

AQUATIC AND WETLAND PLANTS OF PUERTO RICO. I. *PTERIDOPHYTA*

by

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Resumen

CAUDALES, R., E. VEGA HERNÁNDEZ, A. SÁNCHEZ-PÉREZ & H. ALAIN LIOGIER (2000). Aquatic and wetland plants of Puerto Rico. I. Pteridophyta. *Anales Jard. Bot. Madrid* 57(2): 333-339 (en inglés).

Estudio de los helechos acuáticos y palustres de Puerto Rico, con especial atención a las especies asociadas a cuerpos de aguas quietas y pantanos. Se reconocen 8 géneros y 13 especies. Se dan descripciones, claves, notas de sus hábitats y mapas de distribución.

Palabras clave: Pteridófitos, plantas acuáticas, distribución, Puerto Rico.

Abstract

CAUDALES, R., E. VEGA HERNÁNDEZ, A. SÁNCHEZ-PÉREZ & H. ALAIN LIOGIER (2000). Aquatic and wetland plants of Puerto Rico. I. Pteridophyta. *Anales Jard. Bot. Madrid* 57(2): 333-339.

A description of the aquatic and wetland families of Pteridophytes in Puerto Rico is presented herein. Included are brief descriptions of each family, genus and species, and, when appropriate, keys for genera and species accompany the descriptions. The distribution of each species is also documented with maps, as well as with information on some ecological characteristics of each species.

Key words: Pteridophytes, aquatic plants, distribution, Puerto Rico.

INTRODUCTION

The concept of aquatic and wetland habitats has been subjected to various interpretations and definitions. Similarly, the concept of aquatic and wetlands pteridophytes is difficult to define precisely because of complex life cycles and diversified ecological habitats. In general, it may be allowed that all aquatic and wetland pterido-

phytes require soils with high water-holding capacity and with high relative humidity. The aquatic and wetland flora, as interpreted in this paper, are those species which live in bodies of water such as lakes, lagoons, dams, marshes and swamps. In this report we describe such aquatic and wetland pteridophytes of Puerto Rico and their documented distribution.

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KEY TO THE AQUATIC AND WETLAND GENERA
OF *PTERIDOPHYTA* OF PUERTO RICO

1. Plants floating, sometimes rooted in the mud ... 2
 - Plants always rooted 4
2. Small floating aquatic plants, entire fronds ... 3
 - Larger aquatic ferns, leaves dissected, soft fronds **2. *Ceratopteris***
3. Leaves in whorls of three, one of them with root-like filaments **7. *Salvinia***
 - Leaves alternating in rows, leaves divided into two lobes **8. *Azolla***
4. Fronds typically four foliate **6. *Marsilea***
 - Leaves pinnate 5
5. Leaves 2 pinnate, strongly dimorphic **1. *Osmunda***
 - Leaves 1 pinnate 6
6. Sporangia covering all abaxial face of the pinnae **3. *Acrostichum***
 - Sporangia joined in sori, discrete or linear 7
7. Sori roundish, discrete **4. *Thelypteris***
 - Sori linear along costa **5. *Blechnum***

TAXONOMÍA Y BIOGEOGRAFÍA

I. OSMUNDACEAE

These are terrestrial plants of moist habitats, mainly swamps. Rhizomes decumbent to erect, and roots with fibrous and persistent stipe-bases, devoid of hairs or scales. Fronds are erect, clustered, the stipes not articulate, blades 1-2 pinnate, and are dimorphic in the Caribbean species. Sporangia are in a dense panicle cluster, entirely replacing the green vegetative tissue. Spores green, and short-lived.

The family is of world-wide distribution and composed of three genera and about 20 species. Only one genus occurs in Puerto Rico.

1. *Osmunda* L.

Plants of bogs and swamps. Rhizomes creeping. Fronds loosely and deciduously woolly tomentose, dimorphic.

A genus of world-wide distribution. Nearly 14 species are described, but some of them not well defined. A single wetland species occurs in Puerto Rico.

