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Robert R. Smith

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ANEMIA (SCHIZAEACEAE) IN THE BAHAMAS

Kathleen D. Regan
The Nature Conservancy
Pennsylvania Natural Diversity Inventory
Middletown, Pennsylvania

Thomas K. Wilson
Department of Botany
Miami University
Oxford, Ohio

ABSTRACT

This investigation presents a descriptive taxonomic treatment of the genus *Anemia* (Schizaeaceae) as it occurs in the Bahama Archipelago. This genus is represented in the Bahamas by three species; *Anemia adiantifolia* (L.) Sw., *Anemia cicutaria* Kunze ex. Spreng., and *Anemia wrightii* Baker in Hooker and Baker. New diagnostic keys and descriptions to these species are presented, based upon the examination of over 200 specimens from ten herbaria.

INTRODUCTION

The genus *Anemia* is one of the most distinctive and easily recognizable of the Schizaeaceae. Members of *Anemia* either have their sporangia limited to the basal pair of pinnae which are skeletonized (reduced lamina) and held erect (the hemidimorphic condition), or their fronds are fully dimorphic (holodimorphic), that is, there is a distinct difference between the fertile fronds and the vegetative fronds, the former being much longer and with less lamina than the sterile fronds. Three species of the fern genus *Anemia* are native to the Bahamas: *Anemia adiantifolia, Anemia cicutaria*, and *Anemia wrightii. Anemia*, the largest genus in the Schizaeaceae, is subdivided into three subgenera: *Coptophyllum, Anemia*, and *Anemiorrhiza.* The three species involved with this study are in the subgenus *Anemiorrhiza.*

The distribution of the genus *Anemia* was once nearly worldwide, but today the distribution is largely limited to tropical America. The highest concentration of species is presently in Brazil, having more than 60 species, with the second highest in Mexico with 21 species. The subgenus *Anemiorrhiza* is largely limited to calcareous substrates of the Carribean basin; the subgenera *Anemia* and *Coptophyllum* occur together over much of Latin America (Mickel, 1982).

Anemiorrhiza is the smallest subgenus and the most geographically isolated. This subgenus has been monographed by Duek (1980) and again by Mickel (1981), the latter utilizing more characteristics and including more species. *Anemiorrhiza* presently contains 14 species, 2 varieties, and one form (Mickel, 1981). This subgenus is distinguished by its creeping solenostelic rhizome, coriaceous blade, sharp-pointed laminar hairs, and its occurance on a calcareous substrate. Its distribution is limited to the West Indies, Florida, Texas, and from Mexico to northern South America (Mickel, 1981).

Of the three species of *Anemia* which occur in the Bahamas, *A. cicutaria* and *A. wrightii* may be considered as wide endemics. *A. cicutaria* is found on Abaco, Andros, and New Providence Islands, and in Florida, Cuba, and the Yucatan. *A. wrightii* is found on Andros Island, and in Florida and Cuba. *A. cicutaria* and *A. wrightii* are commonly found in solution pits, sinkholes, or "banana holes" which are formed in the limestone substratum common to most of the islands (Correll & Correll, 1982).

The third species of *Anemia* found in the Bahama Archipelago is *A. adiantifolia* and it is much more widespread than are *A. cicutaria* or *A. wrightii. A. adiantifolia* is found on all of the islands in the Bahama Archipelago except Inagua, Caicos, and San Salvador. Its range beyond the archipelago is extensive, including Florida, the West Indies, and from Mexico through Central America to

northern South America (Correll & Correll, 1982).

Anemia adiantifolia is not as limited in its habitat as are *A. cicutaria* and *A. wrightii.* Throughout the Bahamas this species is found to thrive best with the native pine, *Pinus caribea*, but the distribution of *A. adiantifolia* is not limited to the pinelands. This species also occurs in the coppices and the scrub-lands. Its wide habitat tolerance undoubtedly accounts for *A. adiantifolia's* extensive geographic range.

Anemia adiantifolia, A. cicutaria, and *A. wrightii* overlap ranges on Andros Island, and in Florida and Cuba. Hybrids between any combination of these three ferns have not been reported.

Although Mickel (1981) and Duek (1980) have both studied the subgenus *Anemiorrhiza* in detail, their respective works fail to document a large amount of morphological variation which was observed during several botanical expeditions made by Miami University faculty and students to North Andros Island. The purpose of this research was to study this variation within the three species of Bahamian *Anemia*, to document the variation found, and to eliminate taxonomic confusion which might occur as the result of this variation.

