter's suggestion (in Greuter & Rechinger 1967: 28) and check the cytology of some Greek populations of *A. obovatum*.

Methods

All cytological work was done by HR using the method established by Manton (1950) and detailed in Rasbach & Reichstein (1990). Preparations were examined by phase contrast using an Olympus-BH2 microscope. Photographs were taken on Kodak Technical Pan film.

The micromorphological methods used have been described by Viane (1990, 1992, and in Demiriz & al. 1990). For exospore measurements only untreated, fresh spores were used; the mean exospore length (*lexo*) or the equatorial spore diameter (*E*), both based on at least 25 measurements, is mentioned for some specimens. The measurements in Tables 1-5 are from RV's personal database and stem from different populations sampled over the whole range of each taxon. General spore terminology follows Kremp (1968).

The specimens cited, unless otherwise specified, are in the private herbaria of the authors; abbreviations for other herbaria follow Holmgren & al. (1990). *RV-* and *Ras-*, followed by the collecting number, stand for *R. Viane* and *H. Rasbach* & *K. Rasbach*, respectively.

Geology, vegetation, and climate

The area studied extends from 37°29' to 37°37' N, and from 23°09' to 23°31' E (Fig. 1), and forms part of the Nomos Attiki though geographically it belongs to the eastern peninsula (Argolis) of the Peloponnesus. Its Mediterranean climate resembles that of the eastern coast of Greece and the Aegean Islands, with the wettest period from November to April and an average annual rainfall of about 400-500 mm. The average January temperature is 10-15°C, the July average is >25°C (Polunin 1980).

Poros was originally composed of two islands, the small southern isle of Sferia and the larger Kalavria (= Calaurea) to the north. Both, now connected, are situated in the south-west of the Saronic Gulf about 50 km SSW of Athens. Poros city occupies about half of Sferia and is only separated from the mainland by a narrow channel c. 250 m wide. The highest point of the island is c. 358 m a.s.l.. According to Suesskoch & al. (1984) Sferia is entirely composed of (rather acid) Quaternary volcanic andesite rock (SiO₂: 56-63 %), while Kalavria consists of a base of igneous serpentinite and sedimentary Cretaceous (Barremian-Cenomanian) limestones which are overlain with Tertiary marls, sandstones, breccias, and conglomerates. The vegetation on the north-eastern slopes of Sferia consists of phrygana with *Quercus coccifera*, *Calicotome villosa*, *Cistus parviflorus*, *Sarcopoterium spinosum*, *Urginea maritima*, *Muscari comosum*, *Lagurus ovatus*, *Pistacia lentiscus*, *Asparagus acutifolius*, *Allium subhirsutum*, *Ophrys* sp., etc.,

with some planted *Pinus* and *Cupressus* trees. Large parts of Kalavria are covered by degraded woodland of *Q. coccifera* and *Pinus halepensis*.

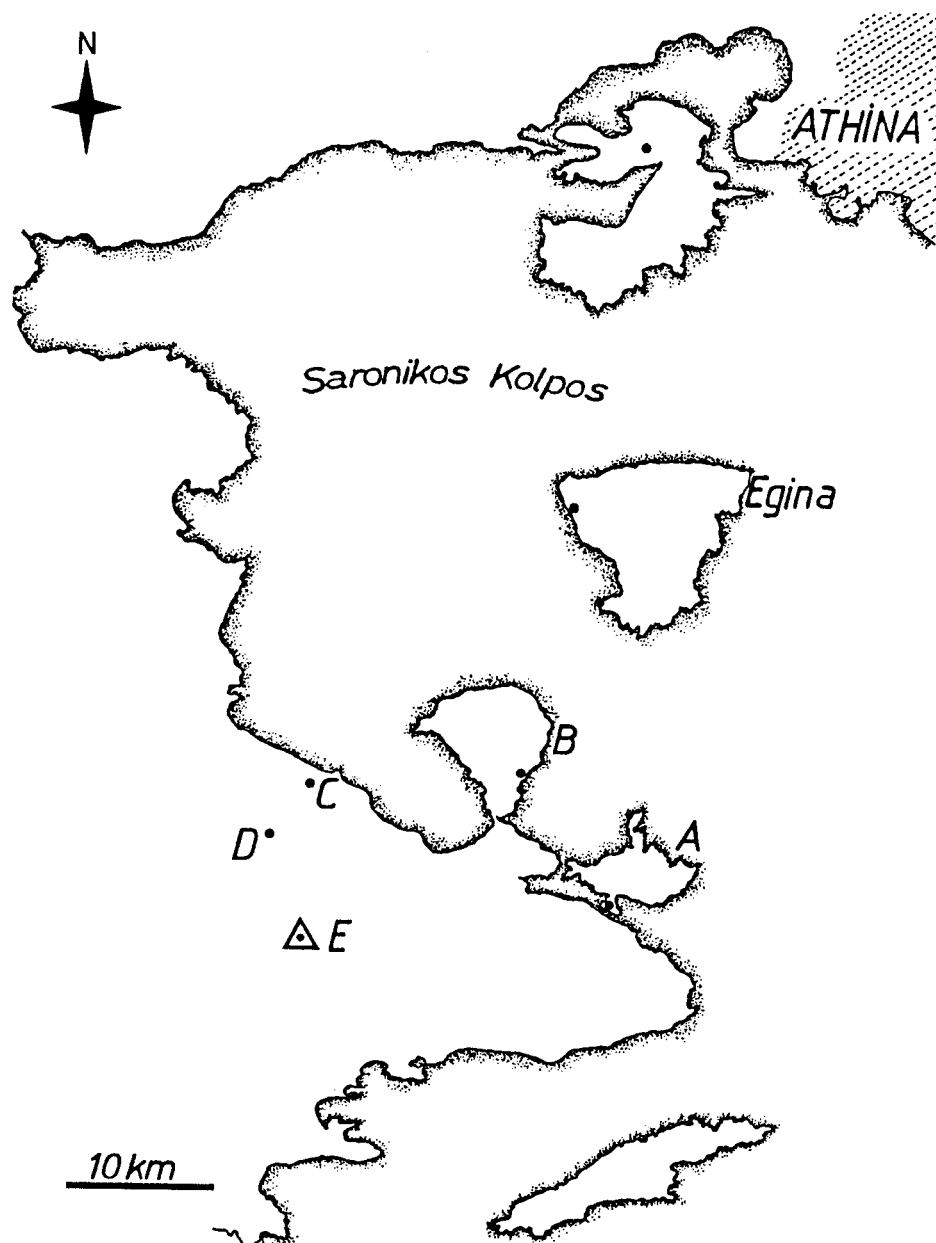


Fig. 1. Simplified map of the area studied, with major settlements denoted by dots. –A, Poros Island, with Poros City; B, Methana peninsula, with Methana; C, Ano Fanari; D, Karatsas; E, top (1113 m) of Mt Didimos.

The Methana peninsula, connected to the mainland by a narrow isthmus of Cretaceous limestone, is a mosaic of Quaternary volcanic lava flows and domes (reaching to over 600 m a.s.l.) of, a.o., dacites and andesites, with an important outcrop of Triassic "Pantokrator" limestone in the extreme north-west (Bannert & al. 1984). There are extensive areas used for agriculture, with *Oxalis pes-caprae* infested by *Orobancha* sp.; *Pinus halepensis* woodland and phrygana with *Hypericum empetrifolium*, *Quercus coccifera*, and *Pistacia lentiscus* are common on the andesites.

On the mainland, a mixed low *Quercus coccifera* woodland dominates the slopes in the area south of Ano Fanari, which consists of Triassic "Pantokrator" limestone bed-rock alternating with Jurassic pillow diabase, limestones, and serpentinite intrusions. The slopes of Mt Didimos, at c. 500-1100 m a.s.l., consist of Triassic "Pantokrator" limestone. Around 1000 m we found, a.o., *Orchis quadripunctata*, *Iris attica*, *Myosotis* sp., *Aubrieta* sp., and *Asplenium ceterach*.

Asplenioid ferns

Asplenium ceterach L. subsp. *ceterach*

Mainland: c. 1 km S of Ano Fanari, among limestone rocks, c. 480 m, 5 May 1992, RV-5118-B; Mt Didimos, limestone pavement, c. 1030 m, with *Orchis quadripunctata*, *Myosotis*, *Iris attica*, *Aubrieta*, etc., 5 May 1992, RV-5135. – Methana: E of Kifeli, rocky andesite outcrop along footpath, 3 May 1992, RV-5059; c. 300 m S of Vathi, rocky outcrop above roadside, 4 May 1992, RV-5077 (*lexo* = 41 µm), 5078 (*lexo* = 41 µm); N of Kaimeni Hora, W-exposed andesite slope with *Pinus halepensis* woodland, c. 210 m, 5 May 1992, RV-5093. – Poros: Sferia, andesite slope S of Poros city, NE-exposed, c. 70 m, 1 May 1992, RV-5041 (*lexo* = 42 µm); Kalavria, E of Poros city, serpentine outcrop near the Zoodohos Piyi Monastery, 2 May 1992, RV-5054 (*lexo* = 42 µm).

