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# SPORANGIAL MORPHOLOGY IN THE ADIANTACEA FROM SOUTH EASTERN NIGERIA

Margaret E. Bassey (Ph. D.)  
*Department of Botany & Microbiology*  
*University of Uyo.*

## ABSTRACT

Six species in five genera of the Family Adiantaceae from South Eastern Nigeria were investigated. All the species had stalked sporangia except Ceratopteris cornuta. Paraphyses were present in most of the species and were either filiform or club shaped. Both types occurred in Acrostichum aureum. Sporangial shape was either globose or elliptical. The later forms had more annular cells than the former. Spore number per sporangium was 64 in Acrostichum aureum and Pityrogramma calomelanos, while the other four species had 32 spores per sporangium. The implication of this is discussed and a revision of the family is recommended.

## Introduction

Ferns and fern allies are commonly referred to as pteridophytes. As a group, the ferns have been classified as Filicopsida (Nayar, 1970), Pteropsida (Sporne 1979 and Filicatae (Tryon *et al.*, 1990). They are mostly plants of shaded damp forests of both temperate and tropical zones.

The family Adiantaceae is one of the families of the class pteropsida. It is a large group of ferns and is worldwide in distribution although centered in the tropics. They are predominantly terrestrial and are homosporous leptosporangiates (Tryon, *et al.* 1990).

Morphologically, members of the family are easily distinguished from other ferns in having sori with false indusia. The sori are mostly



marginal but occur along the veins in some cases. Their fronds are usually decompound and deltoid in outline although species with simple and pinnate forms are known. Their rhizomes are usually short, creeping or sub-erect, dictyostelic or solenostelic (Alston, 1959).

All ferns reproduce by the production of spores, which under normal circumstances are haploid. The spores are produced by the sporophyte generation, which is the dominant phase in the fern life cycle. They are usually borne in sporangia, which are found in sori.

Economically, ferns are popular in floriculture and are useful in decoration. Some ferns are edible while most ferns are useful in biological research as seen in works by Klekowski (1973), Klekowski and Klekowski (1982)<sub>2</sub> and Raghavan (1989).

Gastony (1974) reported striking differences in some of the sporangia from pteridophytes belonging to the family cyatheaceae. He was able to divide the family into two natural groups based on the number of spores produced per sporangium.

In this work an attempt is made at a comparative survey of sporangia in some genera of Adiantaceae family obtained from the study area.

### Materials and Method

Fresh samples of Acrostichum aureum were collected from Enwang in Mbo Local Government Area and from University of Science & Technology (UST) in Port Harcourt. Adiantum philipense and A. capillus-veneris were obtained from University of Calabar Botanical gardens. Ceratopteris Cornuta was collected from Ahoada, Rivers State. Pityrogramma calomelanos and Pteris were collected from some forests in Rivers State, Oban in Cross River State and Ibiaku Uruan in Akwa Ibom State. These samples were preserved by drying and by fixing in formalin – acetic – acid - alcohol solution (FAA) in the ratio of 2: 1: 17.

Adiantum philipense, A. capillus-veneris and Pteris atrovirens were grown in pots, but the last two species did not sporulate. Fertile leaves of A. capillus-veneris and Ceratopteris cornuta were obtained from the University of Ibadan herbarium (UIH) courtesy of Dr. J. Lowe. Other collections made included corniogramme africana and P. mildbraedii. However, fertile fronds could not be obtained from them. Vouchers to all specimens are deposited in the Department of Botany herbarium, University of Uyo.

Sporangia used for size variations and spore counts were obtained from the lowest pinnae or pinnules on the fronds. However, in



Acrostichum aureum and Pityrogramma calomelanos spores were obtained anywhere on the abaxial surface of the pinnae. Sporangia were washed in 50% alcohol, then in distilled water before mounting in glycerine. 5 sporangia per sample were measured and their spores counted. Length and width of sporangia were taken at the widest points. Where present, the length of sporangial stalk was also measured. The presence or absence, and of paraphyses among the sporangia were also noted.

All measurements were made with a calibrated eyepiece micrometer. All observations were made with a PZO microscope at x 40.

## Results

All the results obtained are summarized in Table 1 and Fig. 1.