MATERIAL AND METHODS

Over 200 specimens, including three type specimens, which were borrowed from ten herbaria as well as personal collections from North Andros Island were examined. Descriptions and measurements were based primarly on the examination of dried herbarium specimens and on the information available from herbarium sheet labels.

The descriptions were written using previous treatments whenever possible. Sixteen characters were analyzed and compared to Mickel's 1981 descriptive treatment of the subgenus *Anemiorrhiza.* Additional characters were analyzed in order to obtain specific data on the nature of segment serration and dissection.

TAXONOMIC TREATMENT

The following description of the genus *Anemia* is a compilation of descriptions written by Mickel (1962, 1982) and Correll & Correll (1982).

Anemia Sw.1806, *nom. cons.*

Distribution. Tropics and subtropics of America, Africa, and southern India.

Type Species. *Anemia phyllitidis* (L.) Swartz.

Rhizome horizontal or ascending, compact or short-creeping, indument of dark or orange hairs; blades mostly free veined, pinnate to tripinnate, generally erect, rarely forming a flat rosette, papyraceous to coriaceous; sporangia usually restricted to the lowermost pair of pinnae (hemidimorphic), but fronds occasionally holodimorphic; fertile pinnae usually elongate and surpassing the sterile portion of the blades; sporangia in two rows on ultimate segments of fertile pinnae; spores tetrahedralglobose, striate with parallel smooth or spiney ridges.

The following descriptions and key are from a combination of the authors analysis of herbarium specimens and the descriptions written by Mickel (1981) and Correll & Correll (1982).

Key to the species of *Anemia* in the Bahama Archipelago

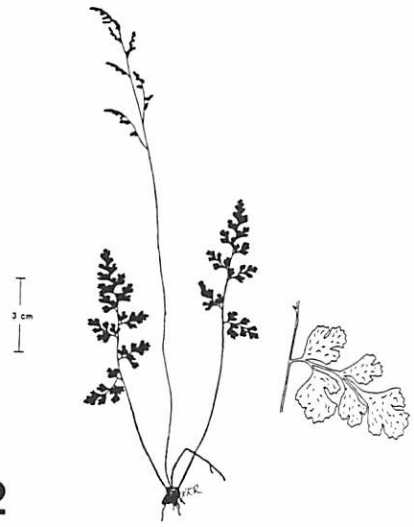
A. Fronds hemidimorphic, basal pinnae fertile and skeletonized (rare exceptions); fronds bipinnate to tripinnate, usually more than 15 cm. tall; spores with deep parallel ridges..... 1. A. adiantifolia

A. Frond holodimorphic, having a rosette of basal sterile fronds and separate fertile, skeletonized fronds held erect above the sterile fronds (rare exceptions); sterile fronds pinnate-pinnatifid to tripinnate, averaging 8 cm. tall; spores with anastomosing ridges.....B.

B. Sterile blade bipinnate to tripinnate, ultimate segments ovate, the margins crenulate; lamina decidedly hairy; fertile blade open with an average of 5 pairs of long, petiolulate pinnae.....2. A. cicutaria

B. Sterile blade pinnate to bipinnate, ultimate segments flabellate, the apex deeply toothed; laminae glabrescent or sparsely hairy; fertile blade closed with an average of 3 pairs of short sessile pinnae..... .....3. A. wrightii

1



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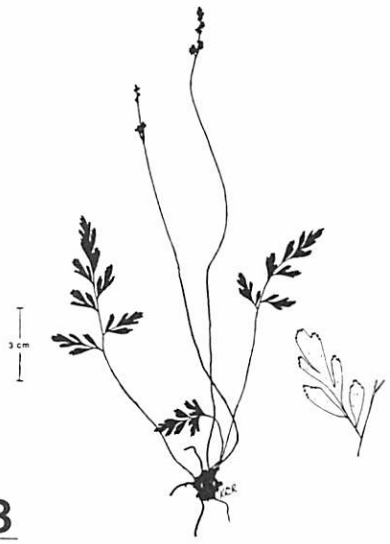

