



## **Asplenium veneticolor, a new spleenwort (Aspleniaceae, Pteridophyta) from Cuba**

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LEDIS REGALADO GABANCHO, CARLOS SÁNCHEZ &amp; CARMEN PRADA

## *Asplenium veneticolor*, a new spleenwort (*Aspleniaceae*, *Pteridophyta*) from Cuba

### Abstract

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A new spleenwort from E Cuba is described and illustrated: *Asplenium veneticolor*. It is closely related to *A. dentatum*, a widespread species in Cuba. In nature it can be recognised by its distinctive bluish green (venetian) colour, on dry material moreover by its fertile leaf blades being pinnatifid at apex, with oblong to oblanceolate pinnae. Stem scales, indusia and spores provide additional criteria that support the distinctness of the two taxa.

Key words: ferns, taxonomy, micromorphology, *Asplenium dentatum*, Greater Antilles.

### Introduction

*Asplenium* L. is a cosmopolitan genus with c. 700 species, showing a great variety of leaf shapes and considerable taxonomic complexity.

For the Americas several regional treatments exist, e.g., for North America (Wagner & al. 1993), Mesoamerica (Adams 1995), Mexico (Mickel & Smith 2004) including Chiapas (Smith 1981) and Oaxaca (Mickel & Beitel 1988), Guatemala (Stolze 1981), Puerto Rico (Proctor 1989), Jamaica (Proctor 1985), the Lesser Antilles (Proctor 1977), Venezuela (Morton & Lellinger 1966, Smith 1995), Ecuador (Stolze 1986) and Peru (Tryon & Stolze 1993). All these treatments adopt a narrow species concept in some complexes, based on the degree of leaf dissection. They concur in using arbitrary limits in some critical species groups and recommend a detailed analysis of them.

In Cuba, the first taxonomic treatment for the *Aspleniaceae* was published in the “Flora de la República de Cuba” (Sánchez & Regalado Gabancho 2003). In that contribution some taxonomic problems remained unsettled due to the scarcity of material or the lack of opportunity for the required in-depth study.

One such case is the highly variable neotropical *Asplenium dentatum* L. complex. Whereas we still need a critical revision, considering the entire morphological variation found in the complex in its whole distribution area, at least we can contribute here to a better understanding of this

