

# A new species of *Asplenium* (Aspleniaceae, Pteridophyta) from Equatorial Guinea

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A new species of *Asplenium* from Equatorial Guinea, *A. carvalhoanum* Herrero, Aedo, Velayos & Viane, is described and illustrated. This new species is similar to *A. preussii* Hieron., which differs in rhizome, scales and in the absence of gemmae on the apical part of the lamina. It is also similar to *A. hallei* Tard., which differs in frond morphology.

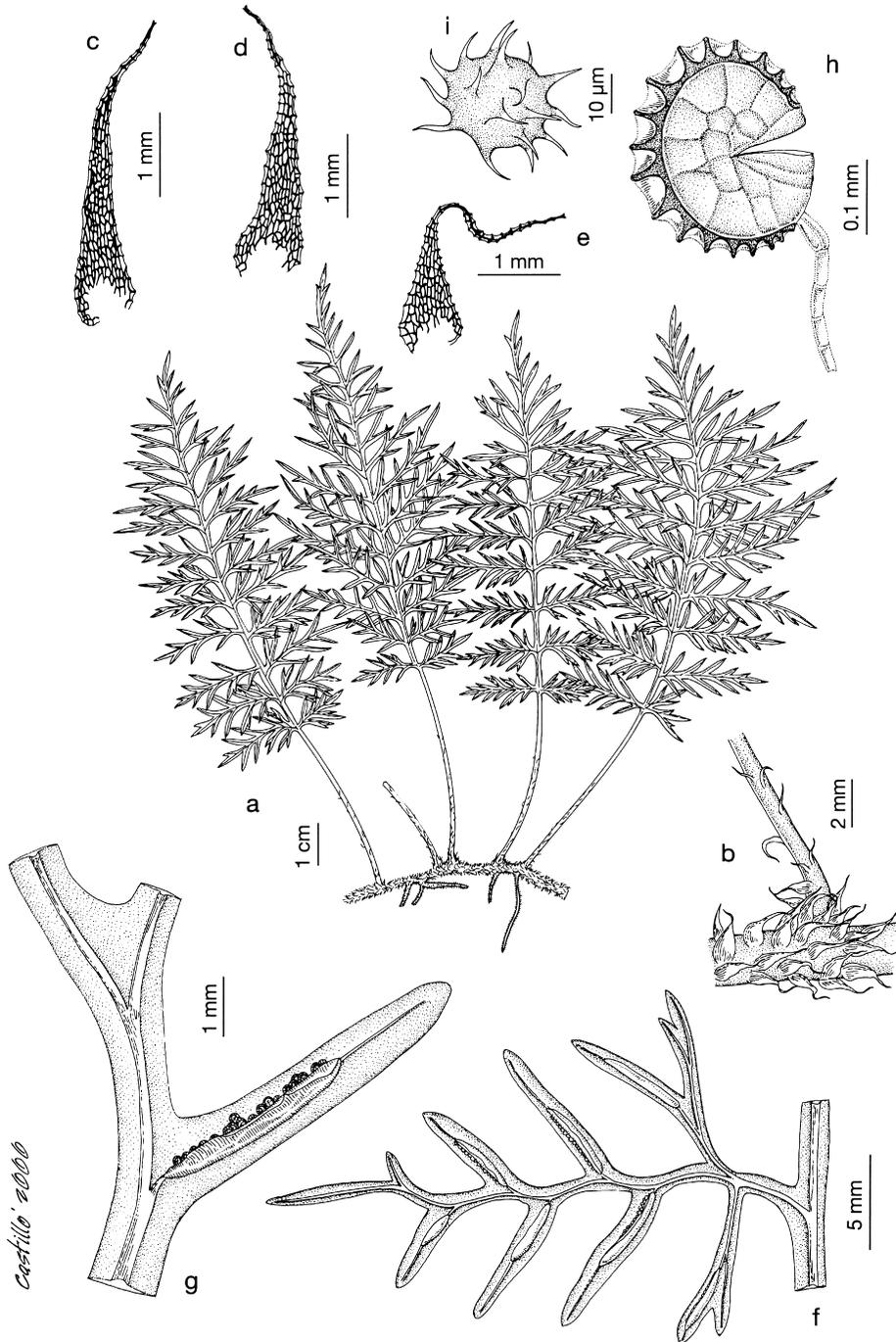
Key words: *Asplenium*, new species, Pteridophyta, taxonomy

## Introduction

*Asplenium* L., one of the largest fern genera, is considered to comprise about 50 species in tropical West Africa. Earlier general studies on the pteridophytes of tropical West Africa are those of Alston (1959) and Tardieu-Blot (1953, 1964a, 1964b). The ferns of Cameroon have been studied by Benl (1976, 1977), Kornaś (1983), Tardieu-Blot *et al.* (1949) and Viane (1986). Further studies on Equatorial Guinea refer only to Bioko, where *Asplenium* was care-

fully studied by Benl (1991). For Río Muni there does not exist a particular pteridological study, though the general vascular plant catalogue of Guinea (1946) includes ferns and fern-allies.