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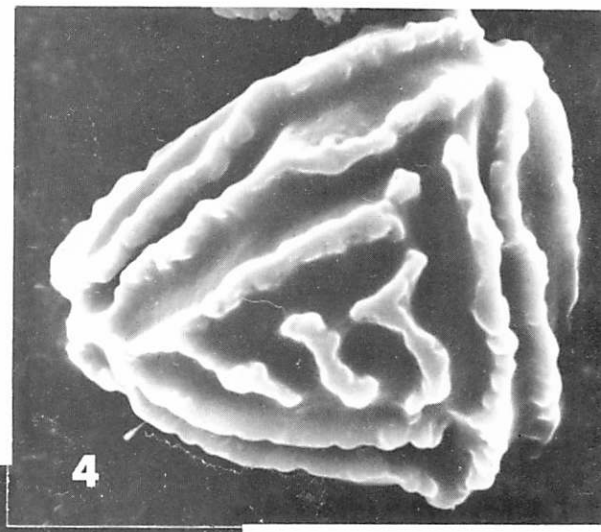
FIGURES 1-6



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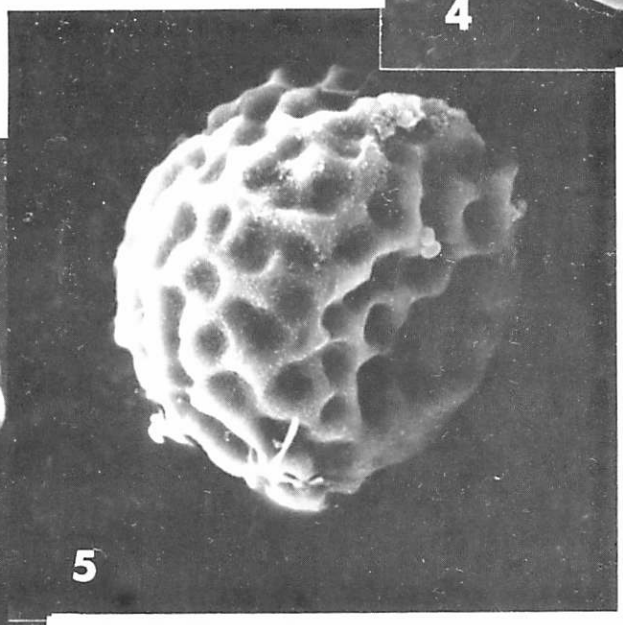

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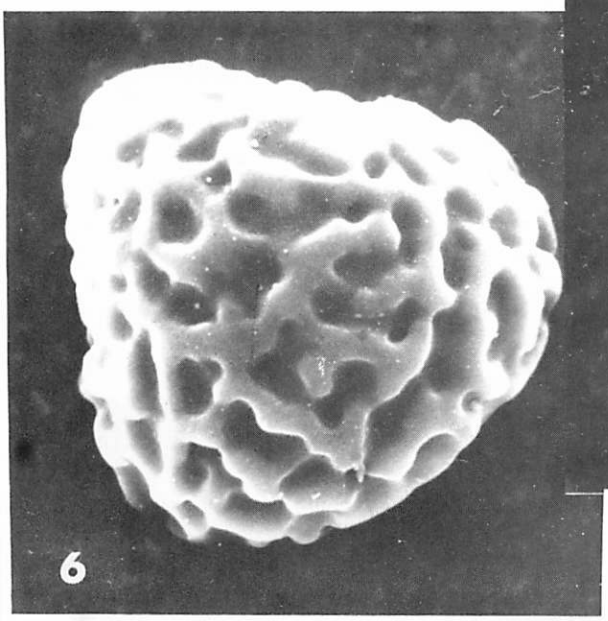

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1. *ANEMIA ADIANTIFOLIA* (L.) SW. Maidenhair Anemia (Fig. 1)

Range: Present on all islands in the Bahama Archipelago except Inagua, Caicos, and San Salvador, and in Florida, the West Indies, and Mexico through Central America to northern South America.

Plants with only basal pinnae pair fertile, skeletonized and held erect; fronds an average of 34 cm. in height, ranging from 7.8 to 82 cm.; stipe diameter an average of 1.1 mm., ranging from 0.5 to 2.5 mm.; stipe color variable between stramineous to darkened; blade shape variable between deltoid to deltoid-ovate or linear-deltoid; fronds bipinnate to tripinnate; segments generally ovate, occassionally flabellate; segment margins typically dentate, seldom rounded, the dissection being continuous around the entire segment; blade apex generally long acuminate; blade texture coriaceous; indument variable, but typically glabrescent; an average of 10 pinnae pairs; spores with deep, parallel ridges (Fig. 4).

