

Novelties in Costa Rican *Pityrogramma* (Pteridaceae): A New Species and a New Hybrid from the Osa Peninsula

WESTON TESTO

Pringle Herbarium, Department of Plant Biology, University of Vermont, 27 Colchester Avenue,
Burlington, Vermont, USA 05405 USA Email: wtesto@uvm.edu

ABSTRACT.—*Pityrogramma hirsuta* Testo is described from a secondary lowland rain forest on the Osa Peninsula of Costa Rica. It is distinguished from all other Costa Rican *Pityrogramma* species by a combination of once-pinnate-pinnatifid laminae, abundant whitish hairs on the petiole, rachis, and laminar surface, and complete lack of farina on the abaxial laminar surface. A hybrid between this species and *Pityrogramma calomelanos* (L.) Link, *Pityrogramma* ×*watkinsii* Testo is also described. It is morphologically intermediate to its progenitors and is characterized by an indument of whitish hairs on the petiole, rachis, and laminar surface, and sparse white farina on the abaxial surface of the lamina. The new species and hybrid are each known only from the type collections. Relationships to other species of *Pityrogramma* are discussed, and a key to Central American *Pityrogramma* is presented.

KEY WORDS.—Central America, Neotropics, new species, *Pityrogramma*, taxonomy

While studying the fern flora of Costa Rica's Osa Peninsula in January, 2016, I encountered several unusual plants that belonged to the genus *Pityrogramma* but did not seem closely allied to any known Central American species. Closer examination of collections made from these plants indicated that they represented two taxa: one fertile species, and a sterile hybrid derived from a cross between that species and another congener. Comparison of this material to *Pityrogramma* collections at CR, HUA, HULE, MEXU, NY, and VT, as well as study of images of types and other relevant material indicated that both taxa are new to science. They are described here, starting with the species.

Pityrogramma hirsuta Testo, sp. nov. TYPE.—COSTA RICA. Provincia Puntarenas: Osa Peninsula, Dos Brazos de Río Tigre, Bolita Rainforest Reserve, Valle Frijol trail, clearing in secondary forest dominated by *Heliconia*. 8°30'52"N 83°24'21"W, 250 m, 6 February 2016, *W.L. Testo 1015* (holotype: VT!, isotypes: CR!, NY!, UC!) (Figs. 1, 2).

DESCRIPTION.—*Rhizome* 0.5–1 cm in diameter, erect; *rhizome scales* 3–6 × 0.3–0.5 mm, linear-lanceolate, golden-brown; *fronds* 40–70 × 6–18 cm; *petiole* 10–30 cm long, grooved slightly adaxially, dark brown, with abundant scales near base, spreading, catenate whitish hairs throughout; *rachis* grooved adaxially, with hairs like those of the petiole; *lamina* 25–50 × 6–18 cm, narrowly lanceolate to elliptic, 1-pinnate-pinnatisect, slightly reduced at base, apex