In the last twenty years the Real Jardín Botánico of Madrid has performed detailed fieldwork in both Bioko and Río Muni. During the preparation of a check-list of the pteridophytes from Equatorial Guinea (Velayos *et al.* 2001), we have found an undescribed species of *Asplenium*.



**Fig. 1.** *Asplenium carvalhoanum* (from the holotype). — **a**: Habit. — **b**: Part of the rhizome and stipe base. — **c–e**: Scales. — **f**: Middle pinna of lamina. — **g**: Detail of a middle pinna of lamina showing an indusium and a sorus. — **h**: Sporangium. — **i**: Spore.

## Methods

A total of six individuals from type collection were studied. Thirty spores and 30 guard cells from three individuals of those six were measured. The mean and standard deviations were calculated for each sample. The mean length of the exospore was obtained from spores, mounted in Depex, using a light microscope. Middle pinnae of well-developed fronds were used to determinate the length of stomatal guard cells. We made epidermis preparations as described in Viane (1990): after boiling pinnae, these are cleared with 2.5% NaOH, rinsed in running water, cleared with ca. 10% NaOHCl solution, carefully washed, stained with Ruthenium red and mounted in Canada balsam.

For scanning electron microscopy (SEM) spores were coated with gold to a thickness of 35–40 nm. The samples were observed with a scanning electron microscope JEOL JSM-T330A at 15 kV.

## Results and discussion

***Asplenium carvalhoanum*** Herrero, Aedo, Velayos & Viane, *sp. nova* (Figs. 1–3)

*Ab Asplenium preussii* differt rhizomate longo, reptanti, paleis minoribus, laminaque gemmis apicalibus carenti; *ab A. hallei*, lamina 2–3 pinnata.

TYPE: Equatorial Guinea. Litoral, Cogo, entre el poblado de Emangós y Ncó, 1°15'N, 9°48'E, 29.VII.1997 *Carvalho 6417* (holotype MA 620514; isotypes BATA, GENT, K).

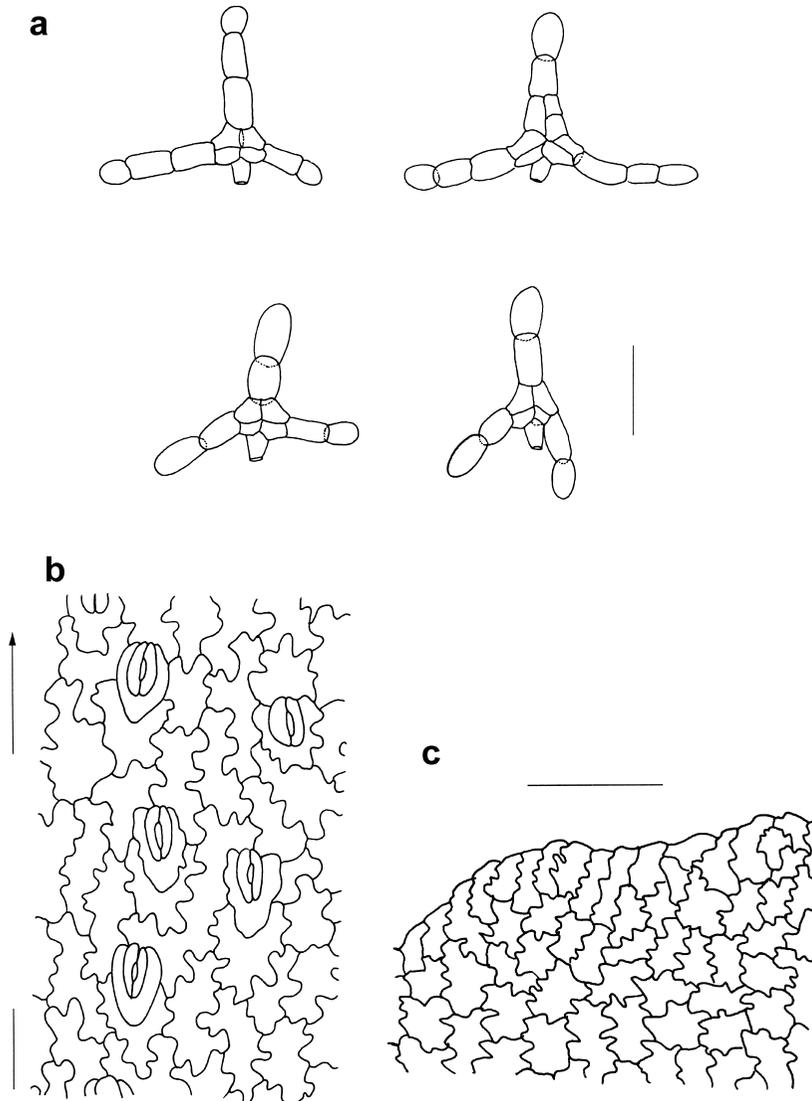
Plants epiphytic. Rhizome long-creeping, 1–2 mm in diameter, subglabrous but sparsely set with blackish-brown scales near the apex (Fig. 1a and b). Scales 2.7–4.2 mm long and 0.6–1.2 mm wide at their base, lanceolate to subulate, base cordate, apex attenuate, uniformly clathrate, entire, ascending and slightly spreading, anticlinal walls dark brown (Fig. 1c–e). Stipes 1.9 to 6.8 cm long, green to slightly straw-coloured, with scattered appressed subulate scales,