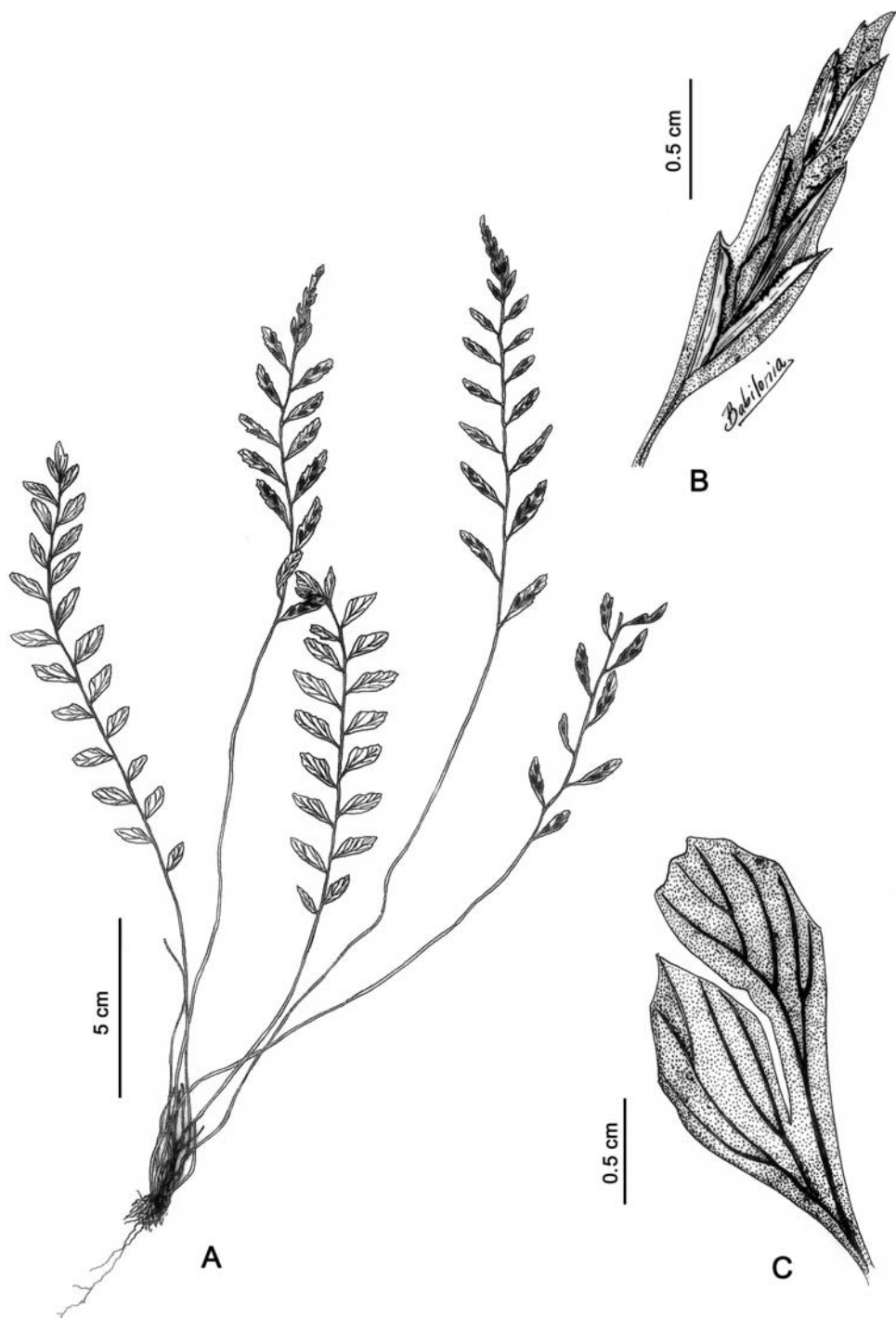


Fig. 1. *Asplenium veneticolor*, from the type specimen. – A: habit; B: pinna of a fertile leaf, showing the sori;

C: apex of a sterile leaf. – Detail drawings by O. Babilonia.

complex in Cuba. The only cytological data so far available are by Wagner's (1963) report of a hexaploid cytotype for Florida and Walker's (1973) of a triploid hybrid from Jamaica.

*Asplenium dentatum* occurs in most of Cuba (Regalado Gabancho & Sánchez 2003), being represented in 30 of the 36 phytogeographical districts established by Borhidi & Muñiz (1986). Sánchez & Regalado Gabancho (2003: 54) indicated the existence of four morphological groups in *A. dentatum* sensu lato, based on subtle differences in lamina and pinna shape, with some specimens showing intermediate features. Even though no cytological analysis of Cuban plants has yet been performed, a detailed study of micromorphological features of stem scales, epidermis, indusia and spores, taking into account these morphological groups, has now resulted in the recognition of two different taxa in Cuba: *A. dentatum* proper, and a new species, described below.

## Material and methods

The Cuban and other Antillean specimens of *Asplenium dentatum* studied by us, with the corresponding herbaria, are listed in the Appendix. All specimens seen of the new species, *A. veneticolor*, are enumerated in the main text.

Spore length (major equatorial diameter, excluding perispore) was measured on 30 spores of each of 8 samples of *A. veneticolor* and 12 samples of *A. dentatum*. The minimum, maximum and mean values were calculated, tabulated (Table 1) and graphically represented in a box-and-whisker plot (Fig. 6).

## Results

*Asplenium veneticolor* L. Regalado & C. Sánchez, **sp. nov.**

Holotype: Cuba, prov. Granma, "Guisa, El Caidizo, road from Guisa to Victorino, mogotes", 29.5.2002, Sánchez & Bécquer HFC 80038 (HAJB; isotypes: B, HAC) – Fig. 1.