Asplenium ceterach L., putative hexaploid specimens

Mainland: Mt Didimos, limestone rocks, c. 760 m, 5 May 1992, RV-5132 (*lexo* = 48 µm; coll. living). – Poros: Sferia, Poros city, on walls, 1 May 1992, RV-5039 (*lexo* = 45 µm).

Table 1. Ploidy level, exospore and stomata length in *Asplenium ceterach*. Figures include the minimum and maximum (in parentheses), the mean (in bold), and the range of one standard deviation.

<i>Asplenium ceterach</i>	Ploidy	Exospore length (µm)	Stomata length (µm)
subsp. <i>bivalens</i>	2x	(25-)29- 32 -34(-41)	(25-)33- 38 -42(-50)
subsp. <i>ceterach</i>	4x	(29-)36- 39 -42(-53)	(29-)39- 43 -47(-59)
hexaploid subspecies	6x	(38-)43- 46 -49(-57)	(36-)43- 47 -51(-64)

The diploid, tetraploid, and hexaploid cytotypes, which we treat as subspecies, are not distinct morphologically but can be identified by measuring stomata and exospore length (Table 1). Based on exospore measurements, most of our specimens were identified as the tetraploid, *Asplenium ceterach* subsp. *ceterach*, but a few are presumably hexaploid or, possibly, hybrids; they require further study. The hexaploid subspecies, first collected on Cyprus in 1987, has been used for cytological studies by Pintér & Vida (1993) and will be described by Viane & al. (in prep.).

In general, *Asplenium ceterach* is found on base-rich rocks or mortared walls, but it is not restricted to such substrates and grows well on andesite within the area studied. Details of the general distribution of both the diploid and the tetraploid subspecies, including maps, are given in Jalas & Suominen (1972), Reichstein (1983), and Pichi Sermolli (1979: 192, 1990: 512). Diploid *A. ceterach* subsp. *bivalens* (D. E. Mey.) Greuter & Burdet is known from Bulgaria, Greece (Kefallinia: type locality; Kithira: Greuter & Rechinger 1967), Hungary, Italy, Yugoslavia, Romania, and Turkey (Greuter 1980), and must also grow in N Algeria where RV recently found the triploid (count: HR) hybrid *A. ceterach* nothosubsp. *mantoniae* (Varoczky & Vida) Jermy. Tetraploid *A. ceterach* subsp. *ceterach* is much more widely distributed and extends into NE tropical Africa (confused with *A. phillipsianum* Kümmerle by Thulin 1993), Saudi Arabia (Collenette 1985), N Yemen (Christ 1900), and the Himalayas.

Asplenium obovatum Viv. subsp. *obovatum* (Fig. 2-3, 5b).

Asplenium obovatum* var. *obovatum

Methana: N of Kaimeni Hora, crater with large andesite boulders, c. 220 m, 5 May 1992, RV-5101-5103; *ibid.*, along fault between limestone and andesite areas, on shaded andesite boulders, c. 210 m, 5 May 1992, Ras-813 ($n = 36^{II}$), Ras-815 ($n = 36^{II}$), RV-5109, RV-5113. – Poros: Sferia, SE of Poros City, NE-exposed andesite rocks, in rock crevices, 6 May 1992, RV-5142, RV-5146a, RV-5147b; *ibid.*, 7 May 1992, RV-5154 ($n = 36^{II}$), RV-5157 (= Ras-823: $n = 36^{II}$), Ras-825.

Asplenium obovatum* var. *obovatum* → var. *deltoideum

Methana: along fault between limestone and andesite areas, on shaded andesite boulders, c. 200 m, 5 May 1992, RV-5108 ($lexo = 29 \mu\text{m}$). – Poros: Sferia, SE of Poros City, NE-exposed andesite rocks, in rock crevices, 6 May 1992, RV-5143, RV-5147a; Sferia, S of Poros city, east of bell tower, N-exposed andesite boulders, c. 50 m, 7 May 1992, RV-5161 (= Ras-818-3: $n = 36^{II}$).

***Asplenium obovatum* var. *deltoideum* Demiriz & al.**

Methana: N of Kaimeni Hora, along fault between limestone and andesite areas, among andesite boulders, c. 200 m, 5 May 1992, RV-5112; R. Viane 5115. – Poros: Sferia, SE of Poros City, NE-exposed andesite rocks, in rock crevices, 7 May 1992, RV-5156 (= Ras-822: $n = 36^{II}$); Sferia, S of Poros city, east of bell tower, N-exposed andesite boulders, c. 50 m, 7 May 1992, RV-5162.

Table 2. Ploidy level, exospore and stomata length in *Asplenium obovatum*. Figures include the minimum and maximum (in parentheses), the mean (in bold), and the range of one standard deviation.

<i>Asplenium obovatum</i>	Ploidy	Exospore length (μm)	Stomata length (μm)
subsp. <i>obovatum</i>	2x	(22-)28- 30 -32(-40)	(27-)41- 45 -49(-60)
subsp. <i>lanceolatum</i>	4x	(28-)33- 36 -38(-49)	(39-)53- 59 -64(-71)

Asplenium obovatum var. *obovatum* → var. *protobillotii*

Poros: Sferia, SE of Poros City, SW-exposed andesite rocks, rare in deep rock crevices, 6 May 1992, *RV-5138*; Sferia, SE of Poros City, NE-exposed andesite rocks, in rock crevices, 6 May 1992, *RV-5145*; *RV-5151*; Sferia, S of Poros city, east of bell tower, N-exposed andesite outcrop, c. 50 m, 7 May 1992, *RV-5163* (= *Ras-818-1*: $n = 36^{\text{II}}$).

Asplenium obovatum var. *deltoideum* → var. *protobillotii*

Poros: Sferia, SE of Poros City, NE-exposed andesite rocks, in rock crevices, 7 May 1992, *RV-5155* (= *Ras-824*: $n = 36^{\text{II}}$), *RV-5158* (= *Ras-820*: $n = 36^{\text{II}}$), – Sferia, S of Poros city, east of bell tower, N-exposed andesite outcrop, c. 50 m, 7 May 1992, *RV-5164* (= *Ras-818-2*: $n = 36^{\text{II}}$).

Asplenium obovatum var. *protobillotii* Demiriz & al.

Poros: Sferia, SE of Poros City, NE-exposed andesite rocks, in rock crevices, 6 May 1992, *RV-5141*, *RV-5144*, *RV-5146b*, *RV-5148*, *RV-5149*, *RV-5150*; *ibid.*, 7 May 1992, *RV-5159* (= *Ras-819*: $n = 36^{\text{II}}$); Sferia, S of Poros city, east of bell tower, N-exposed andesite outcrop, c. 50 m, 7 May 1992, *RV-5160*.

Asplenium obovatum comprises two cytologically defined subspecies: the Mediterranean ancestral diploid *Asplenium obovatum* subsp. *obovatum* and the autotetraploid *A. obovatum* subsp. *lanceolatum* (*A. billotii* F. W. Schultz, *A. lanceolatum* Huds. non Forssk.). The most reliable character for identification at the subspecific level is chromosome number. Further differences exist in exospore and stomata length, and scale size (Demiriz & al. 1990, Rasbach & al. 1990; Table 2). Macromorphology alone, e.g. frond shape, frond size, division of the pinnae or dentation of their margin, is unreliable for identification purposes.

Distributional details on the diploid (as *Asplenium obovatum*) and tetraploid (as *A. billotii*) are given in Jalas & Suominen (1972), (1983) and Pichi Sermolli (1979: 212, 1992: 202), yet the distribution is not yet accurately known. The more widespread tetraploid is an Atlantic to W Mediterranean taxon that also occurs in N Africa (NE Algeria), while the diploid is a mainly Mediterranean taxon restricted to acid (siliceous) rocks at low altitudes.

Demiriz & al. (1990) and Rasbach & al. (1990) have shown that *Asplenium obovatum* subsp. *obovatum* consists of three morphologically differentiated varieties (Fig. 2-3), whose distribution in Europe requires further study. One of them, var. *protobillotii*,

cannot be distinguished by its gross morphology from *A. obovatum* subsp. *lanceolatum*. So far, it had only been recorded for S Spain and NW Turkey (Demiriz & al. 1990). It is reported here as new for the flora of Greece. That it might occur on the Aegean islands

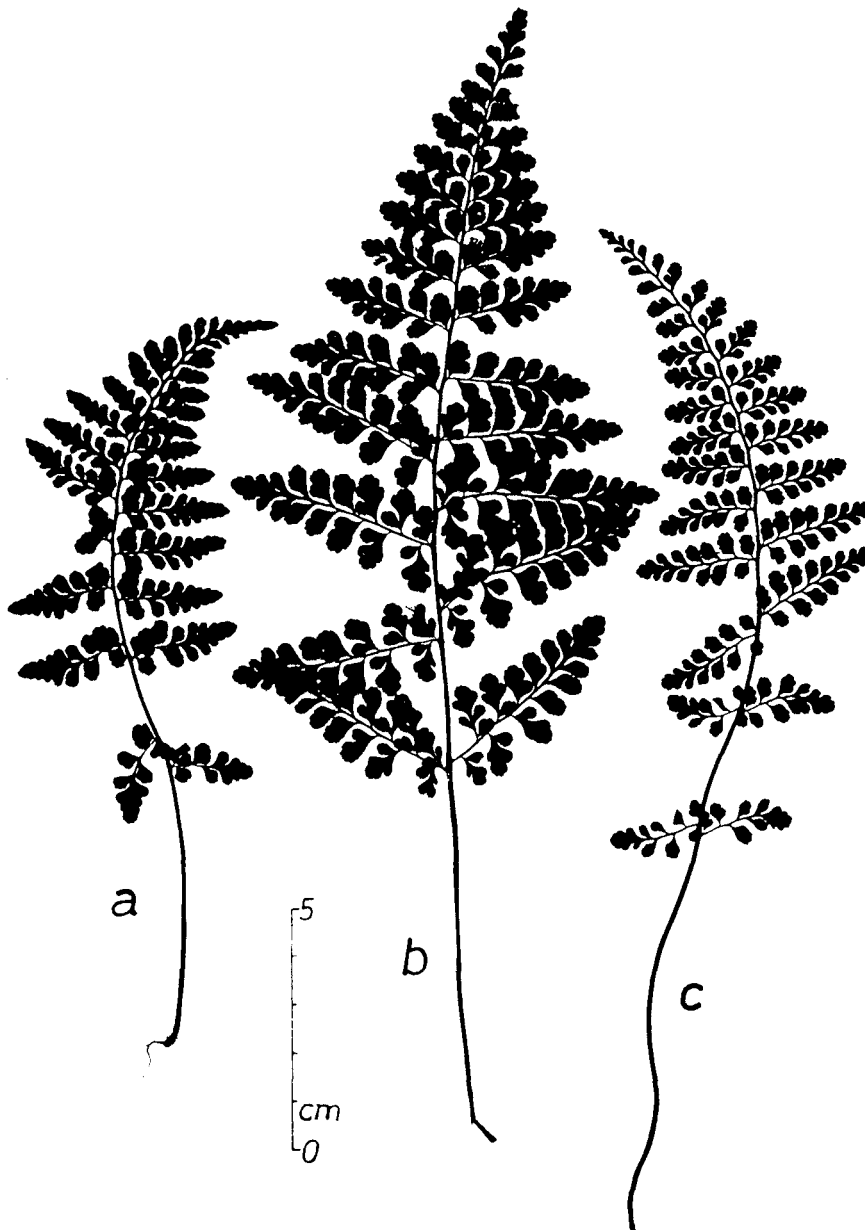


Fig. 2. Frond silhouettes of *Asplenium obovatum* subsp. *obovatum*. – a, var. *obovatum* (Ras-813); b, var. *deltoideum* (RV-5115); c, var. *protobillotii* (RV-5160).

could be inferred from Greuter & Rechinger (1967, for Poros and Kithira), but ours is the first cytological proof of the diploid status of the Greek populations of *A. obovatum*. The following key (see also Fig. 2-3) allows to distinguish the varieties.

1. Fronds triangular to deltoid var. *deltoideum*
- Fronds ovate to narrowly triangular 2.
2. Marginal teeth obtuse to slightly mucronate var. *obovatum*
- Marginal teeth cuspidate to acute var. *protobillotii*

For the first time, all three varieties have been found growing together, appearing to be interfertile and producing intermediate forms. All varieties and intermediates show $n = 36^{II}$ normal chromosomes during meiosis (Fig. 5b). Within the area studied, they are limited to sheltered crevices of andesite rock. Though at present *Asplenium obovatum* var. *protobillotii* is only known from S Spain, Greece and Turkey, and var. *deltoideum* only from France (Labatut & al. 1984), Greece and Turkey, both may likely be found elsewhere in populations of subsp. *obovatum*.

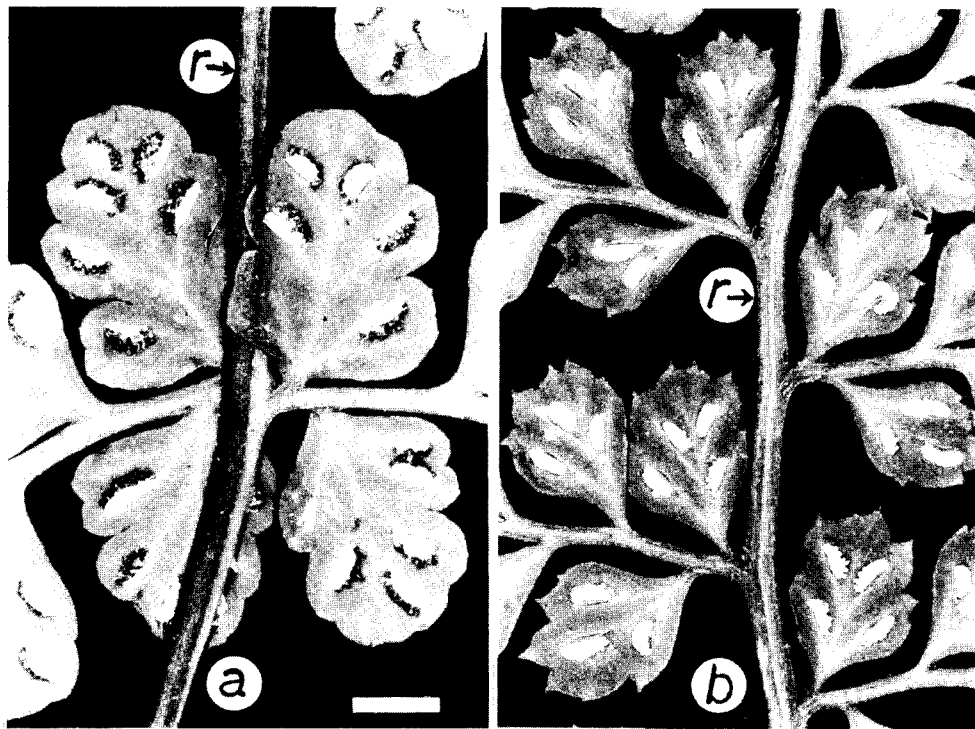


Fig. 3. Details of pinnules from the middle of fronds (both c. 18 cm long) of *Asplenium obovatum* subsp. *obovatum*. – a, var. *obovatum*, with obtuse to slightly mucronate teeth (RV-5154); b, var. *protobillotii*, with cuspidate teeth (RV-5160). – Scale bar = 2 mm; r = rachis.

Table 3. Ploidy level, exospore and stomata length in the *Asplenium onopteris* group. Figures include the minimum and maximum (in parentheses), the mean (in bold), and the range of one standard deviation.

<i>Asplenium</i>	Ploidy	Exospore length (μm)	Stomata length (μm)
<i>onopteris</i>	2x	(21-)26- 28 -31(-39)	(33-)46- 50 -53(-65)
<i>cuneifolium</i>	2x	(22-)28- 31 -34(-44)	(27-)44- 49 -53(-66)
<i>adiantum-nigrum</i>	4x	(21-)31- 34 -37(-45)	(32-)50- 57 -64(-79)

Due to the scarcity of the appropriate acid substrate, *Asplenium obovatum* is a rare species in the E Mediterranean. The two populations studied do not seem to be immediately threatened, but the one on Poros should be monitored to prevent the area from being spoilt by urban development and both should probably be protected. Colonies of mixed taxa are of special scientific interest.

Asplenium onopteris L.

Methana: N of Makrilonos, N-exposed scree of andesite boulders, c. 350 m, 3 May 1992, RV-5065 (*lexo* = 29 μm), RV-5066 (*lexo* = 28 μm), RV-5069, RV-5070; Makrilonos, 350 m, 3 May 1992, Ras-807, Ras-809; scree with *Arbutus*, *Acer*, and *Hypericum empetrifolium* along track from Palea Loutra to Ayios Nikolaos, c. 200 m, 3 May 1992, RV-5076; coastal andesite outcrop of Cape Pounda SSW of Megalohori, S of Vathi, c. 80 m, 4 May 1992, RV-5083; N of Kaimeni Hora, crater with large andesite boulders, c. 220 m, 5 May 1992, RV-5099; N of Kaimeni Hora, along fault between limestone and andesite areas, among andesite boulders, c. 200 m, 5 May 1992, RV-5111.

Species within the complex of *Asplenium onopteris* are morphologically often confusingly similar, and literature reports of their occurrence are often questionable. In addition to the sometimes unreliable macromorphological characters, exospore and guard cell length can be used to separate the diploid *A. onopteris* and *A. cuneifolium* Viv. from the tetraploid *A. adiantum-nigrum* L. (Table 3). We have only collected *A. onopteris*.

Within the area studied, *Asplenium onopteris* seems to be restricted to the acid andesite substrate. This mainly Mediterranean species (Jalas & Suominen 1972: 75, Pichi Sermolli 1979: 212, 1990: 502) extends westward into Macaronesia but has not so far been recorded, to the east, in the *Flora iranica* area.

Asplenium trichomanes L.

Asplenium trichomanes subsp. *inexpectans* Lovis (Fig. 4b-c, 5c).

Mainland: c. 1 km S of Ano Fanari, among limestone rocks, c. 480 m, 5 May 1992, RV-5117, RV-5118-A to RV-5121, RV-5122 ($n = 36^{\text{II}}$), RV-5123, RV-5124 (*lexo* = 30 μm ; $n = 36^{\text{II}}$); *ibid.*, 7 May 1992, RV-5165 (= Ras-826; *lexo* = 30 μm ; $n = 36^{\text{II}}$); c. 3.6 km S of Ano Fanari, "Pantokrator" limestone pavement E of road, with *Asplenium ceterach* and *Selaginella denticulata*, c. 330 m, 5 May 1992, RV-5127-5128, RV-5129 ($n = 36^{\text{II}}$).

Asplenium trichomanes subsp. *quadrivalens* D. E. Mey. (Fig. 4a).

Methana: N of Makrilonos, N-exposed scree of andesite boulders, c. 350 m, 3 May 1992, *RV-5064*, *RV-5071* (*lexo* = 34 μm ; *n* = 72^{II}); Makrilonos, 350 m, 4 May 1992, *Ras-806*; coastal andesite outcrop of Cape Pounda SSW of Megalohori, S of Vathi, scree, c. 80 m, 4 May 1992, *RV-5088-5089*; N of Kaimeni Hora, crater with large andesite boulders, c. 220 m, 5 May 1992, *RV-5100*, *RV-5104* (*n* = c. 72^{II}), *RV-5105*; N of Kaimeni Hora, along fault between limestone and andesite areas, among andesite boulders, c. 200 m, 5 May 1992, *RV-5110*.

No infraspecific categories were recognized by Rechinger (1943). At present, however, 5 subspecies (sometimes treated as species) can be recognized in the E Mediterranean area within the *Asplenium trichomanes* group. They can be keyed out as follows:

1. Mean exospore length < 32 μm ; mean stomata length < 40 μm ; diploid 2.
- Mean exospore length > 32 μm ; mean stomata length > 40 μm ; tetraploid 3.
2. Lamina tapering to an oblong apex; on acid substrates subsp. *trichomanes*
- Lamina ending abruptly in a deltoid apex; on basic substrates subsp. *inexpectans*
3. Fronds usually not appressed to the substrate; lamina gradually tapering to an oblong apex; pinnae not markedly auricled at the base; substrates vary . subsp. *quadrivalens*
- Fronds usually appressed to the substrate; lamina \pm abruptly narrowed to a triangular apex; pinnae usually with one or two basal auricles; mostly on limestone..... 4.
4. Rachis rather brittle; pinnae with a very narrow, pale, crenate margin; at least some of the lower pinnae hastate, with two basal auricles subsp. *pachyrachis*
- Rachis less brittle; pinnae without a distinct pale, crenate margin; some lower pinnae usually with a single, acroscopic auricle at the base subsp. *hastatum*

Our recent studies show that relationships between these subspecies are more complicated than had previously been thought. As macromorphological characters such as can be used in the field are often unreliable, exospore and guard cell length (Table 4) must be measured to separate diploid from tetraploid subspecies when no cytological data are available (all measurements in Table 4 are from cytologically checked specimens). Morphologically intermediate, sterile hybrids between most subspecies exist, contributing to the confusion. Since many former identifications must be reassessed, the distribution of the subspecies within the Mediterranean area is not reliably known at present. Only two of them have been found within the area of our study.

Table 4. Ploidy level, exospore and stomata length in *Asplenium trichomanes*. Figures include the minimum and maximum (in parentheses), the mean (in bold), and the range of one standard deviation.

<i>Asplenium trichomanes</i>	Ploidy	Exospore length (μm)	Stomata length (μm)
subsp. <i>trichomanes</i>	2x	(22-)27- 29 -31(-42)	(22-)32- 36 -40(-51)
subsp. <i>inexpectans</i>	2x	(23-)27- 29 -31(-36)	(24-)33- 38 -43(-53)
subsp. <i>quadrivalens</i>	4x	(26-)32- 35 -38(-47)	(31-)40- 44 -49(-60)
subsp. <i>pachyrachis</i>	4x	(26-)32- 34 -37(-49)	(34-)41- 44 -47(-54)
subsp. <i>hastatum</i>	4x	(28-)32- 35 -38(-43)	(35-)39- 44 -49(-54)

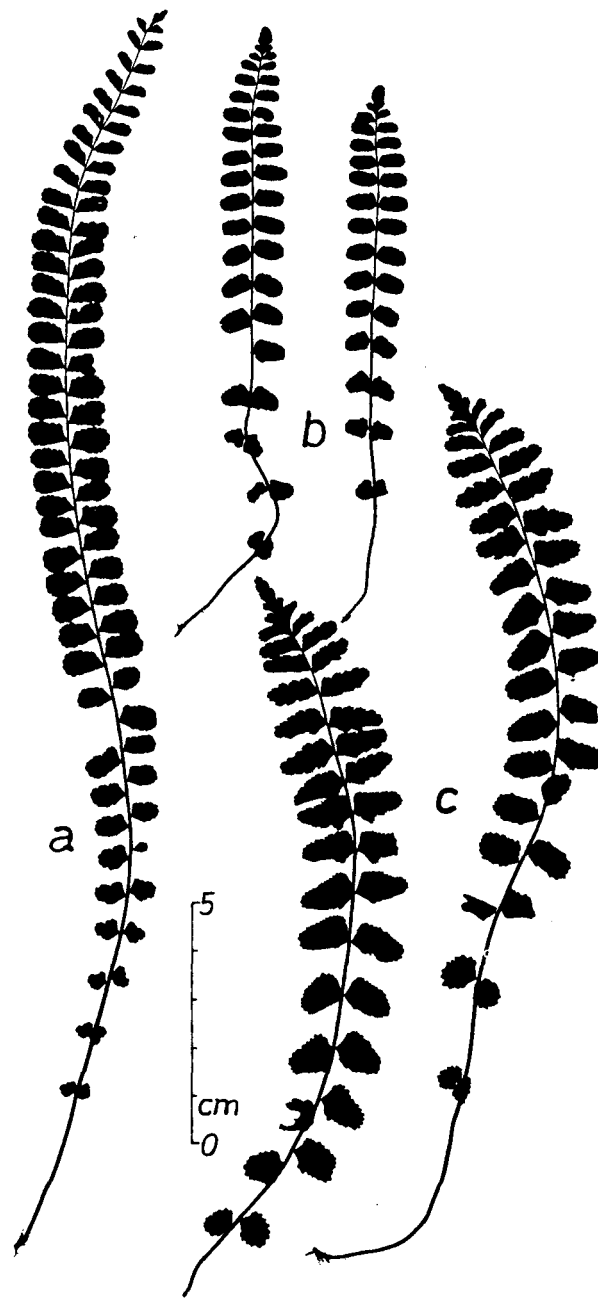


Fig. 4. Frond silhouettes of *Asplenium trichomanes*. – a, subsp. *quadri-valens* (RV-5104); b-c, subsp. *inexpectans* (b, RV-5124; c, RV-5165).

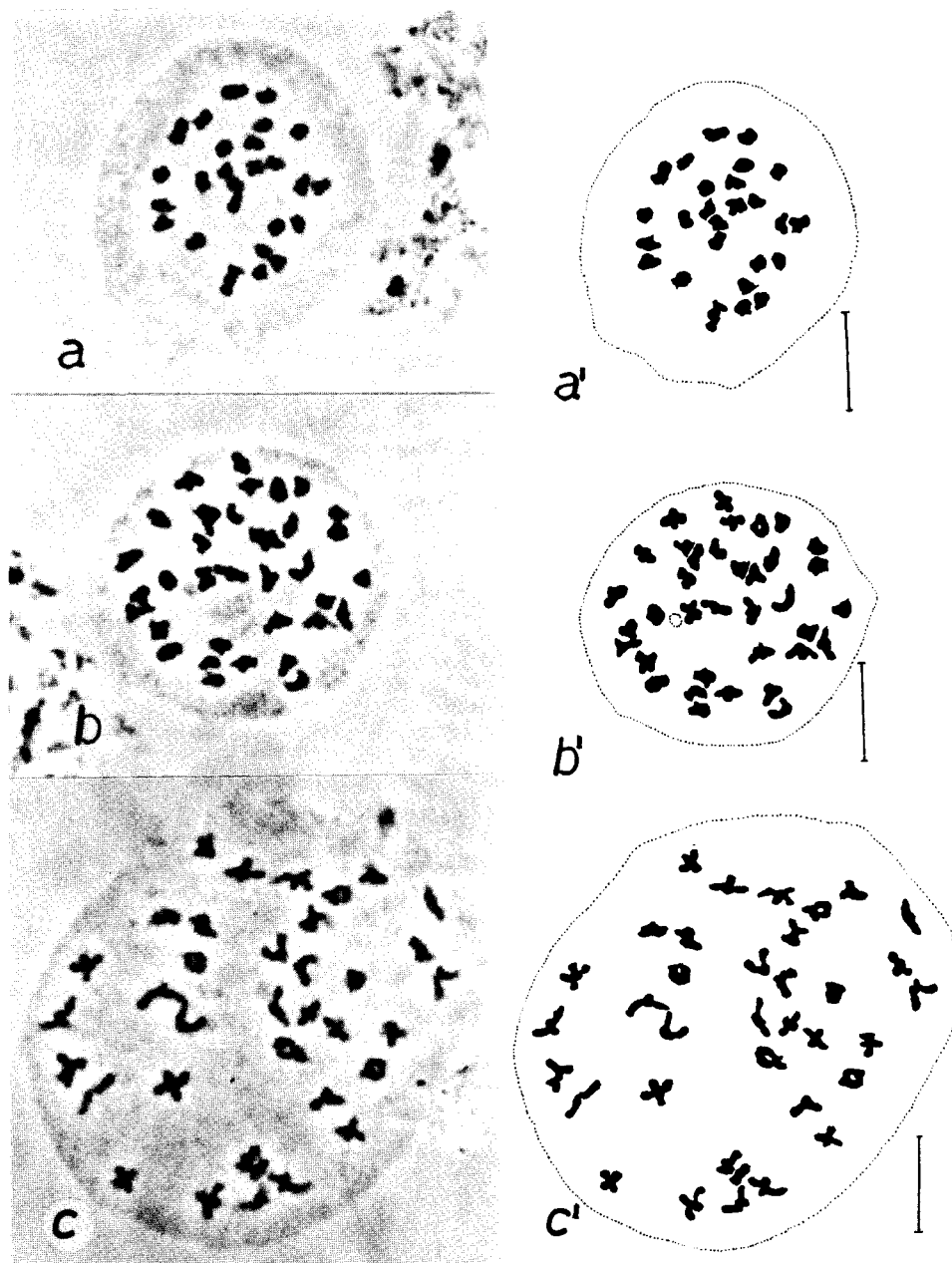


Fig. 5. Spore mother cells in meiosis (photographs and explanatory diagrams). – **a-a'**, *Anogramma leptophylla* (Ras-814), with $n = 26^{II}$; **b-b'**, *Asplenium obovatum* subsp. *obovatum* (Ras-821), with $n = 36^{II}$; **c-c'**, *A. trichomanes* subsp. *inexpectans* (RV-5124), with $n = 36^{II}$. Scale bar = 10 μm .

All specimens of *Asplenium trichomanes* subsp. *inexpectans* were collected on limestone and show the frond morphology typical of this subspecies (Fig. 4). Some were checked cytologically, to make sure that they are distinct from a morphologically very similar tetraploid taxon of central Europe and the Mediterranean, *A. trichomanes* subsp. *hastatum* H. Jess., that had also often been confused with subsp. *pachyrachis* (H. Christ) Lovis & Reichst. (Jessen 1995). Since many identifications based on morphology alone are wrong, the distribution of subsp. *inexpectans* is uncertain. It is however definitely known from Crete (Brownsey & Jermy 1973: 338). Our counts are the first made on material from the Peloponnesus.

Our specimens of *Asplenium trichomanes* subsp. *quadrialeans* were collected on rather acid rock, and not all showed the frond morphology typical of this subspecies (Fig. 4). We checked some of them cytologically (see above), all of which turned out to be tetraploid and thus differ from the similar but diploid subsp. *trichomanes*.

Cheilanthoid ferns

Detailed studies performed between 1965 and 1980, including genome analysis of natural and artificial hybrids, enabled Vida & al. (1983) to elucidate the relationships, taxonomy and nomenclature of the European *Cheilanthes* species; additional evidence sustaining their original hypothesis was provided by Rasbach & Reichstein (1982), and by Rasbach & al. (1983). A scheme of relationships (Vida & al. 1983: fig. 3) shows four ancestral diploids and three allotetraploid descendants.

Cheilanthes acrostica (Balb.) Tod. (Fig. 6a, 7a).

Mainland: near Ano Fanari, 5 May 1992, *Ras-816*. – Methana: E of Kifeli, rocky andesite outcrop along footpath, 3 May 1992, *RV-5063*; c. 300 m S of Vathi, rocky outcrop above roadside, 4 May 1992, *RV-5081*; coastal andesite outcrop of Cape Pounda, SSW of Megalohori, S of Vathi, E-exposed cliffs, c. 80 m, 4 May 1992, *RV-5087*. – Poros: Kalavria, limestone rocks along beach with *Quercus coccifera* on cape N of Daskalio Island, W of Poros, among *Cosentinia vellea*, *Selaginella denticulata*, 2 May 1992, *RV-5049*; Kalavria, E of Poros city, serpentine outcrop near the Zoodohos Piyi Monastery, 2 May 1992, *RV-5052*; Sferia, andesite rocks SE of Poros City, in deep rock crevices, c. 50 m, 6 May 1992, *Ras-828*.

Possibly due to its capacity to grow on different substrates (andesite, limestone, serpentinite), this allotetraploid is relatively common in the region. Pichi Sermolli (1992: 183) and Zimmer (1991: 231) provide distribution maps.

Cheilanthes guanchica Bolle (Fig. 6c, 9).

Poros: Sferia, andesite rocks SE of Poros City, among *Cheilanthes maderensis* and *C. acrostica*, under boulders along ridge, c. 80-90 m, 1 May 1992, *Ras-795*, *Ras-798*, *Ras-799*, *Ras-800*, *Ras-801*, *RV-5037* (= *Ras-796*: $\hat{n} = 60^{II}$), *RV-5038*; Sferia, in deep rock crevices along SW-exposed andesite slope, among *Asplenium obovatum*, *Cheilanthes acrostica* and *C. maderensis*, c. 50 m, 2 May 1992, *RV-5045*.

Cheilanthes guanchica, first considered a Canarian endemic, was subsequently found to be widespread in the Mediterranean area (Rasbach & al. 1977, Nardi & al. 1978, Rocha Afonso 1981, Pichi Sermolli 1990: map 7, Zimmer 1991) and on the Azores (Jermy & Viane, in prep.). It is to be looked for in suitable habitats along the western coast of Turkey. It occurs essentially on serpentinite (e.g., in Spain) and siliceous rocks (e.g. on granite, in Corsica and Sardinia). On Poros it grows exclusively at the base of large andesite boulders along the SW-exposed ridge SE of Poros city. Contrary to Zimmer's (1991) remark, the fronds do smell of coumarin.

As was to be expected, the plants cytologically checked turned out to be tetraploid (Fig. 9). This is the first count of the species made on Greek material.

Greek botanist should try to preserve the habitat of the population on Poros since it is very small and, same as the second known Greek occurrence on Ikaria (Zimmer 1991),

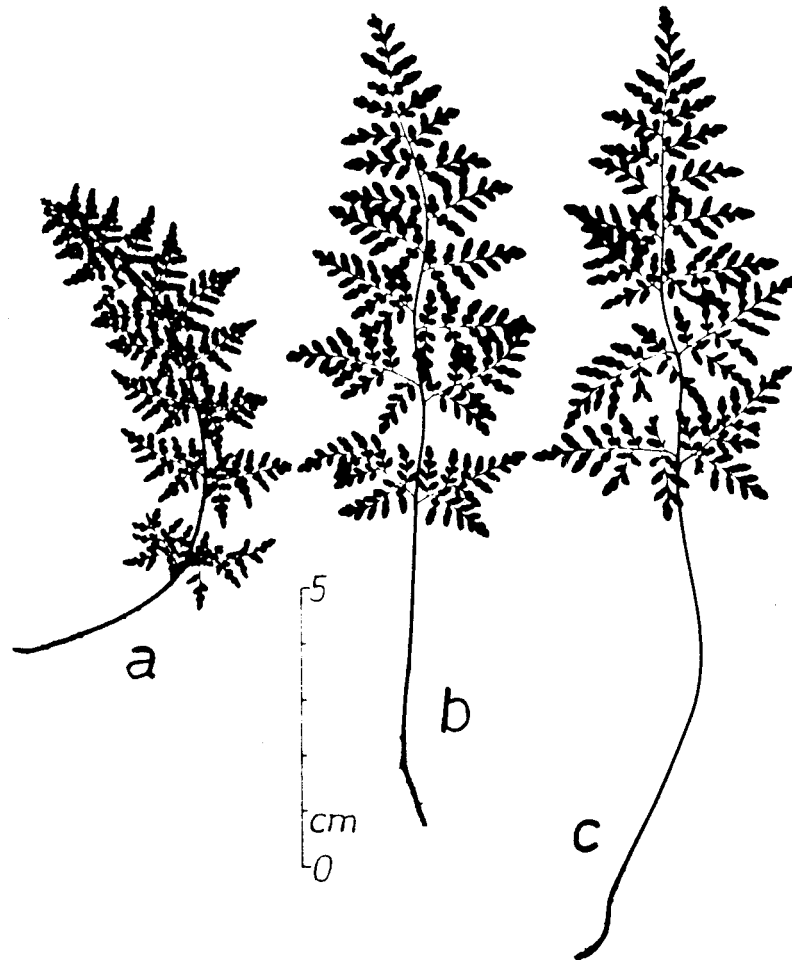


Fig. 6. Silhouettes of *Cheilanthes* fronds. – a, *C. acrostica* (Ras-828); b, *C. ×malacitensis* (RV-5043); c, *C. guanchica* (Ras-796).

very isolated from the main range of the species. The heaviest present threat are building activities.

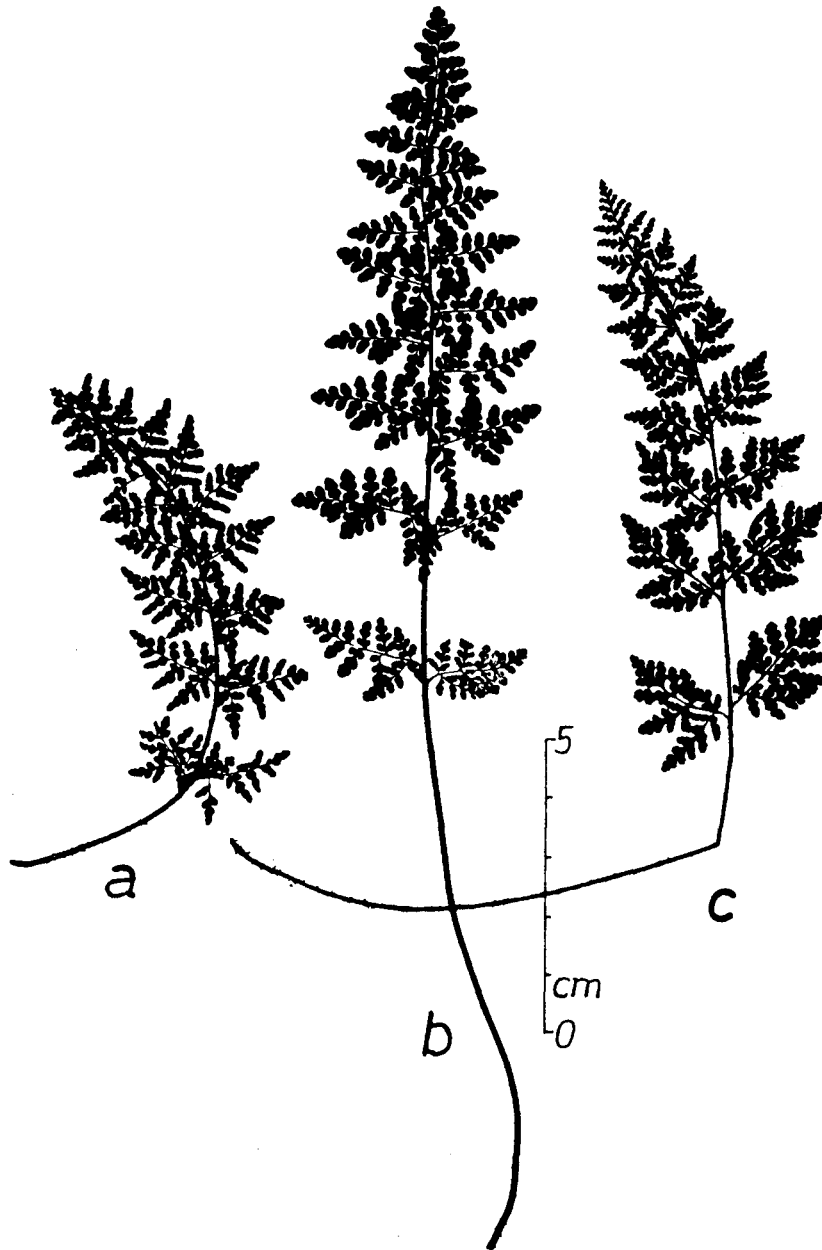


Fig. 7. Silhouettes of *Cheilanthes* fronds. – a, *C. acrostica* (Ras-828); b, *C. x marchettiana* (RV-5042); c, *C. maderensis* (Ras-827).

Cheilanthes maderensis Lowe (Fig. 7c).

Mainland: "Pantokrator"-limestone outcrop c. 1.3 km SE of junction between Epidavros-Kranidi and Galatas road, c. 220 m, 5 May 1992, *RV-5130*. – Methana: E of Kifeli, rocky andesite outcrop along footpath, 3 May 1992, *RV-5061*; c. 300 m S of Vathi, rocky outcrop above roadside, 4 May 1992, *RV-5080*; roadside above Vathi, 4 May 1992, *RV-5082*; Dritsaika, 4 May 1992, *Ras-810a*; coastal andesite outcrop of Cape Pounda SSW of Megalohori, S of Vathi, E-exposed cliffs, c. 80 m, 4 May 1992, *RV-5086*. – Poros: Sferia, SE of Poros City, in deep rock crevices along SW-exposed andesite slope, relatively common among *Cheilanthes acrostica*, *C. guanchica* and *C. ×marchettiana* c. 50 m, 2 May 1992, *RV-5044*, *RV-5047*; 6 May 1992, *Ras-827*, *Ras-829*.

Our collections confirm Heldreich's 1889 find for Poros, hitherto doubtful (Zimmer 1991: 227-228). As shown above, we also found *Cheilanthes maderensis* in several mainland localities. The species ranges from Madeira to Crete (see Pichi Sermolli 1990, Zimmer 1991), the Azorean locality needs confirmation. *Cheilanthes maderensis* is not rare in the explored area; it grows on limestone but seems to prefer the more acid andesite.

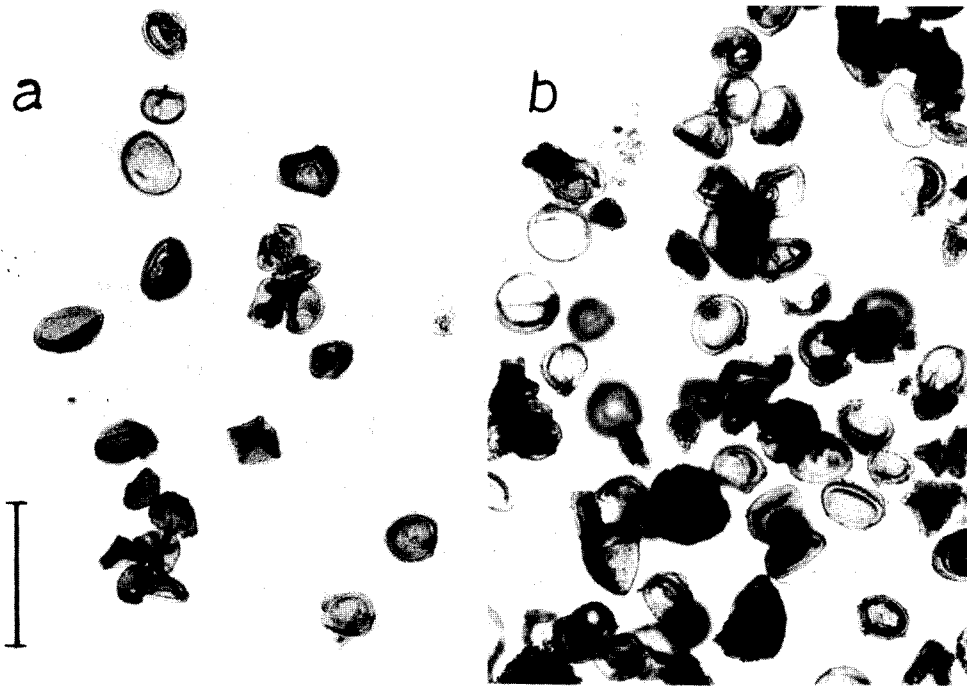


Fig. 8. Aborted spores of *Cheilanthes* hybrids. – a, *C. ×malacitensis* (*RV-5137*); b, *C. ×marchettiana* (*Ras-804*). – Scale bar = 0.1 mm.

Cheilanthes ×*malacitensis* Rasbach & Reichst. (= *C. acrostica* × *C. guanchica*; Fig. 6b, 8a, 10a).

Poros: Sferia, andesite ridge SE of Poros City, in deep rock crevice on SW-exposed slope among *Cheilanthes maderensis*, *C. guanchica* and *C. acrostica*, c. 50 m, 2 May 1992, RV-5043 (= *Ras-805*: $n = c. 30^{II}$ & 60^I); *ibid.*, 6 May 1992, RV-5137.

A description of this hybrid can be found in Rasbach & Reichstein (1982). The plants smell of coumarin and have aborted spores (Fig. 8a). Our new cytological results (Fig. 10a) agree with earlier ones for the artificial (Vida & al. 1983: 111) and natural hybrid (Rasbach & al. 1983: 59). This find of *Cheilanthes* ×*malacitensis* confirms its existence on Poros, doubtfully reported by Rasbach & Reichstein (1982) but ignored by Zimmer (1991). Otherwise, it is only known from the type locality in S Spain. This hybrid may be formed anew in the rare places where its parents grow together. Preservation of the Poros habitat of *C. guanchica* will also protect the hybrid.

Cheilanthes ×*marchettiana* Rasbach & al. (= *C. acrostica* × *C. maderensis*; Fig. 7b, 8b, 10b).

Methana: N of Kaimeni Hora, W-exposed andesite slope with *Pinus halepensis* woodland, c. 210 m, 5 May 1992, *Ras-811* ($n = c. 30^{II}$ & 30^I), RV-5092 (= *Ras-812*: $n = c. 30^{II}$ & 30^I); coastal andesite outcrop of Cape Pounda, SSW of Megalohori, S of Vathi,

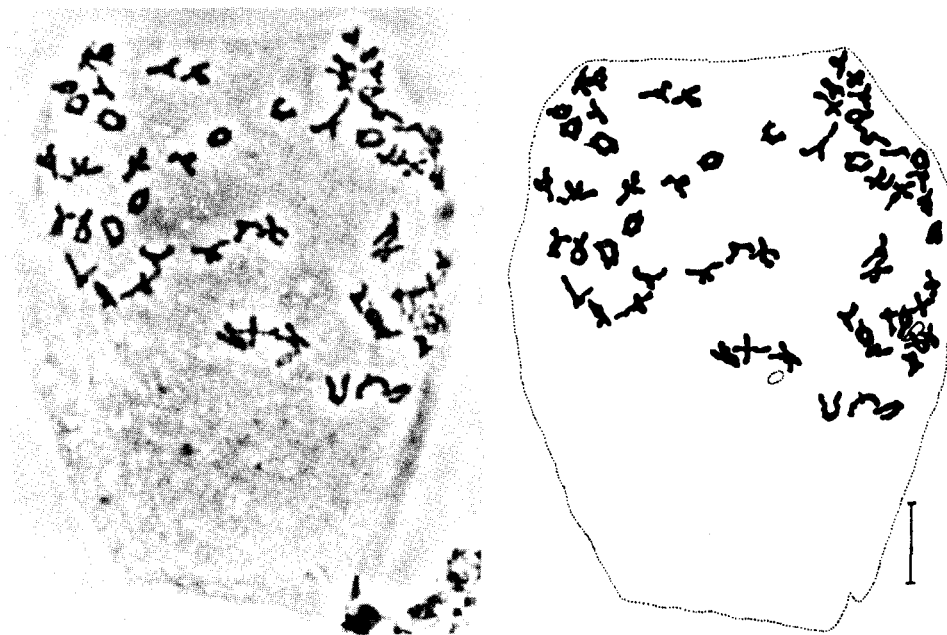


Fig. 9. Spore mother cell in meiosis (photograph and explanatory diagram) of *Cheilanthes guanchica* (RV-5037), with $n = 60^{II}$. – Scale bar = 10 μ m.

E-exposed cliffs, c. 80 m, 4 May 1992, *RV-5085*. – Poros: Sferia, andesite rocks SE of Poros City, 1 May 1992, *Ras-797* ($n = c. 30^{II}$ & 30^I), 2 May 1992, *Ras-802*; Sferia, wall remnants near last chapel on andesite ridge SE of Poros city, c. 80 m, 2 May 1992, *RV-5042* (= *Ras-804*); Sferia, in deep rock crevices along SW-exposed andesite slope, among *Cheilanthes acrostica*, *C. guanchica* and *C. maderensis*, c. 50 m, 2 May 1992, *RV-5048* (= *Ras-803*).