As recorded in Table 1, all the species except Ceratopteris cornuta had sporangial stalk the longest being that of Pteris atrovirens. Paraphyses were observed in Pteris atrovirens, Pityrogramma calomelanos and Acrostichum aureum and absent in the other three species. In A. aureum the paraphyses were of two types, the fili-form type and the swollen tipped type. The former are longer than the latter (Fig. 1a). In Pteris atrovirens paraphyses were present and all filliform shaped while in Pityrogramma calomelanos they were club-shaped (Fig. 1b).

The largest sporangia were found in Ceratopteris cornuta with a length of 468.22  $\mu\text{m}$  and a width of 245.53  $\mu\text{m}$ . The smallest ones were found in Adiantum phillipense with a length of 117.26  $\mu\text{m}$  and width of 96.95  $\mu\text{m}$ . The ratio of sporangial length to width varied between 1.1 and 2:1. In Acrostichum aureum, Adiantum capillus veneris and Ceratopteris cornuta the ratio was 2:1 while in the others it was 1:1. Sporangial shape therefore was either elliptical or globose.

The number of spores per sporangium varied. In A. aureum and P. calomelanos it was 64 while others had 32 spores per sporangium. Sometimes spore counts fell short of 32 or 64.

## Discussion

The presence of paraphyses in seedless plants has been noted as an aid to spore dispersal. Most of them particularly, the swollen tipped ones are hygroscopic (Bold, 1973) Tryon et al., (1990) observed filiform types with globular heads in Adiantum. For want of enough materials, paraphyses were not observed in A. capillus-veneris in this work.



Table 1: Sporangial Information

S/N	Species	Stock length in $\mu\text{m}$	Paraphyses	Sporangium length (L) in $\mu\text{m} \pm \text{SD}$	Sporangium Width (W) in $\mu\text{m} \pm \text{SD}$	Ratio of Sporangial L : W	No. of spores for Sporangium	No. of Annular cells	Shape
1	<u>Acrostidium aureum</u>	124.70	Filiform R Club-shaped	250.10 $\pm$ 2.39	141.61 $\pm$ 1.30	2 : 1	64	20 - 22	Elliptical
2	<u>Adiantum Capillus veneris</u> -	MIR	MIR	260.26 $\pm$ 5.63	144.76 $\pm$ 2.17	2 : 1	MIR	16 - 18	Elliptical
3	<u>A. philippense</u>	229.46	NO	117.26 $\pm$ 3.74	96.95 $\pm$ 4.38	1 : 1	32	13.16	Globose
4	<u>Ceratopteris Cornuta</u>	Sessile	NO	468.22 $\pm$ 10.37	245.53 $\pm$ 5.70	2 : 1	32	20.22	Elliptical
5	<u>Pityrogramma Calomelanou</u>	112.42	+Club-shaped	140.47 $\pm$ 2.67	135.90 $\pm$ 1.79	1 : 1	64	16.12	Globose
6	<u>Pteris atrovirens</u>	234.08	+Filiform	132.99 $\pm$ 4.69	99.38 $\pm$ 5.90	1 : 1	32	16 - 18	Globose