Filices in vivo veneto colore; folia dimorpha: apex laminarum sterilium flabellatus interdum trilobatus, laminae fertiles ad apicem pinnatifidae; squamae caulis lanceolatae in apicem filiformem attenuatae.

Epipetric fern; stem erect, 5-7 mm thick, distally covered with lanceolate-attenuate or deltate, dark brown, iridescent scales with a rounded base and filiform tip, gland-tipped when young. *Leaves* dimorphic, clustered, 4.5-31 cm long; stipe adaxially sulcate, stramineous, brownish at base; blade pinnate, chartaceous, bluish green in nature, glabrous; rachis green to stramineous, marginate, glabrous. *Sterile leaves* decumbent, 4.5-19 cm long; stipe narrowly winged or marginate, 3-8.5 cm long, 0.7-1.3 mm thick; blade oblong, measuring 3-13 × 0.7-2.7 cm, truncate to rounded at base, with a flabellate, sometimes trilobate apex; pinnae in 4-10 pairs, shortly stalked, alternate, ascending, obovate, measuring 0.5-1.9 × 0.25-0.5 cm, obtuse to subacute at apex, inequilaterally cuneate and bearing inconspicuous, brown, hair-like scales at base, with entire to slightly denticulate margins. *Fertile leaves* erect, 17-31 cm long; stipe marginate, 7-13.5 cm long, 0.7-1.5 mm thick; blade linear-oblong, measuring 7.3-17.3 × 1.2-2.3 cm, cuneate at base, pinnatifid at apex; pinnae in 7-12 pairs, stalked, alternate, ascending to slightly falcate, oblong to obovate-lanceolate, measuring 1.1-2.1 × 0.2-0.4 cm, obtuse to acute at apex, inequilaterally cuneate at base, with slightly to conspicuously crenate-dentate margins; veins forked once or twice. *Sori* 2-3 to each side of the costa, oblong, 1.9-4.1 mm long; indusium 0.3-0.6 mm broad, greenish when dry, entire, slightly repand. *Spores* monoletic, ellipsoidal, measuring 20-25 × 22.5-37.5 × 20-25 μm; perispore lophate, with narrow or broad lophae, more or less echinate and perforate at margins or with blunt spine-like elements, sometimes linked at base by shallow ridges; lacunar surface almost psilate or with a combination of few crests, echinae and perforations. *Spores* with variable morphology can be found in some specimens (Fig. 5).

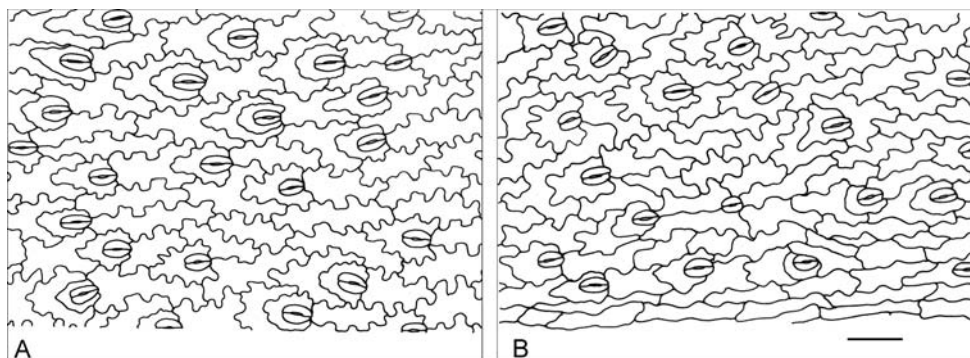


Fig. 2. Cell patterns of the abaxial leaf epidermis – A: *Asplenium dentatum*, Regalado & al. 42368 (HAC); B: *A. veneticolor*, HFC 80036 (HAJB). – Scale bar = 100  $\mu$ m.