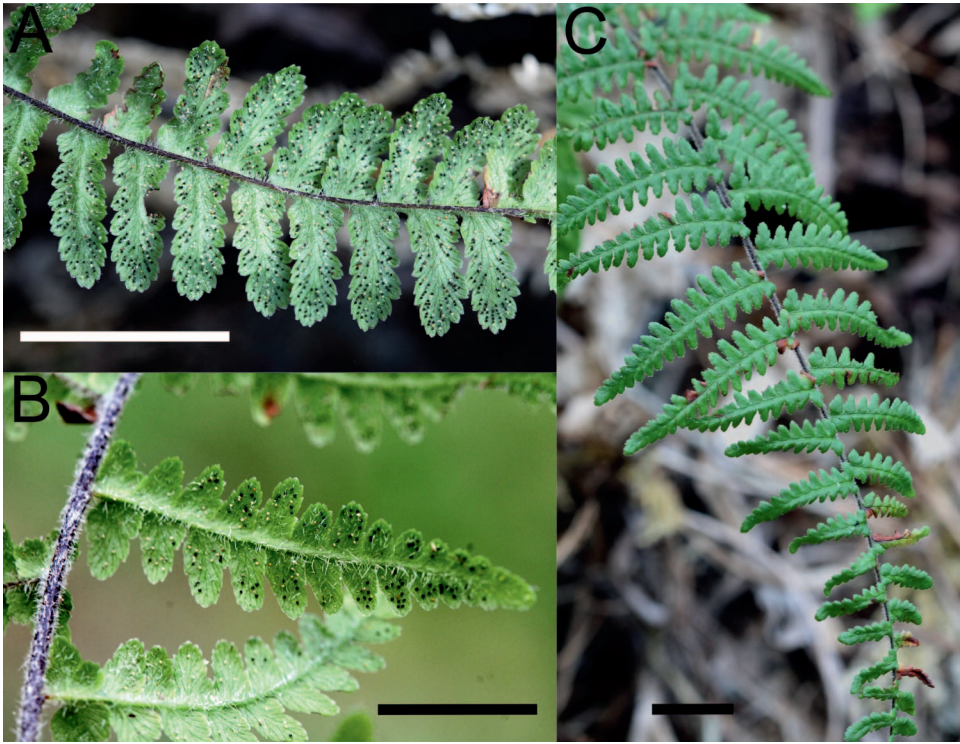


FIG. 1. Details of *Pityrogramma hirsuta*. A. Abaxial surface of medial pinna. B. Abaxial surface of rachis and distal pinna. C. Leaf apex. Scale bar = 2.5 cm.

gradually tapered; *pinnae* 5–9 × 0.5–1.2 cm, 10–17 free pairs, divided nearly or completely to costa, pinnules rounded; *laminae* herbaceous, with catenate hairs like those of leaf axes abaxially, glabrous or nearly so adaxially; *veins* free, running to leaf margin, with short light-brownish hairs abaxially; *sori* scattered along veins; *sporangia* glabrous; *spores* 47–53 μm, reddish-brown, trilete.

ETYMOLOGY.—The specific epithet refers to the pubescent leaf axes and laminar surfaces of this species.

DISCUSSION.—This new species is known only from a single collection made at the Bolita Rainforest Reserve near Dos Brazos del Río Tigre, on Costa Rica's Osa Peninsula. Thorough study of the extensive *Pityrogramma* collections at the National Museum of Costa Rica (CR) failed to reveal additional specimens of *P. hirsuta*, suggesting that it has not been previously collected in Costa Rica. This species was abundant along a trail near disturbed secondary forest, and occurred with *Heliconia* spp., *Solanum rovirosanum* Donn. Sm., *Pityrogramma calomelanos* (L.) Link, and *Tectaria rufovillosa* (Rosenst.) C. Chr.



FIG. 2. Holotype of *Pityrogramma hirsuta* (Testo 1015, VT).

Among Central American *Pityrogramma*, only two other species possess pubescent, non-farinose abaxial laminar surfaces: *Pityrogramma ferruginea* (Kunze) Maxon and *P. ochracea* (C. Presl) Domin. Both species can be distinguished from *P. hirsuta* by their reddish-brown (vs. whitish) indument, as well as the distribution of hairs on the leaf. In *P. hirsuta*, hairs are distributed evenly and at a moderate density across the leaf axes and abaxial surface of the lamina. In *P. ferruginea*, the rachis, costae, and abaxial surface of the lamina are so densely covered in hairs that they are mostly or completely obscured. Conversely, the hairs of *P. ochracea* are almost entirely restricted to the laminar surface; the rachis and petiole are nearly glabrous.

Critical to this work was the study of *Pityrogramma* from beyond Central America, especially given the phylogeographical affinities between the Osa Peninsula and northwestern South America (Cornejo et al., 2012). Among the remaining species of *Pityrogramma*, only the Andean *Pityrogramma jamesonii* (Baker) Domin is pubescent and completely non-farinose. This species can be readily distinguished from *P. hirsuta* by its broadly lanceolate lamina, glabrous or nearly glabrous leaf axes, and acute pinnule apices. Two other species from the northern Andes, *Pityrogramma lehmannii* (Hieron.) R.M. Tryon and *P. opalescens* Sundue, also possess hairs on the abaxial surface of the lamina; however, these hairs differ from those of other *Pityrogramma* species in that they bear farina-producing glands at their apex (Sundue, 2011). These species are further distinct from other *Pityrogramma* species in that their lamina is merely pinnatisect; further study is needed to confirm the phylogenetic placement of these anomalous taxa.

Pityrogramma hirsuta bears a striking resemblance to *P. boucheana* (A. Braun) Domin, an enigmatic taxon described (as *Gymnogramme boucheana*) by Alexander Braun (Braun, 1854). Braun described *P. boucheana* from a single plant at the Berlin Botanical Garden that appeared in a planting of *P. ferruginea*, and he hypothesized it was a hybrid between that species and *P. chrysophylla*. Domin (1929) transferred *G. boucheana* the species to *Pityrogramma* and agreed with the parentage proposed by Braun, citing its pubescence and divaricate pinnule attachment as evidence that *P. ferruginea* was one parent and the presence of yellow farina to support the involvement of *P. chrysophylla* as the other. Examination of a high-resolution image of the holotype of *P. boucheana* at K [A. Braun s.n.; barcode: K001057896] confirmed the presence of sparse yellow farina on the lamina and showed that the hairs present were reddish-brown, in agreement with the proposed hybrid origin and confirming the distinctness of *P. hirsuta* from *P. boucheana*. It is unsurprising that *P. boucheana* is only known from cultivation, as *P. ferruginea* is Central American (disjunct in central Peru) and *P. chrysophylla* is restricted to Puerto Rico and the Lesser Antilles (Tryon, 1962).

Given that farina color and presence can sometimes vary within some species of *Pityrogramma* (Tryon, 1962), the possibility that *P. hirsuta* may simply be an aberrant variant of a typically farinose *Pityrogramma* species

warrants consideration. Only three such species are known from the Pacific lowlands of Costa Rica: *Pityrogramma calomelanos*, *P. dealbata* (C. Presl) Domin, and *P. trifoliata* (L.) R.M. Tryon. The latter two species can be readily distinguished from *P. hirsuta* based on leaf shape alone: *P. dealbata* has a broadly deltate lamina, whereas *P. trifoliata* has lanceolate leaves with entire or 2–7-foliolate pinnae that are rotated out of the plane of the leaf. *Pityrogramma calomelanos* is more similar to *P. hirsuta* than the aforementioned two species, but differs by typically having twice-pinnate-pinnatifid leaves with acute, ascending pinnules (vs. once-pinnate-pinnatisect leaves with obtuse and divaricately arranged pinnules in *P. hirsuta*). These differences were evident when the two species were observed co-occurring at the type locality of *P. hirsuta*. Additional evidence that *P. hirsuta* is not merely an aberrant form of *P. calomelanos* is the existence of an abortive-spored hybrid between the two species. A single plant of this morphologically intermediate hybrid was observed growing with *P. hirsuta* and *P. calomelanos*; it is described here.

Pityrogramma* × *watkinsii Testo, *hyb. nov.* TYPE.—COSTA RICA. Provincia Puntarenas: Osa Peninsula, Dos Brazos de Río Tigre, Bolita Rainforest Reserve, Valle Frijol trail, clearing in secondary forest dominated by *Heliconia*. 8°30'52"N 83°24'21"W, 250 m, 6 February 2016, *W.L. Testo 1016* (holotype: VT!, isotype: CR!) (Fig. 3).

DESCRIPTION.—*Rhizome* 1–2.5 cm in diameter, erect; *rhizome scales* 4–8 × 0.3–0.5 mm, linear-lanceolate, golden-brown; *fronds* 65–80 × 20–36 cm; *petiole* 28–34 cm long, grooved slightly adaxially, dark brown, with abundant scales near base, spreading, catenate whitish hairs sparse; *rachis* grooved adaxially, with sparse hairs like those of the petiole, *lamina* 35–50 × 20–36 cm, lanceolate, 2-pinnate-pinnatifid, broadest near base, apex gradually tapered; *pinnae* 10–15 × 1.0–2.2 cm, 19–27 free pairs, divided completely to costa, pinnules acute, deeply lobed; *laminae* herbaceous, with sparse white farina and sparse catenate hairs like those of leaf axes abaxially, glabrous or nearly so adaxially; *veins* free, running to leaf margin, with short light-brownish hairs abaxially; *sori* scattered along veins; *sporangia* glabrous, often malformed; *spores* highly irregular, reddish-brown, tetrahedral.

ETYMOLOGY.—The epithet honors fern ecologist James “Eddie” Watkins, a close friend and mentor who has encouraged my studies of Costa Rican ferns, especially *Pityrogramma*.

DISCUSSION.—*Pityrogramma* × *watkinsii* is a hybrid between *Pityrogramma hirsuta* and *Pityrogramma calomelanos*, and is morphologically intermediate between these species. It is recognizable by a combination of the following characters: sparse white farina on the abaxial surface of the lamina, scattered whitish hairs on the lamina and leaf axes, and irregular spores. It is only known from the type collection.



FIG. 3. Holotype of *Pityrogramma watkinsii* (Testo 1016, VT).

To aid in identification of Central American *Pityrogramma* species, the following key is presented:

KEY TO CENTRAL AMERICAN *PITYROGRAMMA* SPECIES

1. Distal pinnae entire, pinnae twisted out of plane of leaf, proximal pinnae even-sided or broadest near middle *P. trifoliata*
1. Distal pinnae lobed or more divided, pinnae not twisted, proximal pinnae broadest near base 2.
 2. Abaxial surface of lamina pubescent or glabrous, not farinose 3.
 3. Lamina 4–5-pinnate, abaxial surface of lamina glabrous *P. pearcei*
 3. Lamina to 3-pinnate-pinnatifid, abaxial surface of lamina pubescent 4.
 4. Hairs on abaxial surface of lamina and rachis whitish *P. hirsuta*
 4. Hairs on abaxial surface of lamina and rachis reddish-brown 5.
 5. Rachis obscured by dense hairs, pinnules sessile *P. ferruginea*
 5. