Three new species of ferns (Woodsiaceae and Polypodiaceae) from Mexico

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Mickel, J. T. (The New York Botanical Garden, Bronx, NY, 10458-5126, U.S.A.; e-mail: jmickel@nybg.org) & J. D. Tejero-Díez, (Universidad Nacional Autónoma de México, Escuela Nacional de Estudios Profesionales Iztacala, Carrera de Biología, Apartado Postal 314, Tlalnepantla 54090, México, Mexico; e-mail: tejero@servidor.unam.mx). Three new species of ferns (Woodsiaceae and Polypodiaceae) from Mexico. Brittonia 56: 115–120. 2004.—Three new species of ferns are described from Mexico: **Athyrium tripinnatum, Cystopteris millefolia,** and **Polypodium praetermissum.**

Key words: Mexico, ferns, *Athyrium*, *Cystopteris*, *Polypodium*.

Preparation of manuscripts on the pteridophytes of the Republic of Mexico (Mickel & Smith, submitted 2002) and on the pteridoflora of the state of México (Tejero-Díez, 1998), reveal three new species of ferns, which are here described.

Athyrium tripinnatum Mickel & Tejero, **sp. nov.** (Fig. 1D–F)

TYPE: MEXICO. México: Mun. Tejupilco, desviación a El Reparo, Km 38 a partir de la desviación (carretera Tejupilco–Bejucos) a Nanchititla, 1500 m, 30 Sep 1988, *Tejero-Díez 2919* (HOLOTYPE: IZTA; ISOTYPE: NY).

Ab *A. palmensi* et *A. skinneri* laminis tripinnato-pinnatifidis distincta.

Rhizomes short-creeping, 3 mm diam.; *rhizome scales* light brown, narrowly deltate, with long-acuminate apices, the margins entire, to 4 × 0.5 mm; *fronds* approximate (2–4 mm distant), to 60 cm long; *stipes* ca. 1/3 frond length, stramineous, adaxially grooved, with sparse linear scales similar to those of rhizomes and appressed septate hairs 0.2–0.5 mm long (mostly on abaxial surface); *blades* tripinnate-pinnatifid, broadly deltate, to 30 cm wide, with 15–18 pairs of free pinnae, the blade apex shortly attenuate; *rachises* subflexuous, stramineous, slightly alate, with scattered hairs similar to those of stipes mainly on abaxial surface; *pinnae* alternate, narrowly triangular, ascending, the basal ones to 19 × 10 cm, texture herbaceous, abaxial surface with appressed hairs 0.1–0.2 mm long, adaxial surface glabrous; *veins* pinnate, ending in the teeth; *sori* one per ultimate segment, 1–1.5 mm long, elongate, J-shaped, or round; *indusia* 0.2–0.4 mm wide, whitish, coarsely toothed.

Distribution.—Terrestrial in oak woods, locally abundant on slopes of arroyos; 1500 m. Known only from the type collection.

Athyrium tripinnatum is similar to *A. palmense* (H. Christ) Lellinger in having slender rhizomes, thin deltate blades, and an indusium deeply lacerated into 2–4 teeth, but differs in having blades that are tripinnate-pinnatifid rather than bipinnate-pinnatifid as in *A. palmense* or pinnate-pinnatifid as in *A. skinneri*. With increasing dissection, there is increasing frond size: *A. skinneri* (Baker) C. Chr. to 44 cm long with 5–7 pinna pairs, *A. palmense* to 53 cm long with 12–15 pinna pairs, and *A. tripinnatum* to 60 cm long with 15–18 pinna pairs.