1. *Osmunda cinnamomea* L., Sp. Pl. 2: 1066 (1753)

Rhizomes growing on the surface of the ground. Fronds 1 pinnate, 0.5-1.5 m long; rachis tomentose to glabrous; blades oblong to lance-elliptic, up to 1 m long, 8-15 cm broad, apex acuminate, base reduced; pinnae distant or more usually, close or imbricate, narrow to oblong, 1-2 cm broad, deeply pinnatifid, segments oblong, 3-6 mm broad, more or less rounded at apex and essentially entire, usually slightly tomentose. Fertile blades, normally without chlorophyll, are 2-pinnate with densely agglomerated linear divisions completely covered by sporangia. Swamps, found mostly in those with silica sand near sea level. Eastern North America, México to Paraguay. Localities near the north coast; recorded from San Juan, Vega Alta and Vega Baja (fig. 1).

II. POLYPODIACEAE

Plants of various habits, terrestrial, epipetric, epiphytic, rarely aquatic. Rhizome creeping to erect, usually bearing hairs or scales. Fronds stipitate or sessile, monomorphic or dimorphic, blades simple to variously subdivided, pubescent or without indument. Sporangia long-stalked, the pedicels with 1-4 rows of cells, arranged in lines or clusters (sori), covering the complete

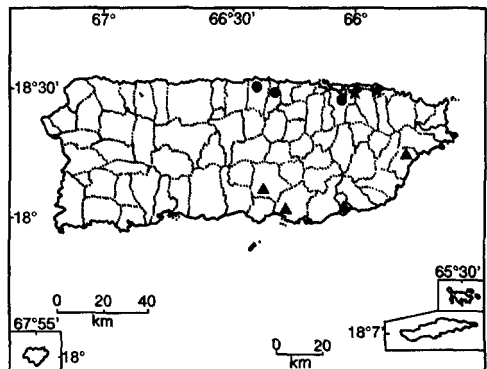


Fig. 1.—Distribution of *Osmunda cinnamomea* (●), *Ceratopteris thalictroides* (★) and *C. richardii* (▲) in Puerto Rico.

abaxial side of the frond, or scattered along veins, sori naked or protected by a scale-like indusium.

A family with more than 170 genera and perhaps as many as 10,000 species. Three genera of wetland species occur in Puerto Rico.

KEY TO THE GENERA OF *POLYPODIACEAE*

1. Plants floating, sometimes rooted in the mud, soft fronds, dimorphic fronds narrowly divided
2. *Ceratopteris*
 - Plants non-floating 2
2. Sporangia densely covering the under surface of the fertile pinnae, indusia lacking
 **3. *Acrostichum***
 - Sporangia joined in sori 3
3. Sori roundish or elliptic, dorsal in veins, indusium usually roundish-reniform when present **4. *Thelypteris***
 - Sori elongate-linear, usually continuous, borne near or against the costa, indusium narrowly linear **5. *Blechnum***

2. *Ceratopteris* Brongn.

Aquatic or subaquatic ferns, subsucculent with soft fronds. Rhizome short, floating. Fronds dimorphic; sterile blades simple to 3 pinnate, broadly divided, bearing proliferous buds; fertile blades longer than the sterile ones, finely-divided, margins reflexed, enclosing 1-4 rows of sporangia.

A genus of perhaps 4 species, widely distributed. Two species in Puerto Rico.

KEY TO THE SPECIES OF *CERATOPTERIS*

1. Plants usually rooted in mud, sterile fronds lanceolate, fertile fronds up to 3 pinnate
 **1. *C. thalictroides***
 - Plants usually floating, sterile fronds large and deltate, fertile fronds up to 5 pinnate
 **2. *C. richardii***

1. *Ceratopteris thalictroides* (L.) Brongn. in Bull. Sci. Soc. Philom. Paris III, 8: 186 (1821)

Aquatic or semiaquatic plants, rooted. Fronds few, clustered; sterile fronds 9-16 cm

long; blades lanceolate, deltate, or ovate; fertile fronds longer than the sterile ones, 2-3 pinnate; pinnae alternate, narrowly linear, margins convolute. Sporangia ordered in 1-3 rows.