2. *ANEMIA CICUTARIA* Kunze ex. Spreng. Parsley Anemia (Fig. 2)

Range: Abaco, Andros, and New Providence Islands in the Bahama Archipelago, and in Florida, Cuba, and the Yucatan.

Plants with separate fertile and sterile fronds (holodimorphic); fronds an average of 9.25 cm., ranging from 1.2 to 21.2 cm.; stipe diameter is an average of 0.3 mm., ranging from 0.1 to 0.8 mm.; stipe color green to stramineous, rarely darkened; blade shape typically deltoid-ovate; fronds bipinnate-pinnatifid to tripinnate; segments ovate; segment margins generally crenulate, continuous around the entire segment; blade apex medium to short acuminate; blade texture typically thin; blade indument abundant; an average of four petiolulate pinnae pairs per sterile frond; spores with a coarse reticulum (Fig. 5).

3. *ANEMIA WRIGHTII* Baker in Hooker and Baker (Fig. 3)

Range: Andros Island in the Bahamas, Florida and Cuba.

Plants with separate fertile and sterile fronds (holodimorphic); fronds an average of 7.67 cm., ranging from 1.6 to 14.6 cm.; stipe diameter is an average of 0.2 mm., ranging from 0.1 to 0.8 mm.; stipe color green to stramineous, rarely darkened; blade shape deltoid; fronds pinnate to bipinnate; segmants flabellate; segment margins deeply dentate to dentate, often limited to the segment apex; blade apex medium to short acuminate; blade texture typically thin; blade indument glabrous or sparsely hairy; typically two or three sessile pinnae pairs per sterile frond; spores with a coarse reticulum (Fig. 6).

DISCUSSION

Anemia adiantifolia was found to exhibit the highest degree of variation among these three species. The major variations observed within the species was with the degree of pinnae dissection and with the depth and shape of the leaf serrations.

Morphological and taxonomic variation within *Anemia cicutaria* and *A. wrightii* is limited. These two species form a distinct group characterized by the texture of their fronds, their fertile pinnae differentiation, and the ornamentation of their spores.

Fertile pinnae differentiation was a relatively stable character within a species, *Anemia adiantifolia* being hemidimorphic, and both *A. cicutaria* and *A. wrightii* being holodimorphic. Specimens which did not exhibit typical fertile pinnae differentiation were removed and examined separately.

During the course of this research a total of 19 specimens exhibiting atypical frond dimorphism were found. Of the three Bahamian species, *Anemia adiantifolia* exhibited the most changes in dimorphism. Several holodimorphic representatives of this typically hemidimorphic species were observed. Many of these holodimorphic specimens were also reduced in size and their appearance approached that of the species *A. wrightii.*

Frond dimorphism was found to be a more stable character in *Anemia cicutaria* and *A. wrightii.* However, hemidimorphic representatives of both of these typically holodimorphic species were found. Previous to this study both *A. cicutaria* and *A. wrightii* had been reported as regularly holodimorphic species (Mickel, 1962 and 1981).

Mickel (1962, 1981) observed these

changes in dimorphism in the species *Anemia adiantifolia* and in a few other species of *Anemia* which were not involved with this study. Mickel regards these changes in dimorphism to be seemingly spectacular, apparently relatively simple, and taxonomically minor. He believes that the differences have been caused by a simple mutation of a single gene or a few genes.

With respect to the plants observed during the course of this study which exhibited atypical dimorphism, we agree with Mickel's views on changes in dimorphism. But it is these changes in dimorphism, however simple or complex, which can cause confusion with identification of species in this genus. Herbarium label information indicates that the atypical specimens were from a variety of locations and environments and no correlation could be drawn between frond dimorphism and a particular habitat.

Information from herbarium labels of *Anemia adiantifolia* did suggest that there may be a correlation between certain habitats and the three characters of leaf texture, size, and shape. It is likely that much of the variation seen in this study is the result of environmental factors and a detailed study of this species' morphological plasticity is needed.

Because frond dimorphism was found to be a less stable characteristic within these plants than first believed, care was taken to utilize additional characteristics in the design of this key. The combined characters of frond dissection, segment shape, and segment margin dissection prooved to be the most reliable characters for identification of these species. As is true with any final identification, several characters should be utilized to avoid mistakes.

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