mostly at the base (Fig. 1b). Lamina 7–14.6 cm long and 2.9–7.6 cm wide, ovate, thin, 2-pinnate to 3-pinnatifid, apex gradually tapered (Fig. 1a). Rachises like the stipe, green, narrowly winged. Pinnae in 10–14 pairs, narrowly ovate, longest 1.5–4.2 cm long and 1–1.9 cm wide, occurring below the middle of the lamina and decreasing regularly in size towards the apex and the base (Fig. 1a), veins 1-forked, free (Fig. 1f). The abaxial surface with multicellular uniseriate trichomes and mostly 3-branched paleasters (Fig. 2a). Stomatal guard cells 60–75 µm long (Table 1), polocytic to copolocytic (Fig. 2b). Ultimate segments of the pinnae 3–8 mm long and 0.8–1.1 mm wide, linear, apices obtuse to slightly acute, margin entire (Fig. 1f). Sori elongate along vein of the ultimate segments (Fig. 1f and g). Indusia 3.1–4.7 mm long, margins entire (Figs. 1g and 2c). Sporangia 0.25–0.30 mm long and 0.23–0.28 mm wide, 16–19 annulus cells (Fig. 1h). Spores ellipsoidal, exospore 30–36 µm long (Table 1), perispore echinate, with the extremely reduced middle perispore layer only present under the spines (Figs. 1i and 3).

DISTRIBUTION AND HABITAT: *Asplenium carvalhoanum* is an epiphyte on shrubs (at 50–80 cm) in primary rain forest and is known only from the type locality.

ETYMOLOGY: This plant is named after Manuel Fidalgo de Carvalho, botanical explorer of Equatorial Guinea.

*Asplenium carvalhoanum* is somewhat similar in leaf morphology, leaf indument and in perispore characters to *A. preussii* Hieron., from which it clearly differs in its widely creeping rhizome, its small and uniformly clathrate scales, and in the absence of gemmae on the apical part of the lamina (cf. Tardieu-Blot 1953: 198, pl. XXXIX). The thin, creeping rhizome set with sparse scales of *A. carvalhoanum* is very similar to that of the *A. hallei* Tard., endemic to Gabon, which clearly differs in frond morphology (cf. Tardieu-Blot 1964b: 127, pl. XXI). Echinate perispores are considered to be derived within Aspleniaceae, where they originated several times in unrelated tropical groups. African taxa



**Fig. 2.** Features of some pinna characters of *Asplenium carvalhoanum* (from the holotype). — **a:** Paleasters (microscopic rudimentary scales) of the abaxial leaf epidermis. — **b:** Cell pattern of the abaxial leaf epidermis (arrow indicates the direction of the veins towards the leaf margin). — **c:** Margin and cell outline in the indusium. Scale bars = 100  $\mu$ m.

