

Four species of fern newly recorded from the state of Jalisco, Mexico

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Abstract. Jalisco is one of the states with the greatest diversity of fern species in Mexico. As part of an ongoing study on the diversity and distribution of ferns along altitudinal gradients in this state, specimens were collected from localities in the Costa-Sierra Occidental region, leading to the discovery of four species of fern new to Jalisco: *Cyathea fulva* (Mart. & Gal.) Fée, *Macrothelypteris torresiana* (Gaudich.) Ching, *Parablechnum schiedeanum* (Schltdl. ex C.Presl) Gasper and Salino, and *Pelazoneuron lanosum* (C.Chr.) A.R.Sm. & S.E.Fawc.

Keywords. *Cyathea fulva*, *Macrothelypteris torresiana*, maple forest, *Parablechnum schiedeanum*, *Pelazoneuron lanosum*, Polypodiopsida, special protection

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Introduction

The richness and distribution of fern species in Mexico are due to multiple biotic and abiotic spatial, as well as temporal factors including topography, elevation, and geographic location (Baldeck et al. 2013; Mastretta-Yanes et al. 2015; Gudiño-Cano et al. 2025). Plant species richness fluctuates at local and regional scales, and therefore, even in relatively well-explored areas, such as the state of Jalisco, the probability of finding unreported species increases with spatial scale, environmental heterogeneity, and niche differentiation (Ricklefs et al. 2004; Qian et al. 2007; Matthews and Whittaker 2015; Villa et al. 2018).

Jalisco ranks sixth among Mexican states for diversity of ferns, with approximately 258 native species (Gudiño-Cano et al. 2025). The study of ferns in the state began with the collection of specimens by Edward Palmer in 1883. That decade, Cyrus Guernsey Pringle continued the collection work, mainly in the area surrounding Guadalajara (Rothfels 2025). More comprehensive floristic studies have since been conducted in some regions of Jalisco, such as the municipality of Zapopan, Sierra de Manantlán, Chamela, San Sebastián del Oeste, and Talpa de Allende (McVaugh, 1992; Vázquez et al. 1995; Guerrero-Hernández et al. 2014; Macías-Rodríguez 2015; Cedano-Maldonado et al. 2017; Colin-Nolasco and Macías-Rodríguez, 2017; Harker and Hernández-López, 2017; Gudiño-Cano et al. 2025). Despite the large number of botanists who have studied the floristic richness of Jalisco, there are still underexplored regions and municipalities and the number of fern species present in the state is uncertain.

Methodology can influence the completeness of floristic inventories. For example, if specimen sampling focuses on a particular group of plants (e.g., exclusively ferns), the probability of detecting more species in the field increases (Hernández-Álvarez et al. 2025). Our objective was to record, for the first time, the presence of four species of ferns in Jalisco, and to provide complementary information on their altitudinal distribution and associated type of vegetation type in the state.

Methods

Study area. The western Mexican state of Jalisco borders the Pacific Ocean to the west and the states of Aguascalientes, Colima, Guanajuato, Michoacán, Nayarit, and Zacatecas to the south. The state has an area of 78,595 km² and representing 4% of the country's total area (INEGI 2020). Four major



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physiographic provinces converge in Jalisco: Trans-Mexican Volcanic Belt (50.4% of the state's area), Sierra Madre del Sur (26.9%), Sierra Madre Occidental (14.9%), and Mesas del Centro de México (7.7%) (Ruiz López and Bollo-Manent 2018). The state of Jalisco is divided into several regions, two of which comprise the study area.

According to the Comisión Estatal del Agua de Jalisco (2024), the Western Sierra Region has an average elevation of 1,401 m, with a minimum elevation of 1,160 m in the municipality of Talpa de Allende and a maximum elevation of 1,720 m in the municipality of Cuautla. The North Coast Region has an average elevation of 230 m above sea level across the region, with a minimum elevation of 40 m in the municipality of Puerto Vallarta and a maximum elevation of 600 m in the municipality of Cabo Corrientes. Together, these regions form part of the Costa-Sierra Occidental region. Across the entire region, the mean annual temperature is 19.7 °C, with average temperatures ranging from 9.1 °C to 31.6 °C, and mean annual precipitation of 1,442 mm. The predominant climate types are warm subhumid (Aw1(w)) and temperate subhumid ((A)C(w1)(w), C(w2)(w)) (CONAFOR, 2016).