Cystopteris millefolia Mickel & Tejero, **sp. nov.** (Fig. 1A–C)

TYPE: MEXICO. México: Mun. Ocuilan, Km 18, Ocuilan-Cuernavaca, 2130 m, 9

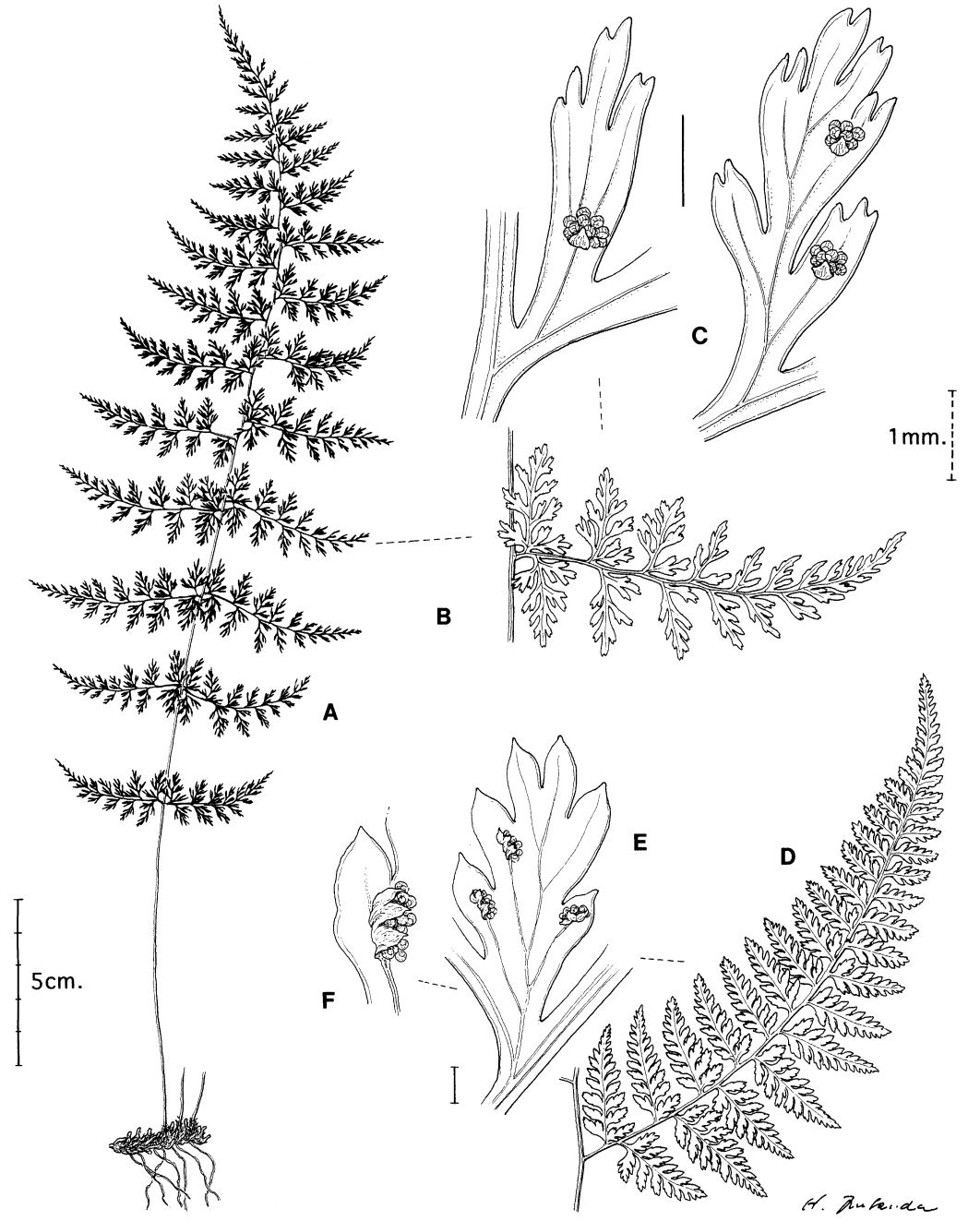

FIG. 1. **A–C.** *Cystopteris millefolia* (*Hinton 13499,* ARIZ). **A.** Habit. **B.** Pinna. **C.** Segments. **D–F.** *Athyrium tripinnatum* (*Tejero Díez 2929,* NY). **D.** Pinna. **E.** Segment. **F.** Sorus.

Nov 1985, *Tejero-Díez 2234* (HOLOTYPE: NY; ISOTYPE: IZTA).

A *C. fragili* laminis tripinnato-pinnatifidis vel quadripinnatis, segmentis linearibus differt.

