

# First record of the exotic fern *Pteris tripartita* Sw. (Pteridaceae) for the Maranhão state, northeastern Brazil

## Abstract

This study is the first record of the exotic fern species of *Pteris tripartita* Sw. (Pteridaceae) for the Maranhão state, northeastern Brazil. Here we present a description of the species, based on examined material and comments about its geographical distribution in the world and Brazilian states. Our data increases the knowledge of the number of change for: fern species recorded for the state, and help to delimit the geographical distribution pattern of this introduced species in the country, determining its invasive potential and possible impacts that it can cause to the native flora.

**Keywords:** amazon forest, botany, invasive species, são luis island

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## Introduction

Exotic species are considered one of the greatest threats to regional and local biodiversity,<sup>1</sup> being an important agent of structural change of the landscape. There are many cases of fern species introduced in Brazil,<sup>2</sup> mainly due to activities related to gardening and ornamentation. Approximately 13,600 species of ferns and lycophytes are estimated to occur worldwide, 3,500 of them in South America.<sup>3</sup> The latest study on the distribution of ferns and lycophytes in Brazil has reported a total 1,111 ferns and 142 lycophytes.<sup>4</sup>

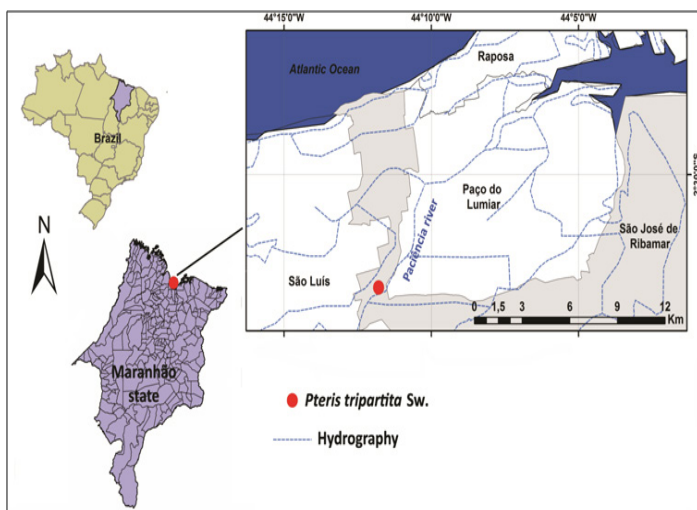
The Family Pteridaceae encompasses 53 genera and 1,211 species of ferns,<sup>5</sup> having a remarkable presence on tropical and subtropical regions. In Brazil, for instance, 23 genera and 196 species of Pteridaceae have been reported.<sup>6,7</sup> Species of this family exhibit a great diversity of life forms, such as: terrestrial, epiphytic, rupicolous, or even aquatic. The genus *Pteris* L. was erected by Linnaeus in 1753;<sup>8</sup> currently including about 250 species, widely distributed along the tropical regions of the world.<sup>9</sup> It is characterized by the sori formed on the margin of the lamina, with paraphyses and indusium formed by the revolute margins of the lamina. *Pteris* species may have ornamental and culinary uses and occur from sunny environments to less sunlight (in forests) in acidic or basic soils. This diversity of life forms and adaptation to environments contributes for its wide geographic distribution.<sup>9,10</sup> In Brazil, *Pteris* has about 24 species (six of them endemic) distributed throughout most of the country. All species occurring in Brazil have lamina at least once pinnate. These species are distributed in the following biomes: Brazilian Cerrado, Atlantic and Amazon Forest.<sup>2</sup>

The Maranhão state, northeastern Brazil, includes a transition zone between the Amazônia and the Brazilian Cerrado biomes, which

caused a great variety in the vegetation, such as fragments of Amazon Forest, babassu-palm forests and mangroves, on depressions and plains.<sup>11</sup> In the Maranhão state officially just two species of *Pteris* occur with specimens deposited on herbarium: *Pteris biaurita* L. and *Pteris denticulata* Sw.<sup>2</sup> The collection of *Pteris tripartita* Sw., mentioned in this paper, increases the number of species of the genus in this state to three. It is important to emphasize that a fourth species of the genus, *Pteris vittata* L., is also found in Maranhão, but always associated with urban areas, never occurring on natural areas and environment (Fernandes Pers. Obs.). For this reason, *P. vittata* was not considered in this study. The present study reports the first record of *Pteris tripartita* Sw. for Maranhão state, northeastern Brazil.

## Materials and methods

Specimens were collected during studies on the Maranhão flora. Species locality was accurately recorded by using GPS (Figure 1) and photographed using a digital camera. Fertile material was collected, pressed and oven-dried according to Silva.<sup>12</sup> Voucher specimens were then deposited in the MAR Herbarium, at Federal University of Maranhão. Herbarium acronyms followed THIERS.<sup>13</sup> The taxonomic treatment and description of the geographical distribution of *Pteris tripartita* Sw. were made based on existing literature, on the Brazilian Flora online database,<sup>14-16</sup> and on the analysis of specimens from the Re flora Virtual Herbarium.<sup>17</sup> The species geographical species geographical distribution was consulted on the Brazilian Flora online database.<sup>16</sup> The taxonomic classification system followed was that proposed in the PPGI.<sup>5</sup> The map of the study area was prepared with software QGIS<sup>®</sup> 2.18.16 Essen,<sup>18</sup> using the coordinate system UTM zone 23S, GCS South American Datum 1969. The conservation status of the species was consulted in the IUCN Red List criteria.<sup>19</sup>

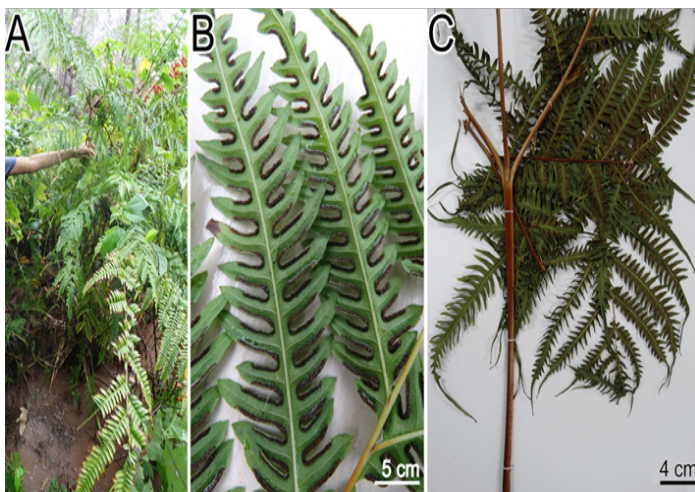


**Figure 1** Collecting site of *Pteris tripartita* Sw. in the Maranhão state, northeastern Brazil.

## Results and discussion

*Pteris tripartita* Sw., *J. Bot.* 1800 (2): 67. 1801. Figure 2.

Type: INDONESIA. JAVA: undated, Thunberg s.n. (holotype: UPS-T).



**Figure 2** *Pteris tripartita* Sw. (MAR 9285). (A) Habit. (B) Detail of sori distribution on the leaf. (C) Detail of the three frond divisions in an exsiccate.

Terricolous herb, up to 2m high. Rhizome ascending, short, ca. 2 cm in diam., apex brown, lanceolate, 0.2–1.3cm. Fronds 52 cm to 1.2m×30–100cm, erect, monomorphic; petiole dark brown at the base and light brown at its distal portion, 60–80×0.5–1cm, glabrous, bisulcate adaxially; papery leaf blade, deltate, tripartite, pinnate-pinnatifid, 20–40×10–15cm, glabrous adaxial and abaxial surfaces, pinnules pinnatifid 20–30 pairs, alternate, lanceolate, sessile, or short-petiolulate; proximal pinnules slightly shorter, 5–7×1–3cm; middle pinnules, 15–22×1–3cm; distal pinnules, 4–8×1–2.5cm; terminal pinnule, 6–10×1–3cm; frond segments falcate to oblong, acute apex, denticulate margin, costulae adaxially visible; venation partially areolate, veinlets anastomosing to form a series of narrow

areoles along costulae. Sori interrupted in the sinuses and absent at the apex of frond segments; pseudoindusium; trilete spores.

**Examined specimen:** Brazil. Maranhão: São José de Ribamar, mata de galeria, Rio Paciência [riparian forest, Paciência River], 02°32'55.6" S, 044°11'47.3" W, 11-I-2017, W.R.Silva Junior and A.W.C. Ferreira 004 (MAR 9285).

**Additional examined specimen:** Brazil. Paraná: Antonina, Reserva Natural Rio Cachoeira (SPVS). Trilha dos Fornos. Floresta Ombrófila Densa [Rio Cachoeira Natural Reserve (SPVS). OvensTrack. Dense Ombrophilous Forest], 25°15'00" S, 048°41'00" W, 2-III-2005, F.B. Matos and U. Ferreira 474 (UPCB 56964). BRAZIL. ACRE: Rio Branco. APA PZ, 09°57'14" S, 067°72'17" W, 23-V-2007, C.S. Pessoa et al. (RB 515212).

**Comments:** The species was collected at São José de Ribamar municipality, in a gallery forest fragment along the Paciência River (Figure 1). The specific epithet *tripartita* refers to the division of the leaf into three large parts (Figure 2). *Pteris tripartita* is not included in the IUCN Red List,<sup>19</sup> but according to the IUCN Red List criteria and its geographic distribution in Brazil,<sup>16</sup> the species has an EOO (Extension of Occurrence) greater than 20,000 km<sup>2</sup>, and thus may not be considered endangered.

*Pteris tripartita* is found in tropical regions of the world, occurring in the following countries and continents: Africa (Ghana, Madagascar and Zaire) Australia, Central America (Costa Rica, Cuba, Dominican Republic, Haiti, Jamaica, Leeward Islands, Panama, Puerto Rico, Virgin Islands and Windward Islands), South America (Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname and Venezuela), North America (Mexico, United States) and Asia (China, India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand and Vietnam).<sup>20</sup> This species is not native from the Americas. It was introduced by humans on this region and is considered an invasive plant.<sup>15,16,20</sup> *Pteris tripartita* is scarcely distributed in Brazil due to few botanical collections, with records confirmed only for the states of Acre, Amazonas, Paraíba, Pernambuco, Alagoas, Espírito Santo, São Paulo and Paraná,<sup>2,16</sup> and, being recorded in this paper for the Maranhão state, more accurately in the Amazon region of the state.

## Conclusion

The presence of the collected species indicates a certain degree of conservation of the site where they were found, since ferns depend on humid and well-preserved environments to grow and live.<sup>21</sup> No studies have been conducted in Brazil concerning the invasive potential of *P. tripartita*. The few collections recorded in Brazilian territory point to the high dispersion capacity of this species. These collections occurred in areas of the Amazon Forest (northern Brazil) and the Atlantic Forest (Northeast, South and Southeast regions of Brazil). These regions are isolated by about 4,000km.<sup>2,16</sup> This broad dispersion capacity may contribute to *P. tripartita* becoming an invasive fern.

The occurrence of an exotic species such as *Pteris tripartita* Sw. brings a question about the invasive ferns and their impacts on the native flora. Among the impacts that can be caused by introduced ferns, are the replacement of native species, formation of hybrids with local representatives, and invasion of native forests, as recorded in the islands of Hawaii.<sup>22</sup> In Brazil, some species of change for “ferns” are highlighted by the invasive potential, such as *Deparia petersenii* (Kunze) M. Kato, *Pteris vittata* L. and *Salvinia molesta* D.S. Mitch.<sup>23,24</sup>

but the best documented case in the country is the *Pteridium aquilinum* (L.) Kuhn, a species that usually spreads in livestock management fields, and is characterized by its carcinogenic effect in animals and by the aggressive action in the local vegetation.<sup>25–27</sup> Therefore, it is very relevant to record the geographic distribution of these exotic species and to monitor them, with the aim of preventing them to become invasive and to threaten the native vegetation and local fauna. The record of the occurrence of *Pteris tripartita* in the Maranhão state can help to trace its geographical distribution pattern in the country and determine its potential as an invasive species.

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## Conflict of interest

There is no conflict of interest to declare regarding the publication of this paper.

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