Floating in free water or rooted in mud of swamps. Pantropical. Very rare in the island; found only in Loiza and Torrecilla Baja (fig. 1).

2. *Ceratopteris richardii* Brongn. in Bory, Dict. Class. 3: 351 (1823)

Floating plants, sometimes submerged. Fronds few; stipes 9-33 cm; sterile blades 1 pinnate, deltate to ovate, 20-50 cm long; fertile blades longer than the sterile ones, 4-5 pinnate; pinnae narrowly linear, margins convolute. Sporangia ordered in 1-4 rows.

Floating in free water or rooted in mud of swamps. Southern United States, Greater Antilles, Trinidad and continental tropical America. Very rare species found in southeastern Puerto Rico; recorded from Arroyo, Coamo, Salinas and Humacao (fig. 1).

3. *Acrostichum* L.

Aquatic or subaquatic ferns of saline and brackish swamps and marshes. Rhizome woody, erect, bearing broad scales at the apex. Fronds clustered erect, 1 pinnate; venation closely reticulate; sporangia densely covering the under surface of fertile pinnae.

A small genus with pantropical distribution of several species. Two wetland species occur in Puerto Rico.

KEY TO THE SPECIES OF *ACROSTICHUM*

1. Fertile fronds with distal pinnae bearing sporangia **1. *A. aureum***
 - Fertile fronds with all pinnae bearing sporangia **2. *A. danaeifolium***

1. *Acrostichum aureum* L., Sp. Pl. 2: 1069 (1753)

Rhizomes large, forming tussocks; scales dark brown. Fronds 1-5 m long, mono-

morphic, stipes shorter than the blades, subterete; blades 1 pinnate, 20-40 cm broad; pinnae 10-14 pairs, 10-25 cm long, elliptic. Fertile pinnae 1-4 pairs at the apex, similar to the sterile ones. Sporangia situated in only several distant pinnae.

Saline swamps, mangrove swamps and marshes. Pantropical. A common species; recorded from Coco Beach, Ramos Island, Dorado, Sardinera Pond, Loiza Aldea, Aguirre Swamp and Mameyes (fig. 2).

2. *Acrostichum danaeifolium* Langsd. & Fischer, Pl. voy. Russes monde 1: 5, t. 1, (1810)

Rhizome massive; scales linear lanceolate, dark brown. Fronds large, up to 4 m long, dimorphic; stipe stout, subwoody, dark brown; sterile blades 1.5-3.5 m long, erect, pinnae numerous, 15-40 pairs, crowded, subimbricate; fertile blades fleshy in texture. Sporangia situated in all pinnae.

Saline and brackish swamps and marshes. Tropical and subtropical America. A common species; recorded from Santa Teresa, Humacao, Mona Island, Punta Comején, Río Grande, and also in St. Croix, St. Thomas and Tortola (fig. 2).

4. *Thelypteris* Schmidel

Terrestrial and wet places ferns. Rhizomes slender, creeping to erect. Fronds scattered to

fasciculate, blades usually 1 pinnate, rarely simple or 2 pinnate, glabrous or commonly pubescent. Sori roundish or elliptic, with or without indusium.

The largest genus of ferns, with nearly 1,000 species of worldwide distribution, Two wetland species occur in Puerto Rico.

KEY TO THE SPECIES OF *THELYPTERIS*

1. Rhizome ascending to erect, sori medial, small, indusium reduced if present **1. *T. sancta***
- Rhizome extensively creeping, branched, sori suprasedial with indusium orbicular reniform **2. *T. interrupta***

1. *Thelypteris sancta* (L.) Ching in Bull. Fan Mem. Inst. Biol. 10: 254 (1941)

Rhizome ascending to erect; scales ovate, dark brown. Fronds densely tufted; rachis puberulous; blades oblanceolate, 6-48 cm long, 1-9 cm broad; pinnae narrowly deltate-lanceolate, lowest ones unequally 3 foliate; pinnules oblique linear-oblong or oblanceolate. Sori medial, small; indusium minute if present.