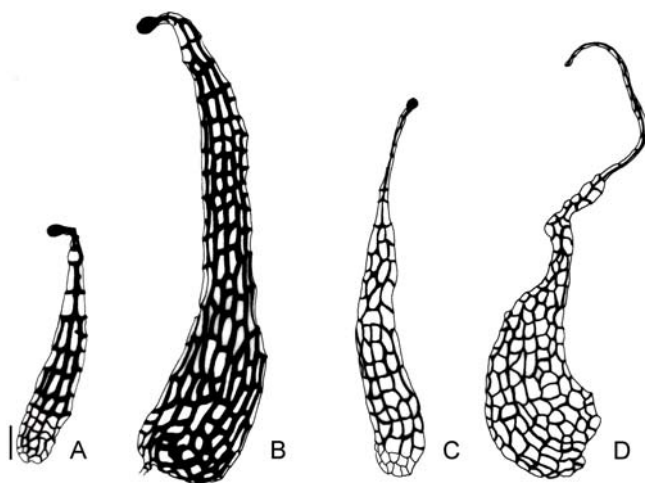


Fig. 3. Stem scales – A-B: *Asplenium dentatum*, HFC 38613 (HAJB); C: *A. veneticolor*, HFC 80006 (HAJB); D: *A. veneticolor*, HFC 80007 (HAJB). – Scale bar = 100  $\mu$ m.

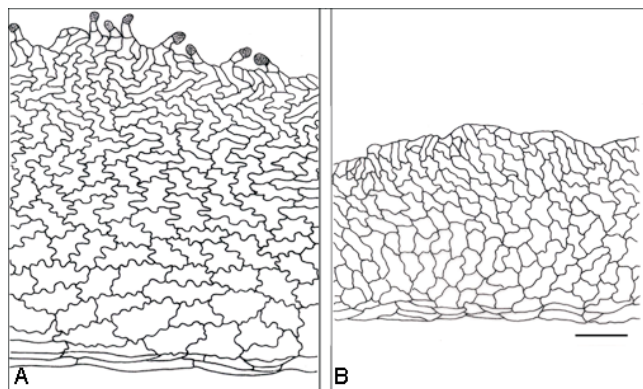


Fig. 4. Indusium – A: *Asplenium dentatum*, Oviedo & al. 42419 (HAC); B: *A. veneticolor*, Clément 2443 (HAC). – Scale bar = 100  $\mu$ m.