Rhizomes short-creeping, ca. 2 mm diam., not protruding beyond fronds; *rhizome scales* brown, membranous, lustrous, lanceolate, entire, 1.5–3 × 0.8–1.5 mm, mixed with fine hairs; *fronds* 14–50 cm

long, clumped; *stipes* ⅓–½ frond length, stramineous, reddish brown at base, with scales at base to 3 mm long, mixed with hairs as on rhizomes, glabrous distally; *blades* tripinnate-pinnatifid to quadripinnate, lanceolate, 12–30 × 4.5–14 cm, with proximal 2–3 pinna pairs slightly reduced; *rachises* glabrous or with scattered minute glandular hairs in rachis grooves adaxially; *pinnae* 12–16 pairs, 2–8 cm long, perpendicular to rachises, chartaceous, glabrous; *segments* linear, 1 mm wide; *veins* ending in small emarginations; *indusia* hoodlike, glabrous, entire.

Distribution.—Wet mossy rocks in forest streams, moist banks in pine and pine-fir forests; 2200–3500 m. Central Mexico.

Additional specimens examined. MEXICO. **México**: Side of Popocatépetl, ca. 4100 m, 16 Jul 1947, *Barkley et al. 2346* (LL); NW of Toluca, Mexico Hwy 15, Km 105, 8500 ft (ca. 2600 m), 16 Sep 1962, *Barr 62–795* (ARIZ); Mun. Villa de Allende, San José de Allende, 10 Oct 1985, *Bartholomew 2886* (GH, MEXU); between Km 76 and 77 on Amecameca–Popocatépetl rd., 3250 m, 2 Aug 1958, *Beaman 2061* (TEX); Mun. Temascaltepec, El Polvorín, Km 13 Toluca a Temascaltepec, 9 May 1988, *Flores 817* (MEXU); Mun. Ocuilan, Km 14 entre Santa Mónica Ocuilan y Cuernavaca, 99°21′44″W, 18°59′N, *Hernández Salazar 15* (IZTA); Mun. Ocuilan, Cerro Zempoala en el Parque Nacional Lagunas de Zempoala, 22 Jul 2000, *Rojas 5411* (MEXU); Mun. Villa Victoria, Laguna del Carmen en Parque Nacional Bosencheve, 19°28′W, 100°10′N, *Tejero-Díez 2937* (IZTA). **Michoacán**: Rt. 15, ca. 0.7 km N of Km 146, ca. 7 km W of México-Michoacán state line, ca. 2930 m, 14 Jul 1966, *Cruden 1068* (GH, MICH); Mun. Angangueo, Ejido Cerro Prieto en Barranca Honda, 15 Mar 1987, *Díaz Barriga 3597* (IEB, MEXU); Distrito Zitácuaro, Zitácuaro–La Difunta, 3000 m, 27 Nov 1938, *Hinton 13499* (ARIZ, GH, LL, PH, TEX); Distrito Uruapan, Tancítaro, 3150 m, 18 Nov 1940, *Hinton 15711* (TEX); Mun. Queréndaro, 3 km al sur de San José de la Cumbre, *Rzedowski 48315* (MEXU). **Morelos**: Mun. Cuernavaca, Barranca Tepeite, Dec 1947, *Lyonnet* [*471200019*] (MEXU); Mun. Cuernavaca, Barrancas rumbo a Santa Maria de Ocuilan, *Pérez-García 766* (UAMIZ).

Cystopteris fragilis (L.) Bernh. s.l. is one of the most widespread pteridophyte species in the world. It is known to hybridize with other species in North America (Haufler et al., 1990, 1993; Haufler & Windham, 1991). Nearly all Mexican and Central American material is treated by us and others (e.g., Stolze, 1981; Mickel & Beitel, 1988; Moran, 1995; Riba et al., 1996) as *C. fragilis*, largely because it has not been studied as closely as specimens from North America. *Cystopteris membranifolia* Mickel (from Veracruz, Oaxaca, and Guatemala) is distinguished by its very thin blades, long-creeping rhizomes, and tuberculate-echinate spores. Within *C. fragilis* s.l. in Mexico, there is considerable morphological variation (especially in degree of dissection), spore variation (both rugose and echinate), and ploidal variation, judging from spore sizes (diploid 26–39 μm, tetraploid 37–45 μm, hexaploid 46–53 μm; Moran, pers. comm.). Most specimens have veins ending in segment emarginations, but this character seems variable. Much, but certainly not all, Mexican material referred to *C. fragilis* may be *C. reevesiana* Lellinger which is common in the southwestern United States, but until detailed studies are made, we prefer to use the name *C. fragilis*. There may yet be several taxa to be segregated from *C. fragilis* in Mexico, but *C. millefolia*, with its finely dissected fronds, is the most distinct.