Wet places, borders of streams and rivers. Greater and Lesser Antilles, central and northern South America. A common species; recorded from El Yunque, Cueva Ensueño, Río Abajo Forest, Utuado, Esperanza, Cidra, San Sebastián, Florida, Lares, Ciales and Hatillo (fig. 3).

2. *Thelypteris interrupta* (Willd.) Iwatsuki in J. Jap. Bot. 38: 314 (1963)

Rhizome extensively creeping, branched; scales sparsely ciliate, dark purple-brown. Fronds usually erect, up to 2 m long; rachis grooved adaxially, minutely puberulous along groove, scales ovate-lanceolate; blades lance-oblong, 35-80 cm long or more, 22-40 cm broad, abruptly acuminate at the apex; pinnae linear, 5-15 mm broad, lobes deltate to rounded; veins 7-15 pairs, simple. Sori suprasedial, close; indusium orbicular reniform, usually glabrous, margins irregular or erose.

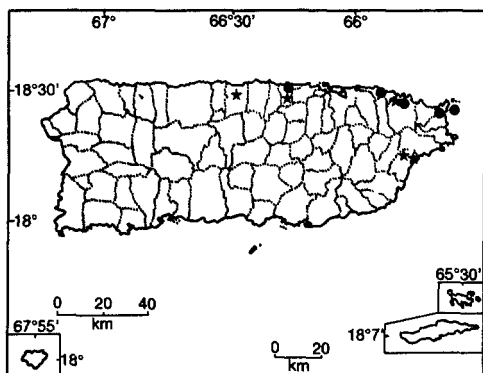


Fig. 2.—Distribution of *Acrostichum aureum* (●) and *A. danaeifolium* (★) in Puerto Rico.

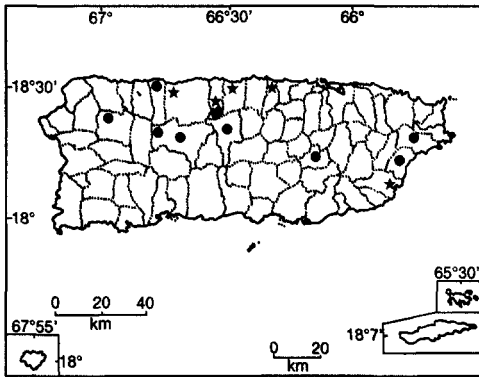


Fig. 3.—Distribution of *Thelypteris sancta* (●) and *Th. interrupta* (★) in Puerto Rico.

Boggy ponds and borders of fresh-water swamps at low to middle elevations. Pantropical. Very widespread, usually abundant; recorded from Arecibo, Florida, Manatí, Vega Alta and Yabucoa (fig. 3).

5. *Blechnum* L.

Rhizome ascending to erect, sometimes trunk-like. Fronds 1 pinnate, usually glabrous. Sori elongate-linear, usually continuous, borne along, near or against costa on an elongate transverse veinlet parallel to costa; indusium narrowly linear, continuous or near so, opening toward the costa.

A large worldwide genus with perhaps 180 species occurring in the southern hemisphere. Only one species is known to the wetlands in Puerto Rico.

1. *Blechnum serrulatum* L.C.M. Richard in Act. Soc. Hist. Nat. Paris 1: 114 (1792)

Rhizome subterranean, wide-creeping, with erect branches bearing the fronds. Fronds rigidly erect, up to 1.2 m long; stipes shorter than the blades, naked; blades linear to broadly oblong, acuminate at the apex, 35-70 cm long, 10-25 cm broad, free-pinnate, pinnae numerous, oblong to ligulate, sessile; veins close, 1-3 forked. Sori usually occurring in the upper pinnae; indusium narrow.

Swampy borders of lakes and wet savannas. Florida, Bahamas, Caiman Islands,

Greater and Lesser Antilles, Trinidad, continental tropical America from México to southern Brazil and also in the Old World tropics. Very abundant; recorded from Tortugero, Punta Las Marias, Martín Peña, Arecibo, Cataño, Humacao, Manatí, Utuado, Vega Alta and Vega Baja (fig. 4).