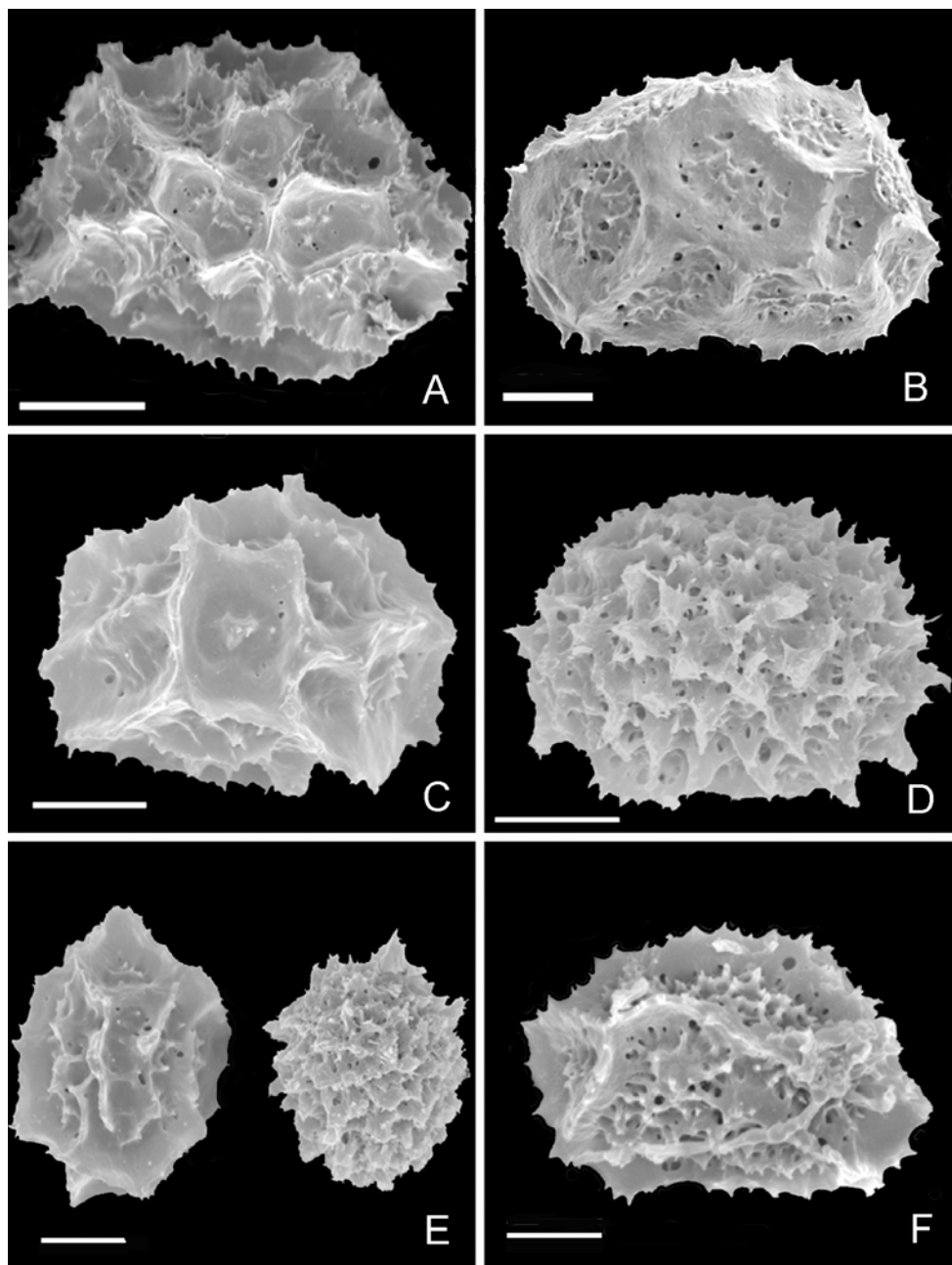


Fig. 5. Scanning electron micrographs of spores – A: *Asplenium dentatum*, Ekman 6101 (S); B-F: *A. veneticolor*, B: Ekman 10366 (S), C-E: HFC 80006 (HAJB), F: HFC 80038 (HAJB). – Scale bar = 10  $\mu$ m.

Table 1. Spore length values (minimum, mean, maximum) of Cuban specimens of *Asplenium veneticolor* and *A. dentatum*. Two specimens of each HFC 43417 and HFC 21279 were studied.

Species	Specimen	Spore length values [ $\mu\text{m}$ ]
<i>A. veneticolor</i>	<i>Ekman 10366</i>	(27.5-)30(-35)
	<i>HFC 80036</i>	(25-)28.83(-35)
	<i>Clément 2443</i>	(25-)31.58(-35)
	<i>HFC 80038</i>	(25-)30(-35)
	<i>HFC 80028</i>	(22.5-)27.87(-32.5)
	<i>HFC 80007</i>	(30-)32.91(-37.5)
	<i>HFC 80005</i>	(27.5-)29.75(-32.5)
	<i>HFC 80006</i>	(22.5)26.83(-30)
<i>A. dentatum</i>	<i>Núñez 42418</i>	(30-)33.91(-37.5)
	<i>HFC 72956</i>	(40-)43.5(-47.5)
	<i>HFC 43417(1)</i>	(45-)49.1(-52.5)
	<i>HFC 43417(2)</i>	(35-)40(-45)
	<i>HFC 66671</i>	(30-)37.6(-45)
	<i>HFC 65706</i>	(27.5-)32.9(-37.5)
	<i>HFC 69684</i>	(42.5-)47.5(-50)
	<i>HFC 60463</i>	(35-)39.1(-45)
	<i>HFC 21279(1)</i>	(30-)34.66(-37.5)
	<i>HFC 21279(2)</i>	(22.5-)25.9(-30)
	<i>Caluff 1097</i>	(22.5-)23.58(-27.5)
	<i>Ekman 6101</i>	(32.5-)36.25(-40)