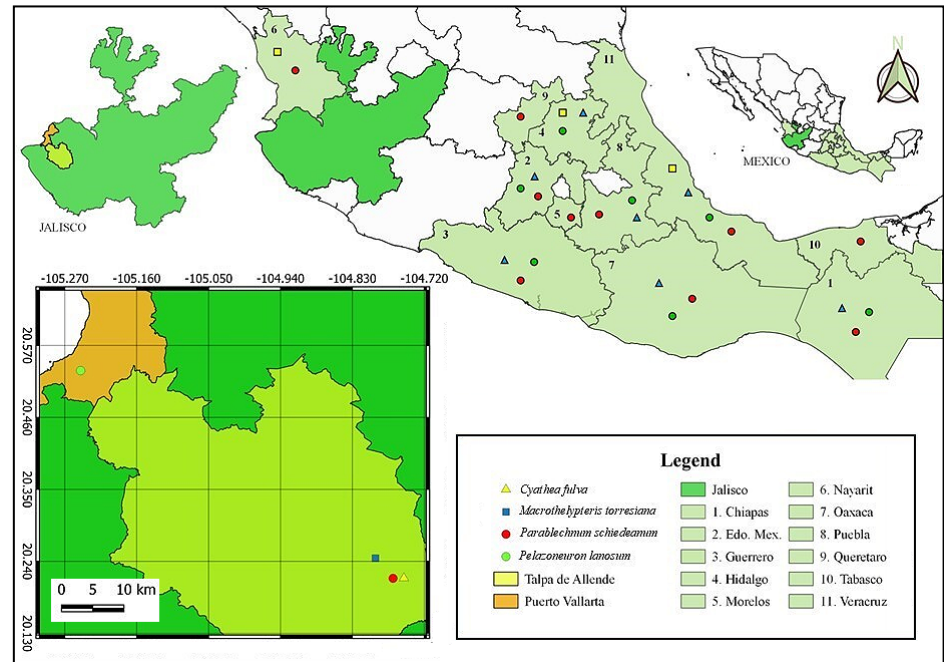
Fieldwork. As part of a broader research project aimed at understanding the distribution and diversity of ferns in different vegetation types along an altitudinal gradient, specimens were collected in various locations in the Costa-Sierra Occidental region, Jalisco, specifically in the municipalities of Talpa de Allende and Puerto Vallarta. Fieldwork was conducted between February and April 2025, following an ad hoc protocol that consisted of the intensive search and collection of fern specimens in different microhabitats. This sampling alternative has proven more efficient than conventional methods when the main objective is to find the greatest number of species possible in a area (Gordon and Newton 2006; Jayakumar et al. 2009; González-Oliva et al. 2017; Meave et al. 2017; Hernández-Álvarez et al. 2025). This sampling method is useful when a more complete floristic list is desired, implying a collection effort commensurate with the degree of environmental heterogeneity or structural complexity of each vegetation type. These methods generate comprehensive information on the richness and composition of plants in specific areas or regions. Specimen collection was based on the proposal of Lot and Chiang (1986). In addition to the presence of species, their growth habits (terrestrial, epiphytic, and epipetric), elevation, and vegetation type were recorded. Vegetation types were defined using physiognomic criteria, based on the dominant tree species (Mateucci and Colma 1982), and employing the nomenclature proposed by Rzedowski (1978). Specimen collection was carried out with a collection permit (SPARN/DGVS/06440/24) issued by the Ministry of Environment and Natural Resources (SEMARNAT).

Laboratory work. The collected specimens were pressed, dehydrated, and subsequently identified to the species level in the laboratory using the dichotomous keys of Mickel and Smith (2004). The nomenclature was updated according to recent monographs, studies, and taxonomic revisions (Molino 2022; Hassler 2026). Taxonomic categories above species were defined based on the classification proposed by the Pteridophyte Phylogeny Group (PPG I 2016), and the species names were compared with the online list of plant synonyms at <https://www.worldplants.de/world-ferns/ferns-and-lycophytes-list>. To verify that the specimens were correctly identified, they were compared with the type specimens at <https://plants.jstor.org>, as well as with specimens from the digital database at <https://pteridoportal.org/portal/index.php>. Subsequently, a duplicate of the specimens was deposited in the Luz María Villarreal de Puga Herbarium (IBUG) of the University of Guadalajara; other duplicates will be deposited to the National Herbarium of Mexico (MEXU) and the Herbarium of the National School of Biological Sciences (ENCB, IPN).

The identified species were compared with various floristic lists compiled for the state (Vázquez et al. 1995; Mickel and Smith 2004; Cedano Maldonado et al. 2006; Villaseñor 2016; Colin-Nolasco and Macías Rodríguez 2017; Gudiño-Cano et al. 2025) and with online images of herbarium specimens, allowing their current distribution in the country to be defined and recognized as newly reported at the state level. Digital herbaria, the UNAM Open Data Portal, and the Pteridoportal platform were consulted (Rothfels et al. 2025).