III. MARSILEACEAE

Aquatic or semiaquatic herbs, with elongate, branches and hairy rhizomes. Fronds circinnate in bud, long-stipitate and 2-4 foliate, segments with flabellate venation. Fertile plants bearing one or more sessile or stalked, capsule-like sporocarps at the base of the stipes or along the lower part. Sporocarps variously septate within, the sori solitary within the compartments, each sorus with two kinds of sporangia: megasporangia each containing a single large megaspore coated with mucilage, and microsporangia containing numerous minute microspores.

A small family of 3 genera and about 56 species. Only one genus in Puerto Rico.

6. *Marsilea* L.

Plants of shallow ponds. Rhizome creeping, glabrous to pubescent. Fronds 4 foliolate. Sporocarps subglobose to oblong-ovoid.

A cosmopolitan genus of about 50 species. Two species occur in Puerto Rico

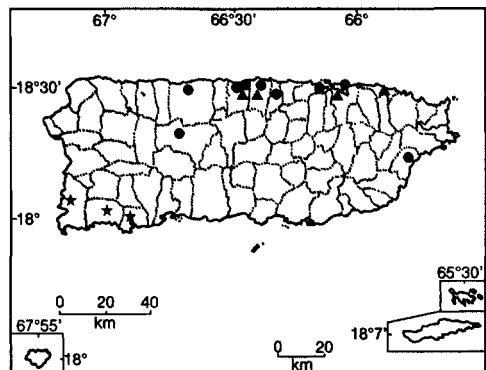


Fig. 4.—Distribution of *Blechnum serrulatum* (●), *Marsilea ancypoloda* (★) y *M. polycarpa* (▲) in Puerto Rico.

KEY TO THE SPECIES OF *MARSILEA*

1. Sporocarps borne single on solitary peduncles **1. *M. ancylopoda***
 – Sporocarps borne in a row along the stipe
 **2. *M. polycarpa***

1. *Marsilea ancylopoda* A. Braun in Monatsber. Königl. Preuss. Akad. Wiss. Berlin 1863: 434 (1864)

Rhizome wide-creeping, glabrous, 0.5-0.8 mm thick, frequently branching. Fronds ascending or erect, 5-15 cm long; stipes mostly 0.5-0.7 mm thick, glabrous, segments broadly obovate-cuneate or roundish, 0.5-0.2 cm broad at the sides, entire, light green. Sporocarps few, oblong-ovoid, 1-toothed, densely appressed-hirsute, the hairs brown. Sori about 23 in each sporocarp.

Seasonal ponds, muddy borders, receding lakes, and ditches. In some places forming extensive colonies. Florida, continental America from México to Brazil and Argentina. Southwest; recorded from Cabo Rojo, Guánica and Lajas (fig. 4).

2. *Marsilea polycarpa* Hooker & Grev., Icon. Fil. 2: 160 (1829)

Rhizome widely-creeping, pubescent near the nodes and toward apex, 0.5-1.7 mm thick, branched, forming extensive carpets. Fronds ascending to erect, 5-25 cm long; stipes mostly 0.5-1 mm thick, grooved, sparsely or lightly pubescent; segments broadly obovate-cuneate or rounded, 0.5-3.5 cm broad at the apex, slightly concave on the sides, entire, green. Sporocarp numerous, sub-globose, not toothed, at first densely and loosely pubescent, the hairs yellowish. Sori 6-10 in each sporocarp.

Seasonal ponds, margins of lagoons and marshes. Continental tropical America from México to Brazil. A rare but locally abundant fern found in Northeast Puerto Rico; recorded from Loiza, Manatí, San Juan and Vega Baja (fig. 4).

IV. SALVINIACEAE

Small floating plants with dorsoventral

structure. Stems horizontal bearing fronds in whorls of three, two of them green, entire, the third submerged, finely dissected and hairy. Floating fronds with a reticulate venation, the upper surface covered by erect papillae, the under-surface with septate hairs. Plants monoecious, sori in clusters on the submerged frond.

A family of a single genus.