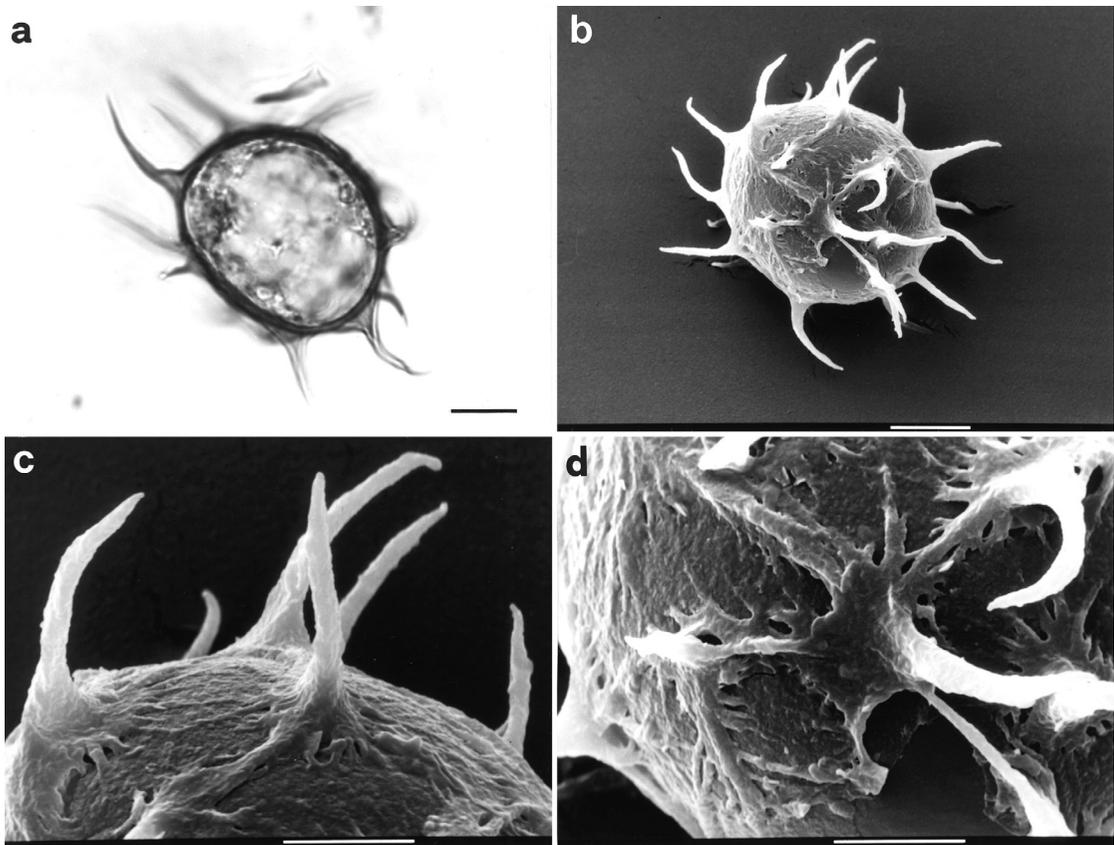
with the same perispore type include: *A. isabelense* Brause, *A. longicauda* Hook., *A. repandum* Mett. ex Kuhn and *A. variabile* Hook. These taxa also possess the typical polycytic stomata shown in Fig. 2b.

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**Table 1.** Length of the exospore (in  $\mu$ m) and guard cells (in  $\mu$ m) of three specimens of *Asplenium carvalhoanum*. Mean in boldface  $\pm$  standard deviation, and minimum and maximum values in parentheses.

Specimen	Exospore length	Guard cells length
1 (holotypus)	(30)31.09– <b>32.56</b> –34.03(35)	(60)62.16– <b>65.66</b> –69.16(70)
2	(32)32.19– <b>33.34</b> –34.93(36)	(60)63.65– <b>66.73</b> –69.81(75)
3	(30)31.61– <b>32.97</b> –34.33(35)	(62)64.57– <b>67.47</b> –70.37(72)
Mean	(30)31.61– <b>32.96</b> –33.31(36)	(60)63.11– <b>66.61</b> –70.11(75)



**Fig. 3.** Spores of *Asplenium carvalhoanum* (from the holotype). — **a:** Light microphotograph, proximal view. Scale bar = 10  $\mu$ m. — **b:** Scanning electron microphotograph, proximal view. Scale bar = 10  $\mu$ m. — **c and d:** Scanning electron microphotographs, detail of the spines. Scale bar = 5  $\mu$ m.

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