Distribution map. Distribution data for the states where the species mentioned here have previously been recorded were obtained from the works of John T. Mickel and Alan R. Smith (2004) and José Luis Villaseñor (2016), as well as from digital platforms such as the UNAM Open Data Portal (2026) and PteridoPortal. Although some digitized specimens from virtual herbaria include geographic coordinates, the map only indicates the known distribution within the federal entities. Geographic coordinates were used exclusively to indicate the new records of the species for the state of Jalisco, corresponding to the municipalities of Puerto Vallarta and Talpa de Allende (Figure 1). The map was created using QGIS v. 3.22 (Białowieża 2021).

Figure 1. Known distribution in Mexico of the species of four new fern records for the state of Jalisco. In the state of Jalisco, the new records are in the municipalities of Talpa de Allende and Puerto Vallarta.



Results

Four fern species are recorded for the first time in Jalisco; three herbaceous and one arborescent, belonging to four genera and three families (Table 1). All four species are terrestrial and develop in montane cloud forest (MCF) and tropical subdeciduous forest (TSF). *Cyathea fulva* and *Parablechnum schiedeanum* were collected in the MCF (dominated by *Acer binzayedii* Y.L.Vargas-Rodr.) in the municipality of Talpa de Allende; *Macrothelypteris torresiana* was collected in the same municipality and forest type, but at a lower elevation, with individuals growing in forest clearings and along the banks of a stream; *Pelazoneuron lanosum* was found along the banks of the Palo María stream, in the MCF TSF ecotone, in the municipality of Puerto Vallarta.

Family Cyatheaceae

Cyathea fulva (Mart. & Gal.) Fée

Figure 2A

New record. MEXICO — JALISCO • Talpa de Allende, along margins of small streams in the maple forest; 20°12'51"N, 104°45'04"W; 1754 m alt.; 15.II.2025; C. Zavala-Álvarez 954, A. Sánchez-González, A.G. Hernández-Álvarez (IBUG 224615).

Identification. Caudex up to 6 m; petiole not conspicuously spiny, brown, dull, scales 15–20 × 2–5 mm, lanceolate yellowish-brown; scale brown; fronds with 2-pinnate-pinnatifid blade; pinnae with pinnatifid apex; pinnules 4.0–9.0 × 1.0–1.8 cm, sessile to shortly pedicelled, pedicel up to 2 mm; last segments 12–18 per pinnule, 3–4 mm wide, entire to serrate; rachis without trichomes, with a brown

Table 1. New records of ferns from Jalisco, Mexico. BCF = montane cloud forest, TSF = tropical subdeciduous forest. Distribution in Mexico, based on Mickel and Smith (2004) and Villaseñor (2016): CHIS = Chiapas, GRO = Guerrero, HGO = Hidalgo, MEX = State of Mexico, MOR = Morelos, OAX = Oaxaca, PUE = Puebla, QRO = Querétaro, TAB = Tabasco, VER = Veracruz.

Family/species	Municipality	Type of vegetation	Geographical coordinates	Elevation (m)	Known distribution in Mexico
Blechnaceae					
<i>Parablechnum schiedeanum</i> (Schtdl. ex C.Presl) Gasper & Salino	Talpa de Allende	BCF	20°12'51"N, 104°45'04"W	1754	CHIS, GRO, HGO, MÉX, OAX, VER
Cyatheaceae					
<i>Cyathea fulva</i> (Mart. & Gal.) Fée	Talpa de Allende	BCF	20°12'51"N, 104°45'04"W	1754	CHIS, GRO, HGO, MEX, OAX, PUE, VER
Thelypteridaceae					
<i>Macrothelypteris torresiana</i> (Gaudich.) Ching	Talpa de Allende	BCF	20°14'41"N, 104°47'41"W	1330	CHIS, GRO, MEX, OAX, MOR, NAY, QRO, TAB, VER
<i>Pelazoneuron lanosum</i> (C.Chr.) A.R.Sm. & S.E.Fawc.	Puerto Vallarta	BCF-TSF ecotone	20°31'53"N, 105°14'45"W	388	HGO, NAY, VER



Figure 2. Four species of fern found for the first time in Jalisco, Mexico. **A.** *Cyathea fulva*, specimen in situ, stipe spines, detail of the middle pinna, scales at the base of the stipe, and circinate leaf. **B.** *Parablechnum schiedeanum*, specimen in situ, vegetative blade, and fertile blade. **C.** *Macrothelypteris torresiana*, specimen in situ, scales at the base of the stipe, sori on the underside of the blade. **D.** *Pelazoneuron lanosum*, enlarged and incised basal acroscopic segments, scaled stipes, leaf in its middle part and apex, darkened stipe towards base and reduced proximal pinnae.

scale; costae glabrous or nearly glabrous; costulae puberulent and scaly, trichomes ca. 0.1 mm, pale reddish, generally appressed, scales broadly ovate, pale to dark brown; veins 8–10 pairs per pinnule, 1-bifurcated, glabrous; laminar tissue between veins glabrous; sori inframedial; paraphyses shorter than sporangia, inconspicuous; indusium globose, completely surrounding receptacle.