7. *Salvinia* Séguier

Floating plants. Floating leaves less than 3 cm long. Microsporangiate sori several or many with numerous microsporangia containing trilete microspores; macrosporangiate sori one or two, with few megasporangia containing trilete megaspores.

A widely distributed genus of about 10 species. Two species in Puerto Rico. Both of them introduced and now escaped.

KEY TO THE SPECIES OF *SALVINIA*

1. Fronds 5-15 mm long, hairs free ... **1. *S. minima***
 – Fronds 10-22 mm long, hairs fused
 **2. *S. auriculata***

1. *Salvinia minima* Baker in J. Bot. 24: 98 (1886)

Fronds 5-15 mm long, colored. Floating fronds elongate, up to 16 mm long, 6-13 mm broad, upper surface pale green, bearing free papillae; submerged fronds up to 3 cm long. Pools and streams at low to middle elevations. Southern United States, Cuba and tropical continental America. Known from scattered localities; recorded from Arecibo, Carolina and Mayagüez (fig. 5).

2. *Salvinia auriculata* Aublet, Hist. Pl. Guiane 2: 969, t. 367 (1775)

Fronds up to 20 mm long. Floating fronds orbicular-cordate, up to 20 mm long, 8-18 mm broad, dark green, bearing papillae fused at the apex.

Pools and streams at low elevation. Florida, Cuba, Hispaniola and continental

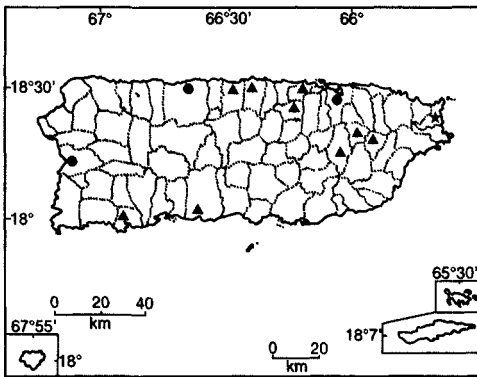


Fig. 5.—Distribution of *Salvinia minima* (●), *S. auriculata* (★) y *Azolla caroliniana* (▲) in Puerto Rico.

tropical America. Known from scattered localities; recorded from Fajardo (fig. 5).

V. AZOLLACEAE

Small or minute, floating or subaquatic, heterosporous plants. Habit dorsoventral, stems branching pinnately or dichotomously, bearing stems and roots. Fronds imbricate, alternate in two rows, each frond divided into two lobes, the lobes opposed, unequally developed, the upper ones covering the stem, with a cavity filled with mucilaginous material containing filaments of symbiotic cyanobacteria, the lower ones submerged, without cavities. Sori in pairs on submerged frond-borne lobes, each pair consisting of two microsporocarps, or two megasporocarps.

A family with a single genus.

8. *Azolla* Lam.

Small, annual plants with several long, filiform roots. Upper surface of leaves

minutely papillate, lower surface immersed in water. Microsporangium sorus globose, containing several to many long-stalked microsporangia; megasporangium sorus smaller than the microsporangium sorus

A widespread genus of 7 species. A single species occurs in Puerto Rico.

1. *Azolla caroliniana* Willd., Sp. Pl. 5: 541 (1810)

Plants minute. Rhizome 1-1.5 cm long; roots few, lax, filiform, alternately branched. Fronds imbricate; upper lobes oval, 0.7-0.9 mm long, 0.5-0.6 mm broad, green, pink, or bronze red, upper side convex, minutely papillose-puberulous, lower side hollow-concave; lower (submerged) lobes larger, pale green, membranous, glabrous. Sporocarps glabrous; megasporangia ovoid-apiculate, 0.4-0.5 mm long; microsporangia numerous.

Pools and streams at low to middle elevations. Eastern United States, Greater Antilles, Lesser Antilles (Grenada, Trinidad and Tobago) and tropical continental America. Originally distributed in Manatí, Caguas, Guánica, Gurabo, Juncos, Ponce, Toa Baja and Vega Baja. At present it is found only in Laguna La Esperanza and Manatí (fig. 5).

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