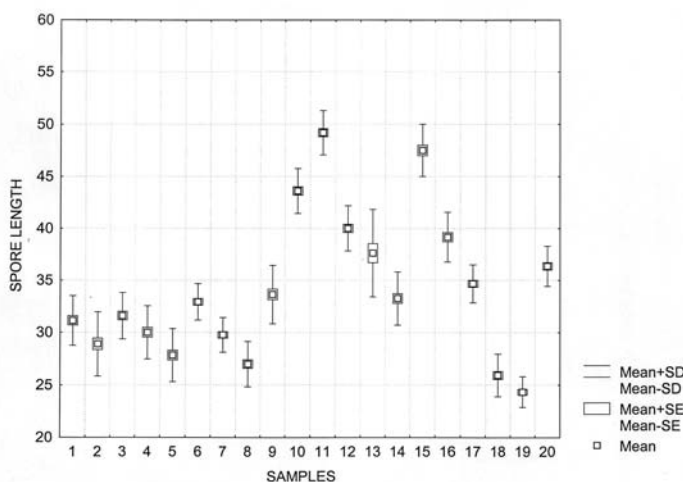


Fig. 6. Box-and-whisker plot of spore length of Cuban specimens of *Asplenium veneticolor* (1-8) and *A. dentatum* (9-20). – 1: *Ekman 10366*, 2: *HFC 80036*, 3: *Clément 2443*, 4: *HFC 80038*, 5: *HFC 80028*, 6: *HFC 80007*, 7: *HFC 80005*, 8: *HFC 80006*, 9: *Núñez 42418*, 10: *HFC 72956*, 11: *HFC 43417(1)*, 12: *HFC 43417(2)*, 13: *HFC 66671*, 14: *HFC 65706*, 15: *HFC 69684*, 16: *HFC 60463*, 17: *HFC 21279(1)*, 18: *HFC 21279(2)*, 19: *Caluff 1097*, 20: *Ekman 6101*.

*Etymology.* – The epithet refers to the bluish green colour of the plants in nature, a tinge called venetian in Dade's (1949) terminology.

*Distribution and habitat.* – Eastern Cuba: Holguín and Granma provinces. Epipetric on limestone rocks, in evergreen forests and “mogote” vegetation, on calcareous rocky banks with abundant semi-decayed humus, up to 600 m.

*Additional specimens seen.* – CUBA: PROV. HOLGUÍN: Mayarí, Sierra de Nipe, 5.1940, *Carabia 4034* (HAC); Mayarí, Miranda, Cayo del Rey, Lomas del Cubano Libre, 28.12.1940, *Clément 2443* (HAC); Bayate, Cayo del Rey, in the Cañon of Canapú, on limestone rocks, 6.9.1914, *Ekman 2755* (S); Sierra de Nipe, in sylvia ad flum. Canapú, locis umbrosis (ad ‘diente de perro’), 11.2.1920, *Ekman 10366* (S). – PROV. GRANMA: Guisa, El Caidizo, Road from Guisa to Victorino, mogotes, 29.5.2002, *Sánchez & Bécquer HFC 80028* (HAJB) and *80036* (HAJB); Guisa, road from Guisa to Mogote Caidizo, 28.5.2002, *Sánchez & Bécquer HFC 80005* (HAJB); Guisa, road from Guisa to Mogote Victorino, 28.5.2002, *Sánchez & Bécquer HFC 80006*, *80007* and *80008* (HAJB).

## Discussion

*Asplenium dentatum* L. was lectotypified by Morton & Lellinger (1966: 25) with Plumier (1705: t. 101, fig. c), presumably based on a specimen from Haiti, which is a recognizable representation of the species to which the name *A. dentatum* has been applied. 13 sheets of *A. dentatum* from Jamaica, Hispaniola, Puerto Rico and Trinidad we studied (see Appendix) all match the concept of *A. dentatum* adopted by Morton & Lellinger (1966), Proctor (1985), Wagner & al. (1993), Adams (1995), Sánchez & Regalado (2003) and Mickel & Smith (2004).