Family Thelypteridaceae

***Macrothelypteris torresiana* (Gaudich.) Ching**

Figure 2C

New record. MEXICO — JALISCO • Talpa de Allende, on banks of streams, mainly in open areas; 20° 14'41"N, 104°47'41"W; 1330 m alt.; 16.III.2025; C. Zavala-Álvarez 983 (IBUG 224616).

Identification. Plants 60–160 cm tall; rhizomes short, erect, or ascending, with dense reddish-brown linear-lanceolate scales at tips. Fronds clustered; stipes 30–70 cm long, greyish-green, stramineous when dry, with bases briefly hairy, distally subglabrous; blades triangular-ovate, 3-pinnate, acuminate and pinnatifid at tips; pinnae ca. 15 pairs, subopposite, petioles 2.0–2.5 cm long; proximal pairs larger, oblong-lanceolate. Blades herbaceous, dark-brownish green when dry, with long, spreading, multicellular greyish-white acicular trichomes and short capitate glands on underside and adaxially with short hairs along costa and costule. Rachis and costa stramineous, glabrous on underside and adaxially with thin, multicellular trichomes. Sori in 2–6 pairs per segment, united near ends of veinlets; indusia, orbicular-reniform, greenish, hidden in mature sori. Sporangia with 2 or 3 short, capitate trichomes at top.

Family Blechnaceae

***Parablechnum schiedeanum* (Schltdl. ex C.Presl) Gasper & Salino.**

Figure 2B

New record. MEXICO — JALISCO • Talpa de Allende, near wetlands, in open areas, and along stream banks; 20°12'51"N, 104°45'04"W; 1754 m alt.; 15.II.2025; C. Zavala-Álvarez 961, A. Sánchez-González, A.G. Hernández-Álvarez (IBUG 224617).

Identification. Terrestrial plant with an erect but not subarborescent rhizome, lanceolate scales light brown or rarely black, entire; sterile and fertile leaves dimorphic; petiole 30–160 cm, yellowish-brown or straw-coloured and often with brown spots, densely scaly to glabrescent on both surfaces; blade up to 160 × 30 cm long, 1-pinnate, scaly to glabrescent on the underside, truncate at the base, without vestigial pinnae, apex of pinna similar in shape to lateral pinnae; buds absent; pinnae in 12–25 pairs, sessile or nearly sessile, entire, often narrowly involute; rachis and costa straw-colored, papillose, densely scaly to glabrescent; aerophores low, rounded, oblong; Fertile leaves 50–150 cm; petiole 30–50 cm, straw or chestnut-coloured.

Family Thelypteridaceae

***Pelazoneuron lanosum* (C.Chr.) A.R.Sm. & S.E.Fawc.**

Figure 2D

New record. MEXICO — JALISCO • Puerto Vallarta, at margins of streams in ecotone of tropical vegetation and elements of montane cloud forest; 20°31'53"N, 105°14'45"W; 388 m alt.; 10.IV.2025; C. Zavala-Álvarez 1010 (IBUG 224618).

Identification. Rhizomes short, creeping; fronds commonly 100–170 cm long; stipes stramineous, darkened at base, 60 cm × 9 mm, scaly at base; scales persistent, white or slightly pink when young, light brown when mature; blades chartaceous to subcoriaceous, dark greenish-grey when dry, 110 × 70 cm, tapering uniformly towards pinnatifid apices; pinnae sessile, proximal ones slightly or not at all reduced, with basal acroscopic segments often much enlarged and incised; segments oblique, subfalcate to falcate, margins frequently revolute; veins in 13–19 pairs per segment, with proximal pair of adjacent segments connivent in sinuses or distal vein of a pair reaching margin just above sinuses. Abaxially an indumentum of dense trichomes on costa, costula, veins and usually tissue between veins; ribs lacking scales and glands, or latter inconspicuous, stipitate, obscured by hairs; adaxially costa densely hairy, hairs mostly 0.5–1.0 mm long; medial sori, with pale-brown indusium, densely hairy, trichomes 0.5–1.0 mm long, sometimes almost obscuring indusium.