+ = Present  
 NO = Not observed  
 MIR = Material inadequate for research

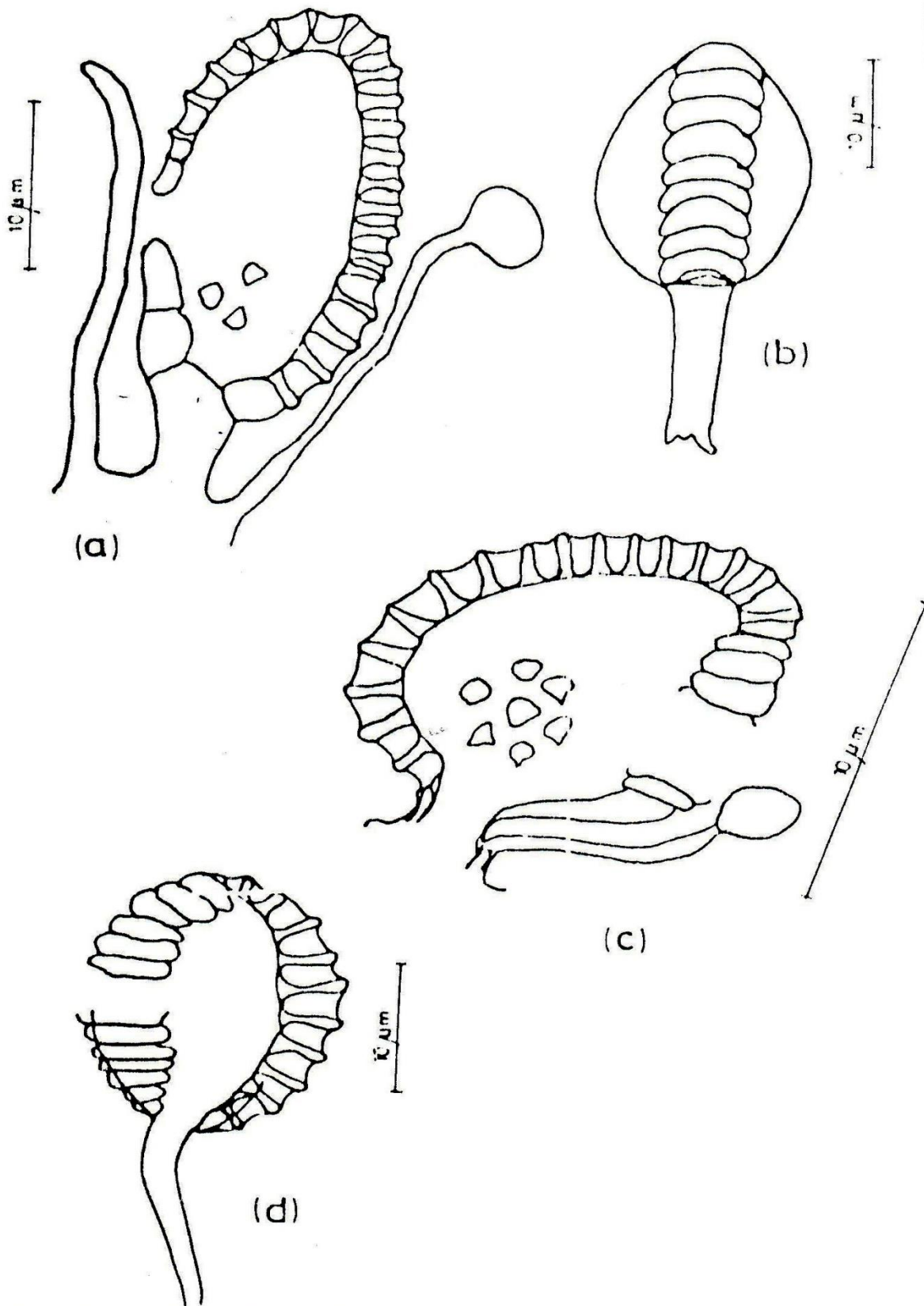


Fig. 1 Sporangial morphology  
 (a) *Acrostichum aureum* (b) *Pteris atrovirens*  
 (c) *Pityrogramma calomelanos* (d) *Adiantum phillipense*



Gastony (1974) noted that typical number of spores per sporangium were either 4, 8, 16, 32 or 64. When shortfalls in counting occurred, he attributed it to counting errors or to the failure of one or more tetrads or partial tetrads to mature. Counts of 57 according to him could be recorded as 64 while a count of 26 was taken to be 32 Bir (1976), observed that in higher leptosporangiate ferns sexual species produce 64 spores while apogamous taxa produce 32 spores per sporangium. Tyron (1986) opined that half the normal spore number per sporangium as well as a larger spore size is indicative of apogamy. The occurrence of 32 spores in Ceratopteris cornuta, A. phillipense and Pteris atrovirens as found in this study may also be indicative of apogamy. Nayar and Kaur (1971) noted that apogamy is widespread in certain groups of ferns of which he included the Adiantaceae. Shape characteristics are often stable irrespective of size. Therefore in this group of ferns it has been observed that sporangial shapes are either globose or elliptical. Annular cell numbers were noted to be higher (16-22) in elliptic sporangia than globose ones (13-18).

In conclusion, sporangial morphology in genera of Adiantacear studies in this work revealed the following characteristics: In most cases, they are stalked, they possess paraphyses which could either be club-shaped or filiform although both types may occur together as in Acrostichum aureum. Sporangial shape could be either globose or elliptical and the later types possess higher number of annular cells than the globose forms. These findings go to confirm morphological observations that ferns of the family Adiantaceae are variable. As a result, a revision of the group is hereby recommended.

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