Both *Asplenium dentatum* and *A. veneticolor* have dimorphic leaves. They mainly differ in the shape of apex and pinnae of the fertile leaf blades. In *A. veneticolor* the apex is pinnatifid and the pinnae are oblong to oblanceolate (Fig. 1A), whereas in *A. dentatum* the apex consists of a conform, rhombic or sometimes flabellate pinna and the lateral pinnae are rhombic (Sánchez & Regalado 2003: 53). The colour of the leaf blades in live plants of *A. veneticolor* has a characteristic bluish green hue instead of the dark green colour of *A. dentatum*. These macromorphological features of *A. veneticolor* are not comprised in the range of variation described for *A. dentatum* in the above-mentioned floras.

Regarding micromorphological characters, *Asplenium veneticolor* and *A. dentatum* mostly differ in features of the stem scales, indusia and spores. An analysis of the abaxial leaf epidermis does not show clear-cut differences. Epidermal patterns are similar; stomata are generally polycytic, but anomocytic stomata can be observed in both taxa (Fig. 2).

Stem scales have a divergent tip in both species, but it is filiform in *Asplenium veneticolor* and attenuate in *A. dentatum*; the anticlinal cell walls are slightly thicker in the latter. In both, young scales end in a gland cell (Fig. 3).

Indusium features are among the most useful for distinguishing these species. In all examined specimens of *Asplenium dentatum* (Appendix) the indusium margin bears  $\pm$  numerous marginal 2-3-cellular glandular hairs, also mentioned by Adams (1995) for Mesoamerican plants; such hairs are lacking in *A. veneticolor*. Morphology and arrangement of cells in the indusium are also distinctive of either species (Fig. 4).

As to spore morphology, both species have a lophate perispore, the surface of lacunae being psilate to cristate, microechinate or perforate (Fig. 5B-F). In some specimens of *Asplenium veneticolor*, the spores of some sporangia bear blunt spine-like elements, sometimes linked at base by shallow ridges, while those of other sporangia are of the lophate type. In several of the analysed samples of *A. dentatum* the spores are abortive; in well-formed spores the perispore was consistently lophate, with acute microechinate, rarely perforate lophae and generally smaller lacunae than in *A. veneticolor* (Fig. 5A).



Mean values of spore length (Table 1, Fig. 6) range from 26.8 to 32.9  $\mu\text{m}$  in *Asplenium veneticolor* and from 23.58 to 49.1  $\mu\text{m}$  in *A. dentatum*. *A. veneticolor* shows a relatively narrow range of spore sizes; in contrast, in *A. dentatum* the variation of mean spore length is high. Previous data for *Asplenium* and other pteridophyte genera (e.g., Bouharmont 1968, Barrington & al. 1986, Pangua & al. 1989, Viane & al. 1996) demonstrate that there is a good correlation between ploidy level and spore size.

Our results are consistent with the assumption that *Asplenium veneticolor* has a uniform ploidy level, whereas in *A. dentatum* more than one ploidy level may exist. Indeed, Walker (1973) found triploid *A. dentatum* in Jamaica, likely resulting from a cross between diploid and tetraploid plants; and Wagner (1963) reported a hexaploid from Florida. Among the Cuban material of *A. dentatum*, mean values of spore length may differ by more than 20  $\mu\text{m}$  (samples 11 and 19), which again might best be explained by the existence of different ploidy levels. In some cases (samples 11 vs. 12 and 17 vs. 18) size differences of about 10  $\mu\text{m}$  between individuals of the same locality indicate that plants with different ploidy levels might grow side by side, as has been demonstrated in other species complexes of *Asplenium* (Walker 1973, Rasbach & al. 1990). If such an assumption is confirmed, it would also explain the abundance of specimens with abortive spores among the studied material of *A. dentatum*. However, a cytological study of this group is needed to justify the above assumption.

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## Appendix

### 1. Examined specimens of *Asplenium dentatum* L. from Cuba

CUBA: PROV. PINAR DEL RÍO: Sumidero, mogotes de la Sierra Sumidero, 13.12.1978, *Bisse & al. HFC 38613* (HAJB, JE); southern slope of Sierra de la Güira, near Cabañas de Los Pinos, 15.10.2003, *Regalado & Ventosa 42355* (HAC); Mogote Pico Chico, epipetric, 14.2.1997, *Sánchez & al. HFC 72956* (HAJB); Sierra del Infierno, Hoyo de Los Cimarrones, riverbed of Palmarito River, 8.1991, *Sánchez HFC 69684, 69689, 69696* (HAJB); San Cristóbal, Soroa, 1.1985, *Caluff 1097* (BSC); San Cristóbal, north-eastern region of Soroa, between Los Hoyos and Río Hondo, 20.7.1975, *Bisse & Meyer HFC 26776* (HAJB); Bahía Honda, on rocks, San Claudio, 11.1898, *Graves* (S). — PROV. HABANA: Caimito, Sierra de Anafe, northern slope, on limestone, 22.11.1986, *Duharte HFC 60463* (HAJB); Caimito, Loma Esperón, in fissur rupium, 4.5.1914, *Ekman 667* (S); San José de las Lajas, Lomas de Camoa, limestone hills c. 25 km south east of Havana, in thickets or low forest, on shaded rocks, 7.11.1921, *Ekman 13458* (S); Boca de Canasí, semi decayed forest of southern spur of the sierra, 30.10.2004, *Núñez 42418* (HAC). — PROV. CAMAGÜEY: Hoyo de Bonet, in ravines, 5.1978, *Sánchez HFC 43417* (HAJB), *ibid.*, 3.1986, *Méndez 3036* (BSC). — PROV. SANTIAGO DE CUBA: Monte Líbano, Hongolosongo, 17.10.2004, *Oviedo & al. 42419* (HAC); Comtramaestre, ravines of river, mogote near la Pintadilla, 18.4.1989, *Dietrich & al. HFC 66671* (HAJB); Guamá, Sierra Maestra, El Uvero, on the valley of El Uvero River, 2.1972, *Bisse HFC 21279* (HAJB); Guamá, road between La Granjita and La Alcarraza, 30.5.1988, *Álvarez & al. HFC 65706* (HAJB, JE); around La Tabla, Finca La Angelita, III Frente, cafetales, 2.1991, *Caluff & Shelton 25937* (BSC); Monte Real, Nima Nima, epipetric, 10.1984, *Caluff & Medina 890* (BSC). — PROV. HOLGUÍN: Bayate, on a stone at the base of the Loccoroma hill, 18.6.1915, *Ekman 6101* (S); Pinares de Mayarí, Sierra de Nipe, La Chivera, 17.11.2004, *Regalado & al. 42368* (HAC).

### 2. Additional West Indies examined specimens of *Asplenium dentatum*

JAMAICA: Near Green River on the trail from Cinchona to Blue Mountain Peak, rocky banks, 22.4.1903, *Maxon 1483* (S). — HISPANIOLA, DOMINICAN REPUBLIC: Santo Domingo, vicinity of Ciudad Trujillo, 0-25 m, 2.1.1946, *Allard 14434* (S); Barahona, Polo, 600-1300 m, 26.2.-12.3.1922, *Abbott 1775* (S). — HISPANIOLA, HAITI: prope Payan, in rupibus, 1.1891, *Picarda 153* (S); 1890, *Picarda 576* (HAC); Port au Prince, Massif de la Selle, Marne de l'Hospital, in a ravine, 400 m, 20.5.1927, *Ekman 8190* (S); Ile la Tortue, Ravine de la Rochelle, rough limestone cliffs, 2.6.1925, *Ekman 4197* (S). — PUERTO RICO: Peñuelas, in sylva montis Llano, 6.7.1886, *Sintenis 4756* (HAC); Pueblo Viejo, prope San Juan, 4.10.1912, *Hioram 27* (S); *ibid.*, 19.2.1913, *Hioram* (S); Cabo Rojo, in saxosis montis Buenavista, 29.1.1885, *Sintenis 874* (S); limestone cliff near Ciales, 24.2.1926, *Britton 8595* (S). — TRINIDAD: Mouth of the Oropú Cheguecharo Cave, in crevices of the rocky cliffs, 28.2.1932, *Broadway 7915* (S).