Discussion

Bosque de Arce State Park is located west of La Cumbre de Guadalupe (or cumbre de los Arrastrados), in the municipality of Talpa de Allende, Jalisco, at an elevation of 1,800 m above sea level and approximately at 20°11' N, 105°16' W. It lies on a tributary of the Talpa hydrological basin, which flows into Puerto Vallarta (Vázquez-García et al. 2000).

Populations of *Cyathea fulva* and *Parablechnum schiedeanum* in this park occur exclusively in shaded areas. The *C. fulva* population consists of more than 100 individuals of varying ages; adults reach 7–9 m in height. Many individuals of *P. schiedeanum* were seen in the area. One of the specimens of "*Parablechnum schiedeanum*" that we reviewed in the virtual herbarium collections, collected in 1986, appears to have been mistakenly attributed to Jalisco (Esperón M. 16722, UC), but it was actually collected in the state of Veracruz, according to data from Pteridoportal and eFloramex. The distributions of both *C. fulva* and *P. schiedeanum* in Mexico is restricted to a few states in the south-central, Gulf of Mexico, and South Pacific regions (Mickel and Smith 2004; Villaseñor 2016).

The presence of *C. fulva* in Jalisco is noteworthy because its previous distribution in Mexico only included the Atlantic slope, in the southeastern (Chiapas, Guerrero, Oaxaca and State of Mexico) and eastern (Hidalgo, Puebla, and Veracruz) states, at elevations between 300 and 2,500 m. This species is also distributed in Belize, Guatemala, Honduras, and Nicaragua (Mickel and Smith 2004). It can be confused with *Cyathea divergens* Kunze var. *tuerckheimii*; however, *C. fulva* is distinguished by its scales, both on the stem apex and the base of the petiole. In other regions of Jalisco, two species of tree ferns are distributed: *Alsophila firma* (Baker) D.S.Conant and *Cyathea costaricensis* (Mett.) Domin. In the Sierra de Manantlán, *A. firma* has been identified as *Cyathea mexicana*, Schltdl. & Cham. but this identification

was later corrected (Vázquez et al. 1995). Something similar occurred with the description of the plant species present in the Arce forest of the municipality of Talpa de Allende, where *C. fulva* was confused with *C. costaricensis* (Vázquez-García et al. 2000). Several species of the genus *Cyathea* are included in risk categories under the Mexican standard NOM-059-SEMARNAT-2025; among them, *C. fulva* is classified under the Special Protection category (Pr).

Macrothelypteris torresiana is a non-native species in Mexico, with a natural distribution in the Mascarene Islands, and also found in warmer areas of mainland Asia and Japan, Malaysia, Queensland, Polynesia, and Hawaii (Mirza 2006). In Mexico, it grows in open areas with partial shade, but not in full shade, along roadsides and edges of natural vegetation. According to González de León et al. (2021), it is invasive and has a high capacity to capture resources necessary to maintain high growth rates, become established, and expand its geographic distribution. Until 2004, it was recorded in only 10 federal entities in Mexico, and in 2025 it was recorded in the state of Nayarit (Hernández-Álvarez et al. 2025), indicating that the species is expanding its distribution in the country.

Pelazoneuron lanosum is an endemic species in Mexico (Villaseño 2026). This species differs from *Pelazoneuron patens* (Sw.) A.R.Sm. & S.E.Fawc. primarily in the rhizome habit, which is creeping in *P. lanosum* and erect in *P. patens*, and in the presence of narrow scales at the base of the stipe in *P. lanosum*. It was known only from the states of Hidalgo and Veracruz until 2004 (Mickel and Smith 2004), then from the state of Nayarit in 2025 (Hernández-Álvarez et al. 2025).

Our new data reinforce the need for wide-spectrum field expeditions for ferns, where all taxa of diverse lineages are collected, given the importance of distribution data to understand the real conservation status and distribution of species in Mexico.

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Additional information

Conflict of interest

The authors declare no conflict of interest.

Ethical statement

No ethical statement is reported.

Use of artificial intelligence (AI)

No artificial intelligence tools were used.

Author contributions

Conceptualization: CZA, ASG. Data curation: CZA. Formal analysis: CZA, ASG, VS. Fundraising: CZA, ASG. Research: CZA, ASG, MAMC. Methodology: CZA, ASG. Supervision: ASG. Visualisation: VS, MAMC. Drafting: CZA, ASG. Editing: CZA, ASG.

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Data availability

All data supporting the findings of this study are available in the main text.

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