Polypodium praetermissum Mickel & Tejero, **sp. nov.** (Fig. 2A–G)

TYPE: MEXICO. Nayarit: Mun. de Tepic, a 17 km de Jesús María rumbo a la Mesa del Mayab, 22°15′N, 104°37′W, 7 Sep 1991, *Ramírez 1078* (HOLOTYPE: MEXU; ISOTYPES: IZTA, NY).

A *P. plesiosoro* squamis rhizomatis comosis, patentioribus distincta.

Rhizomes creeping, ca. 5 mm diam.; *rhizome scales* covering 85–100% of rhizomes, orange-tan, concolorous to somewhat paler at margins, sometimes with darker point of attachment, ovate-lanceolate, comose, 2.0–3.5 × 0.8–2.1 mm, margins denticulate or subentire, mostly ascending or somewhat spreading; *fronds* 21–45 × 6–12(–18) cm, distant; *stipes* ⅓ frond length, stramineous to castaneous, adaxially grooved, glabrous; *blades* pinnatisect, deltate to oblong, apex pinnatifid or with a subconform terminal pinna, hairs of laminar tissue 0.1–0.3 mm long with 2–3 cells; *pinnae* 8–26 pairs, linear-deltate, adnate and somewhat surcurrent to slightly narrowed at their bases, the proximal 1–2 pairs often