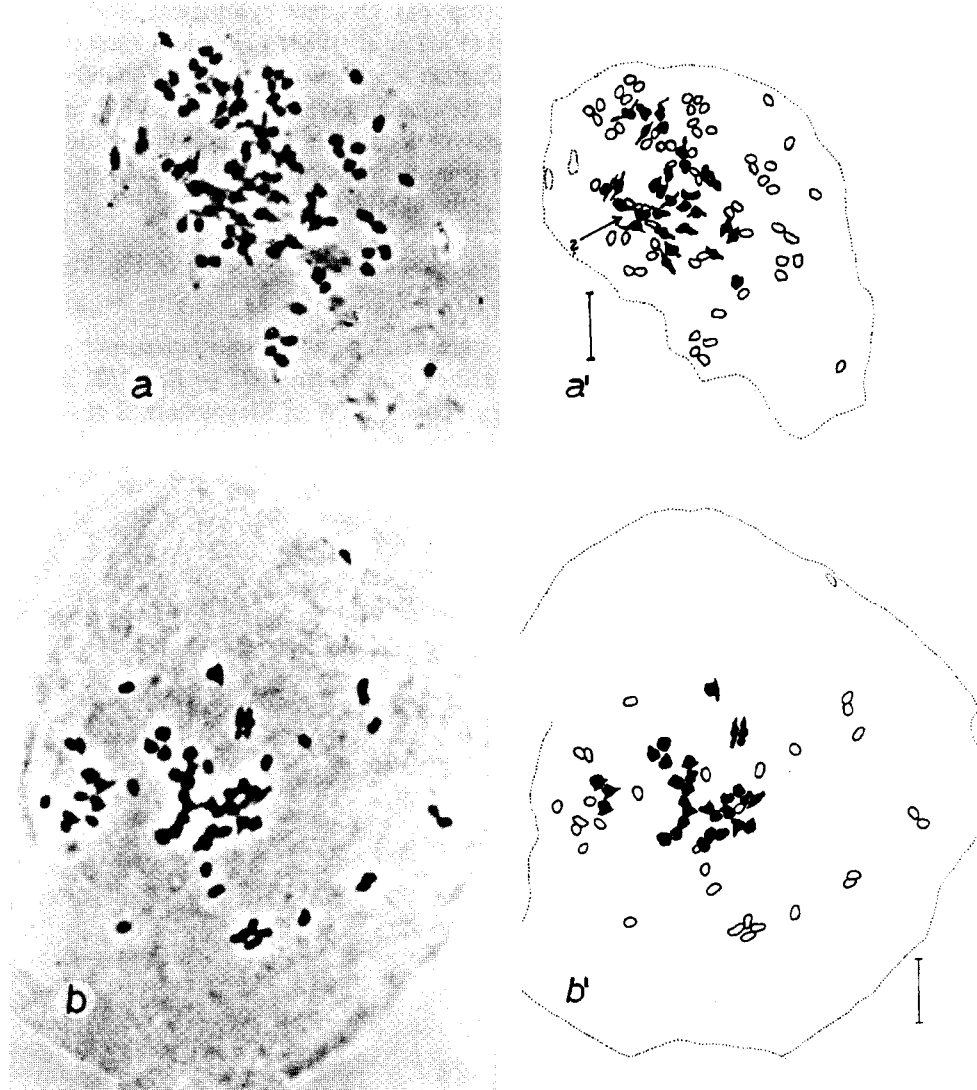


Fig. 10. Spore mother cells in meiosis (photographs and explanatory diagrams, with pairs in black and univalents in outline). – a-a', *Cheilanthes xmalacitensis* (*RV-5043*), tetraploid with $n = c. 30^{II}$ and 60^I ; b-b', *C. xmarcsettiana* (*Ras-812*), triploid with $n = c. 30^{II}$ and 30^I . – Scale bar = 10 μ m.

The plants smell of coumarin and have aborted spores (Fig. 8b); morphological details can be found in Rasbach & al. (1983: 56-58). Our cytological results (Fig. 10b) are the first obtained on Greek material and agree with those of Vida & al. (1983: 110-111) and Rasbach & al. (1983: 56). So far, *Cheilanthes ×marchettiana* is only known from Italy (Rasbach & al. 1983) and Greece (Zimmer 1991). It is not a rare plant, and seems to form easily where both parents grow together.

Cosentinia vellea (Aiton) Tod. subsp. *vellea*

Mainland: “Pantokrator” limestone outcrop c. 1.3 km SE of junction between Epidavros-Kranidi and Galatas road, c. 220 m, 5 May 1992, *RV-5131* ($E = 62 \mu\text{m}$). – Methana: E of Kifeli, rocky andesite outcrop along footpath, 3 May 1992, *RV-5060* ($E = 65 \mu\text{m}$); c. 300 m S of Vathi, rocky outcrop above roadside, 4 May 1992, *RV-5079* ($E = 64 \mu\text{m}$); N of Kaimeni Hora, W-exposed andesite slope, c. 210 m, 5 May 1992, *RV-5095* ($E = 66 \mu\text{m}$), *RV-5096* ($E = 66 \mu\text{m}$), *RV-5097*. – Poros: Kalavria, limestone rocks along beach with *Quercus coccifera* on cape N of Daskalio Island, W of Poros, among *Asplenium ceterach*, *Selaginella denticulata*, 2 May 1992, *RV-5051* ($E = 64 \mu\text{m}$); Kalavria, central Poros, serpentine outcrop along roadside, c. 155 m, 2 May 1992, *RV-5056*; Sferia, SE ridge above Poros City, 2 May 1992, *RV-5058* ($E = 69 \mu\text{m}$).

The systematic position of *Cosentinia* needs further study (see, e.g., Pichi-Sermolli 1985). Kramer & Green (1990) place it in the *Cheilantheoideae*, as a synonym of *Cheilanthes*. The first author (RV) believes that it is close to the essentially Neotropical *Jamesonia* Hook. & Grev. (incl. *Eriosorus* Fée) in the *Taenitidoideae*.

Two subspecies, the diploid *Cosentinia vellea* subsp. *bivalens* (Reichst.) Rivas Mart. & Salvo and the tetraploid subsp. *vellea*, are here recognized (they are disregarded by Jermy & Paul 1993). Apart from chromosome number, they differ in equatorial diameter of spores and stomata size (Table 5). On the evidence of spore data, all our specimens belong to subsp. *vellea*.

So far, the diploid subspecies is only known from southern Spain, the Canary Islands (Jalas & Suominen 1972: 53, Badré & Reichstein 1983) and, judging from microcharacters, from the eastern borders of the *Flora iranica* area where it seems to be the more common subspecies. Tetraploid *Cosentinia vellea* subsp. *vellea* is new for the flora of Poros, and is probably more widespread in the Aegean than given by Zimmer (1991). Within the area studied, it does not seem to be restricted to a particular substrate, growing on limestone, andesite, and other volcanic rocks.

Table 5. Ploidy level, equatorial spore diameter, and stomata length in *Cosentinia vellea*. Figures include the minimum and maximum (in parentheses), the mean (in bold), and the range of one standard deviation.

<i>Cosentinia vellea</i>	Ploidy	Equatorial spore diameter (μm)	Stomata length (μm)
subsp. <i>bivalens</i>	2x	(42-)50- 53 -56(-60)	(29-)34- 37 -40(-50)
subsp. <i>vellea</i>	4x	(54-)62- 66 -70(-77)	(36-)39- 42 -45(-49)

***Notholaena marantae* (L.) Desv.**

Mainland: c. 3 km S of Ano Fanari, west of roadside, W-exposed mixed serpentine and Jurassic limestone outcrop with *Cheilanthes acrostica*, *C. maderensis*, *Asplenium ceterach* and *Selaginella denticulata*, c. 350 m, 5 May 1992, RV-5125-5126 (= Ras-817).

Notholaena marantae has a disjunct distribution, with three partial areas: Central and Mediterranean Europe (Jalas & Suominen 1972: 52), tropical NE Africa, and Himalayas to SW China (Pichi Sermolli 1979: 190). Within each area populations are again isolated, being limited to serpentinite or other rocks containing manganese. Ours is a new record for Peloponnesus. According to Zimmer's (1991) map it mainly occurs in inland localities in N Greece.

Other fern species***Anogramma leptophylla* (L.) Link (Fig. 5a).**

Methana: E of Kifeli, rocky andesite outcrop along footpath eastwards to terraces, 3 May 1992, RV-5062; N of Makrilongos, N-exposed scree of andesite boulders, c. 350 m, 3 May 1992, Ras-807a ($n = 26^{\text{II}}$); RV-5073; N of Kaimeni Hora, along fault between limestone and andesite areas, an andesite boulders, c. 200 m, 5 May 1992, Ras-814 (cytological fixing: $n = 26^{\text{II}}$). – Poros: Sferia, among *Cheilanthes acrostica*, *C. maderensis* and *C. guanchica* in deep rock crevices along SW-exposed andesite slope, c. 60 m, 2 May 1992, RV-5046; Kalavria, E of Poros city, serpentine outcrop near the Zoodohos Piyi Monastery, 2 May 1992, RV-5053.

This species has a wide total distribution (Pichi Sermolli 1979: 183). In Europe, it is most common in the Mediterranean area (Jalas & Suominen 1972: 58). Our cytological data (see above) are the first obtained on Greek material. They agree with other recent reports (Kurita 1971, Rasbach & Reichstein 1990; Lovis & al. 1993) giving the meiotic chromosome number as $n = 26^{\text{II}}$ (not 29^{II} as previously reported by, e.g., Kramer & Green 1990).

***Dryopteris pallida* (Bory) Maire & Petitm.**

Mainland: c. 1 km S of Ano Fanari, among limestone rocks sheltered by *Quercus coccifera*, c. 480 m, 5 May 1992, RV-5116.

This essentially Central and E Mediterranean species usually grows on limestone. Distribution maps are given by Jalas & Suominen (1972: 102) and Pichi Sermolli (1979: 213). It is locally rare.

***Polypodium cambricum* L. (= *P. australe* Fée)**

Methana: N of Makrilongos, N-exposed scree of andesite boulders, c. 350 m, 3 May 1992, RV-5067, RV-5068; scree with *Arbutus*, *Acer*, and *Hypericum empetrifolium*, along track from Palea Loutra to Ayios Nikolaos, c. 200 m, 3 May 1992, RV-5074; coastal andesite outcrop of Cape Pounda, SSW of Megalohori, S of Vathi, W-exposed

scree, c. 80 m, 4 May 1992, *RV-5090*; N of Kaimeni Hora, interior slope of crater with large andesite boulders, c. 220 m, 5 May 1992, *RV-5098*; Poros: Sferia, andesite ridge S of Poros city, 1 May 1992, *RV-5040*.

We found this essentially Mediterranean and calcicole taxon on andesite, close to the sea. For distribution maps, see Jalas & Suominen (1972: 113) and Pichi Sermolli (1979: 195).

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