



A potential invasive species in Cuba (*Angiopteris evecta*): updated morphological description and distribution

Una especie potencialmente invasora en Cuba (*Angiopteris evecta*):
descripción morfológica y distribución actualizadas

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ABSTRACT

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<https://cu-id.com/2402/v223e09>

Angiopteris evecta is a fern species of the family Marattiaceae. It is native to the South Pacific, but it has been introduced into other localities since the 18th century and is currently listed as an invasive species in several regions (Costa Rica, Jamaica and Hawaii). In Cuba, it has been recorded in the eastern part of the archipelago. Due to the invasive behavior of this species, we intended to update the description and distribution of *A. evecta* in the country. The distribution and morphological data are based on two herbarium specimens from HAJB, from which the stem and leaf characters were measured. We confirmed that the species can be identified by the following features: 2-pinnate leaves; its lanceolate, narrow and herbaceous pinnules, with a crenate margin and lateral false veinlets. The species occurs in Gran Piedra (Santiago de Cuba) and in the proximity of Yunque de Baracoa (Guantánamo), in the montane rainforest, at an altitude of 250-600 m a.s.l. It is necessary to emphasize its inclusion in the management strategies for the localities where it has been detected, in order to prevent its future spread.

Keywords: conservation, introduced species, new record, pteridophyte

RESUMEN

Angiopteris evecta es un helecho de la familia Marattiaceae. Es nativa del Pacífico Sur, pero ha sido introducida en otras localidades desde el siglo XVIII y actualmente se considera una especie invasora en algunas regiones (Costa Rica, Jamaica y Hawái). En Cuba, está presente en el oriente del archipiélago. Debido al comportamiento invasor de esta especie, nos proponemos actualizar la descripción y la distribución de *A. evecta* en el país. Los datos de distribución y morfología están basados en dos especímenes del herbario HAJB, de los cuales se midieron los caracteres del tallo y las hojas. Se confirmó que la especie puede ser identificada por las siguientes características: hojas 2-pinnadas, pínulas herbáceas, lanceoladas y estrechas con márgenes crenados y falsas venillas laterales. La especie se distribuye en Gran Piedra (Santiago de Cuba) y en las cercanías del Yunque de Baracoa (Guantánamo), en el bosque pluvial montano, a una altitud entre los 250-600 m s.n.m. Es necesario llamar la atención en su inclusión en las estrategias de manejo de las localidades donde está presente para prevenir la futura expansión.

Palabras clave: conservación, especie introducida, nuevo registro, pteridófito

INTRODUCTION

Marattiaceae Kaulf. is a family of eusporangiate ferns that inhabit the tropics of both hemispheres (Moran, 2017). This family comprises six genera (*Danaea* Sm., *Eupodium* J.Sm., *Marattia* Sw., *Angiopteris* Hoffm., *Christensenia* Maxon and *Ptisana* Murdock) and about 111 species (Murdock, 2008a; PPG, 2016). It is considered a monophyletic group (Pryer *et al.*, 2004) readily distinguishable by the pulvinus-like swellings on the leaf axes (nodes), ear-like stipules at the stem-leaf junction, and sporangia opening by a terminal pore or slit (Moran, 2017).

Several authors have studied the taxonomy of *Angiopteris* (de Vriese and Harting, 1853; Hooker and Baker, 1868; Hieronymus, 1919; Holttum, 1978; Rolleri, 2002; Zhaorong and Christenhusz, 2013). This genus can be distinguished by the presence of monomorphic leaves, strongly swollen petiole bases, blades usually pinnately compound, sporangia opening by slits (fused basally into sori, but free apically) and false veins often prominent on the pinnules (Murdock, 2008b). According to PPGI (2016), species delimitation of *Angiopteris* varies widely; there may be 10 to 30 species worldwide. The genus has been recorded from Madagascar, India, Sri-Lanka, Nepal, Tailandia, Myanmar (Birmanian), Malaysia, China, Indonesia, Melanesia, Micronesia, Polynesia and Hawaii (Zhaorong and Christenhusz, 2013).

The Oriental vessel fern, *Angiopteris evecta* is native to the South Pacific, but has been introduced into

other localities since the 18th century, and is now listed as an invasive species in several regions (Costa Rica, Jamaica and Hawái) (Christenhusz and Toivonen, 2008). Proctor (1985) indicated that it is naturalized in Jamaica, after escaping from cultivation in botanical gardens. *A. evecta* was first recorded in Cuba by Caluff and Shelton (2009-2010) from the Sierra Maestra Mountain range. It is also found in cultivation in the National Botanical Garden of Cuba (López-García and Sánchez, 2021) and in the Ferns Garden of Santiago de Cuba (Caluff and Shelton, 2009-2010). Oviedo *et al.* (2012) and Oviedo and González-Oliva (2015) have included it as a potential invasive species due to its high dispersal capacity. We intend to update the description and distribution of *A. evecta* due to the invasive behavior of allochthonous populations of this species in other regions of the Caribbean and Paleotropics.

MATERIALS AND METHODS

The description of *A. evecta* was based on two herbarium specimens from the HAJB (Acronyms according to Thiers 2024), from which the stem and leaf characters were measured (Table 1). These characters were compared with three digital images of Jamaican collections (from <https://www.gbif.org/>) and with other descriptions (Proctor, 1985; Rolleri, 2002; Murdock, 2008a) (Appendix 1). In addition, distribution maps of the species were generated using Google Maps and ArcGIS v.10.2 (ESRI, 2013), based on the localities annotated in the herbarium labels.

Tabla 1. Morphological characters evaluated in the description of *Angiopteris evecta* in Cuba.

Table 1. Caracteres morfológicos evaluados en la descripción de *Angiopteris evecta* en Cuba.

Quantitative Characters		Qualitative Characters
Stem	- length - diameter - dimensions of scales (length x width)	- habit - type of stem - consistent of stem - type, insertion, color, type of margin, base and apex of scales - position in the stem - blade division degree - type, insertion, color, type of margin, base and apex of scales
Leaves	dimensions of leaves (length x width)	
Stipes	- dimensions (length x width) - dimensions of scale (length x width)	
Blades	- dimensions (length x width) - number of pairs of pinnae	form, type of base and apex
Pinnae and pinnules	- dimensions (length x width) - dimensions of scale (length x width)	- form, type of margin, base and apex - venation - type, insertion, color, type of margin, base and apex of scales
Sporangia	number of sporangia	- form, position of the sori - opening of sporangia

RESULTS AND DISCUSSION

Angiopteris evecta (G.Forst.) Hoffm. *Commentat. Soc. Regiae Sci. Gott.* 12: 29. 1794. $\equiv$ *Polypodium evectum* G. Forst. *Fl. Ins. Austr.* 81. 1786. $\equiv$ *Danaea evecta* (G.Forst.) Spreng. in *J. Bot.* (Schrader) (2): 272. 1799.

Description

Terrestrial plant. Erect and massive stem, 50-80 cm long. and equal width, partly covered by dead leaves and adult leaves stipules, basifixed or peltate scales $5-7 \times 1$ mm (or less), linear, brown, entire margin, truncate base, filiform apex. Monomorphic leaves, fasciculate, 2-pinnate, 2-6 m; stipules $4.88-6.8 \times 5.8-6.45$ cm, orbicular, green, fleshy, sinuous to entire margin; stipes 69.7-195 cm long., 3.28-4.8 cm diameter, shorter than the blades, with one node at the base, when young, bearing basifixed and linear scales, $3.1-5 \times 1$ mm (or less), brown to golden, truncated or rounded at base, filiform apex, deciduous; blades $61.3-147.13 \times 92-205$ cm, ovate, hastate base, evenly pinnate, with up to 45 pairs of pinnae; rachis with indument similar to that of the stipes; pinnae petiolulate, petiolule with one node at the base, 2.6-5.1 cm long., $54.8-92.7 \times 22-31.62$ cm, oblong-ob lanceolate, truncate at base, sagittate at apex, evenly pinnate, 30-36 pairs of pinnules; costa adaxially grooved and abaxially terete, indument similar to that of the stipes; pinnules, petiolulate, 2-4 mm, glabrous, $3.5-10 \times 0.8-2.4$ cm, 2.5 to 3 cm from each other, linear to oblong, asymmetric at base, acuminate-attenuate at apex, crenate at margins but serrate towards the apex; pinnate venation, with simple or forked veins, with a false veinlet between lateral veins extending from the costule to the margin, abaxial surface with indument similar to that of the stipes; sporangia grouped in sori, ellipsoid sori on the distal end of lateral veins, each sori with 7-16 sporangia, opening by a slit (Fig. 1, 2).

Distribution in Cuba

Eastern Cuba: Santiago de Cuba (Gran Piedra) and Guantánamo (near Yunque de Baracoa). Grows in montane rain forest from 250 to 600 m above sea level (Fig. 3). The species was recorded in the Guantánamo province for the first time. It was located 1 km east of Tabajó del Toa and 1.5 km north of Yunque de Baracoa, in the $20^{\circ}21'20.6''$ N and $74^{\circ}34'43.4''$ W. Only one individual was found growing on a slope that descends towards Tabajó del Toa,

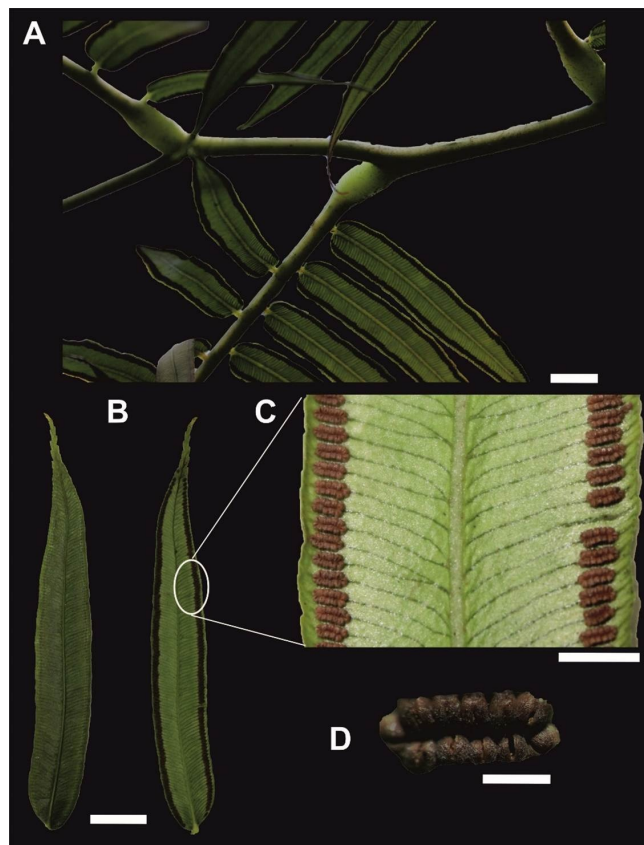


Figure 1. *Angiopteris evecta* from cultivation in the National Botanical Garden. A. Nodes at the base of the petiolule. B. Adaxial (left) and abaxial (right) view of the pinnule. C. Veins and sori on the pinnule. D. Detail of a sori. Scale bars: A= 2 cm, B= 2 cm, C= 0.5 cm and D= 1 mm. Photos by A.G. López-García.

Figure 1. *Angiopteris evecta* en cultivo en el Jardín Botánico Nacional. A. Nudos en la base del peciólulo. B. Vista adaxial (izquierda) y abaxial (derecha) de la pínula. C. Venas y soros en la pínula. D. Detalle del soro. Barras de escala: A= 2 cm, B= 2 cm, C= 0.5 cm and D= 1 mm. Fotos tomadas por A.G. López-García.

sloping towards the west and forming a slope that rises to 450 m. The altitude was about 250 m. This area corresponded to the rainforest ecosystem that has been cleared for the cultivation of coffee and banana plantations, among other crops. Currently, it is covered by some trees such as *Artocarpus altilis* (Parkinson) Fosberg (bread tree), *Cecropia schreberiana* Miq., ferns of the genus *Cyathea* Sm., shrubs of the genus *Piper* L. and lianas such as *Trichostigma octandrum* (L.) H. Walter (“guaniquí”).

The potential range of distribution of *A. evecta* was modelled by Christenhusz and Toivonen (2008). The models predicted that the species could spread across the more humid parts of tropical America, Africa and

Asia, and towards coastal habitats in the Caribbean, Central America and Hawaii. In any case, the species has to be introduced into these areas, just as it is in Cuba. It is considered that this fern arrived for the first time in the country via a traveling spore from a Jamaican individual (Caluff and Shelton, 2009-2010).

The discovery of a new adult individual of *A. evecta* raises the question of how the dispersal of the species is taken place in Cuba. It is important to note that this plant has both vegetative and sexual reproduction. Vegetative propagation occurs through fleshy stipules, which have proliferous buds that can grow into new plants when the stipules detach and find suitable soil (Hoshizaki and Moran, 2001), although the stipules cannot travel long distances. When adults, the leaves produce thousands of sporangia, the spores of which can be wind-dispersed over 3 200 km (Tryon, 1979). It is therefore plausible that the individual from the Yunque de Baracoa was the product of a germinated spore, but *A. evecta* takes many years before producing spores (Caluff and Shelton, 2009-2010).

According to Caluff and Shelton (2009 -2010), a seedling of this fern takes eight to ten years to develop into an adult plant, and a spore germinates in about two years and six months. The individuals located at Gran Piedra were adults in 2008. Given the approximate ages of the specimens recorded in Cuba and the distances between them, it is likely that the

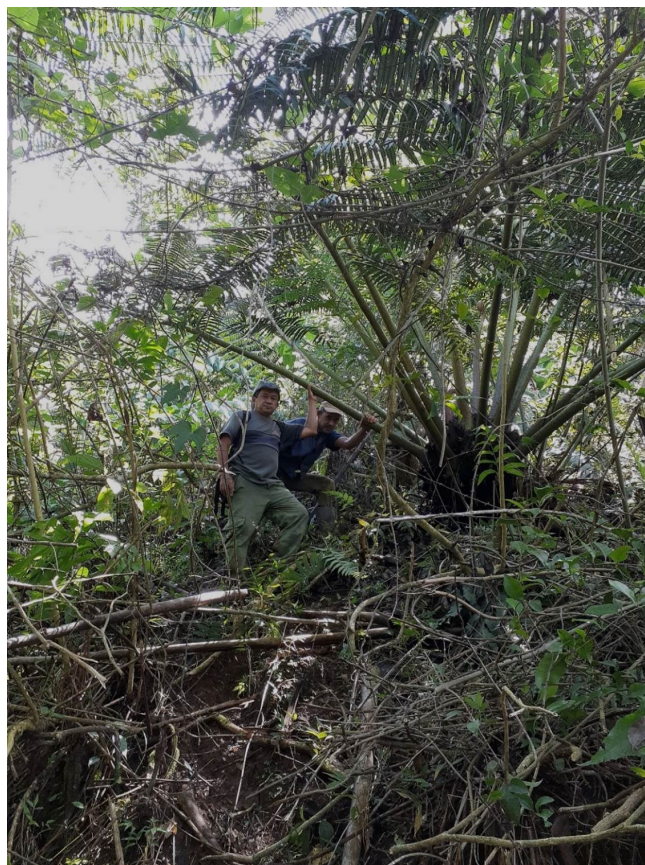


Figura 2. *Angiopteris evecta* collected nearby Yunque de Baracoa, Guantánamo, Cuba. Photo by R. Verdecia.

Figure 2. *Angiopteris evecta* colectada cerca del Yunque de Baracoa, Guantánamo, Cuba. Foto tomada por R. Verdecia.

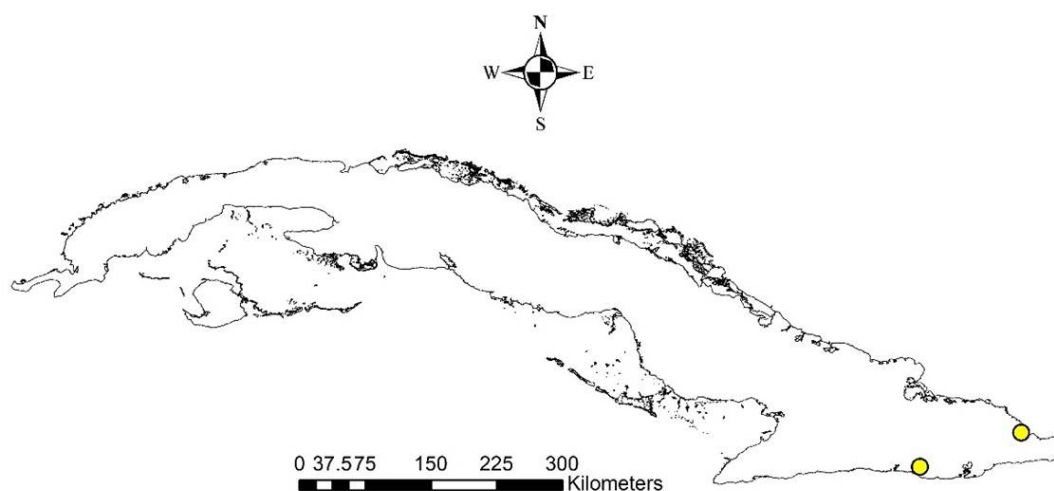


Figura 3. Distribution of *Angiopteris evecta* in Cuba.

Figure 3. Distribución de *Angiopteris evecta* en Cuba.

progenitor of the individual from Yunque de Baracoa is located in Gran Piedra (Santiago de Cuba). However, we cannot rule out the possibility that the new record from Yunque de Baracoa could be from a spore of a Jamaican individual.

On the other hand, the reproduction of *A. evecta* could lead to the formation of dense stands and therefore disturb natural ecosystems by competing with native species for space and light availability (Wilson, 1996). In Cuba, this fern represents a transformer plant according to Oviedo *et al.* (2012) and Oviedo and González-Oliva (2015). However, in the two Cuban localities where the taxon has been recorded so far in the wild, its proliferation is rather slow, with only a few individuals recorded in Gran Piedra (Santiago de Cuba) and only one in Yunque de Baracoa (Guantánamo). The species is a long-lived plant and its invasion, after introduction, will be slow because of slow rates of growth and reproduction (Christenhusz and Toivonen, 2008). Once adults are established, the invasion is difficult to stop (Funk, 1987). For example, it was introduced for cultivation in the Mānoa Valley, in 1927 by H. L. Lyon (Wilson, 1996) and rapidly spreaded (in about 40 years) to other regions of Hawaii. In terms of conservation, it will be crucial to develop a strategy for managing natural and cultivated populations of *A. evecta* in Cuba.

CONCLUSIONS

This work provides a new source of information about the morphology and distribution of *A. evecta* in Cuba, with a new record of its occurrence. At present, it is not considered to be a threat to the natural populations of other plants in the country, given its small population. However, it is a potential short-term invader to the native flora of the Cuban montane rainforests. It is therefore necessary to emphasize its inclusion in the management strategies for the localities where it has been detected, in order to prevent its future spread.

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APPENDIX

Appendix 1. Examined specimens.**Anexo 1.** Especímenes examinados.

-CUBA. Santiago de Cuba province: "La Idalia, Gran Piedra", 650 m, December 11th, 2008, Caluff and Shelton (BSC 6424 A-C, HAJB). Guantánamo province: Laderas 1 km al este de Tabajó del Toa y a 1^{1/2} km al norte del Yunque de Baracoa, 250 m a. s. l., 20° 21' 20.6"N, 74° 34' 43.4"W, June 5th, 2022, R. Verdecia, J. Díaz, L. Galano and N. Coutín (RV 22/11, HAJB) -JAMAICA. "Along Cuna-Cuna Pass, S of Millbank", 700-750 m, 180 O'N, 76023'W, January 19th, 2004, Christenhusz and Tuomisto 3111 (IJ). "Saint Thomas Parish, Corn Puss Gap", 600 m, September 5th, 1976, Proctor 36381 (IJ). "Castleton", July 24th, 1926, Jonson (F #C0677220F).