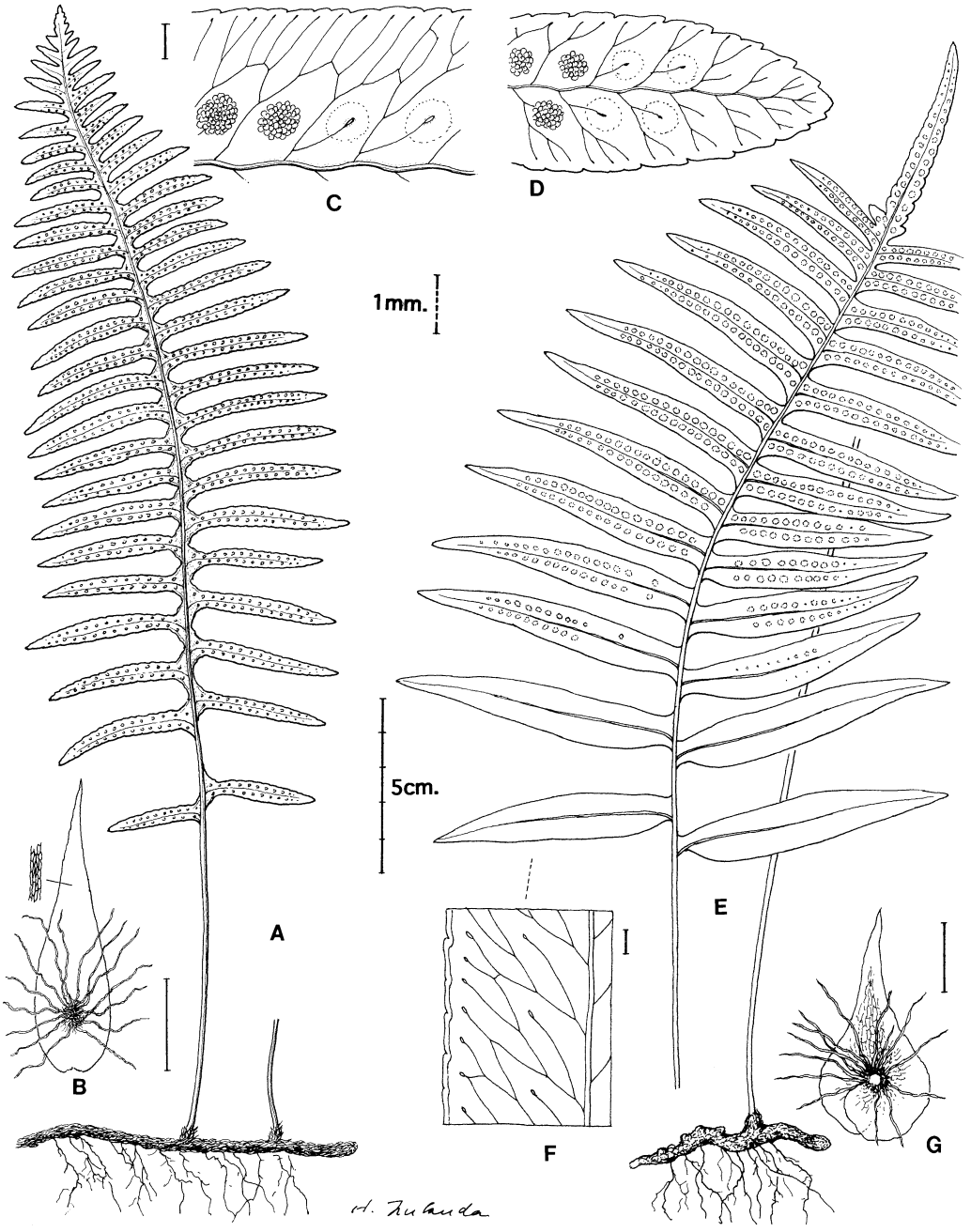

FIG. 2. *Polypodium praetermissum*. **A.** Habit. **B.** Rhizome scale. **C.** Pinna detail. **D.** Pinna detail, distal pinna. **E.** Habit. **F.** Pinna detail, proximal pinna. **G.** Rhizome scale. (A–D, *Palmer 374*, NY; E–G, *Reeder & Reeder 2473*, US.)

discrete and not adnate, attenuate, the larger ones (at or near the base) 5.0–6.0 cm × 0.8–1.2 cm, margins inconspicuously crenulate; *rachises and costae* stramineous to greenish, with scattered hairs on both surfaces but more abaxially, hairs catenate, 0.3–0.7 mm long with 5–10 cells; *veins* partially and irregularly anastomosing with

more anastomoses in proximal half of blades and individual pinnae; *sori* oblong or occasionally round, midway between costae and margins in single rows, 1–1.5 × 1.5–2.0 mm.; *sporangia* glabrous.

Distribution.—On rocks or in rocky soil, rarely epiphytic, wet north-facing cliffs and rock faces on lava flows and steep arroyos in oak, pine-oak, and pine forests; 1100–2150 m. Mexico.

Additional specimens examined. MEXICO. **Durango**: About 21 mi E of Santa Lucía on the rd. from Villa Unión to Durango, 28 Sep 1953, *Reeder & Reeder 2473* (MEXU, US). **Jalisco**: Mun. Zapopan, La Primavera, 24 Aug 1988, *Cola 17004* (XAL); Barranca nr. Atequizallán, lower slopes of Volcán Nevado, *Correll 14362* (US); Mun. Tapalpa, 1–2 mi E of Tapalpa, 30 Oct 1960, *McVaugh 20530* (MEXU, MICH, MO); Mun. Etzatlán, cerca de Etzatlán, 2 Oct 1903, *Rose & Painter 7585* (GH). **Nayarit**: Mun. El Nayar, Arroyo de la Taberna NW of Mesa del Nayar, 1325 m, 13 Aug 1980, *Breedlove 45550* (CAS, MEXU); Mun. Ahuacatlán, Volcán Ceboruco, 3.5 mi NW of Ahuacatlán, 13 Aug 1959, *Feddema 462* (GH, IEB, NY); Mun. Santa María del Oro, NE of Santa María del Oro, 18–20 Aug 1959, *Feddema 776* (MEXU, MICH); Mun. Tepic, 17 km de Jesús María, rumbo a la Mesa del Mayab, 22°15′N, 104°37′W, 1 Aug 1990, *Flores 2155* (MEXU); Mun. Compostela, 9 mi N of Compostela, 28 Aug 1957, *McVaugh 16497* (MEXU); Mun. Ahuacatlán, arroyo 5 mi SE of Ahuacatlán on rd. to Barranca del Oro, 27 Aug 1957, *McVaugh 16353* (MEXU); 6.5 mi NW of Ahuacatlán, new lava flow of Volcán Ceboruco, 13 Aug 1963, *Mickel 1370, 1371, 1375* (all NY); Mun. Acaponeta, 5 mi NE of La Mesa Nayar, 29 Jul 1970, *Norris & Taranto 14275* (ENCB); Mun. Ixtlán del Río, 11 mi N of Ixtlán del Río, 13 Aug 1959, *Straw & Foreman 1820* (GH); Mun. Ahuacatlán, 10 km al S de Ahacatlán, 21°00′N, 104°30′W, 19 Oct 1986, *Téllez 9777* (MEXU), *9863* (MEXU); Mun. Tepic, 4 km a San Blas a partir del entronque Tepic–Mazatlán, 6 Aug 1987, *Téllez 10739* (MEXU). **Sinaloa**: Mun. Badiraguato, 5 mi NE of La Cienega along rd. to Santa Rita, 2230 m, 5 Oct 1970, *Breedlove 18573* (NY), Mun. Concordia, along small logging rd. nr. Loberas Microwave Station, 1570 m, 4 Aug 1980, *44963* (CAS); Mun. Tamazula, La Bajada, 500 m, *González Ortega 4291* (MEXU); Cerro Quemado, NE of Panuco, ca. 1500 m, 30 Aug 1935, *Pennell 20137* (PH). **Sonora**: Sierra de Álamos, upper Cañon de Bolsa, 1650 m, 20 Aug 1994, *Fishbein 1934* (ARIZ), *1937* (ARIZ); Cerro Seguarivo, E of San Bernardo, 1500–1700 m, 7–8 Aug 1935, *Pennell 19657* (PH); Trigo Moreno, Sierra El Chuchupate, ca. 15 km (by air) SE of Yecora, 1420–1480 m, 17 Aug 1998, *Van Devender 98–1025* (NY).

Polypodium praetermissum has blade surfaces with short hairs on the costae and rachises adaxially, scattered on laminae and axes abaxially. However, the Sonoran and Sinaloan specimens are essentially glabrous and have fewer pinnae (8–10 vs. 13–20 in Durango, 25–28 in Nayarit and Jalisco). Furthermore, blades are narrowly oblong in Jalisco and Nayarit (Fig. 2A–D) vs. broadly deltate in Durango, Sinaloa, and Sonora (Fig. 2E–G). This variation is probably clinal.

Polypodium praetermissum is close to *P. plesiosorum* Kunze in its general architecture, with many broadly adnate pinnae (at least in Jalisco and Nayarit) and short laminar hairs, but differs in having spreading to ascending, comose rhizome scales and less regular vein anastomoses. *Polypodium praetermissum* has a pinnate (vs. pinnatisect) blade base and generally alternate (vs. opposite) pinnae. In *P. praetermissum* the rhizome scales are clearly individual, somewhat spreading, and narrowly ovate-deltate to lanceolate with a clump of hairs at the base of the scales, at the point of attachment; in *P. plesiosorum* the scales are strongly appressed to the rhizomes or to each other (making it often difficult to distinguish individual scales) and broadly ovate to oblong (at least those of the body of the rhizome) to broadly lanceolate at the rhizome apices.

The new species also resembles *Polypodium subpetiolatum* Hook., which can be distinguished by its abundant laminar hairs, toothed pinna margins, and free veins.

The more northern specimens of *Polypodium praetermissum* resemble *P. fraternum* Schltdl. & Cham. in having glabrous (or subglabrous) laminae, irregularly anastomosing veins, fewer pinna pairs, attenuate pinna apices, and untoothed pinna margins, but *P. praetermissum* differs in having more broadly adnate pinnae, thinner blade texture, shorter and comose rhizome scales, some short hairs on the costae and laminae, and more northwestern distribution.

The more northern specimens of *Polypodium praetermissum* are similar to *P. dulce* Poir. in Lam. in blade and pinna shape and comose rhizome scales. The former, though, is distinct in having anastomosing (vs. free) veins.

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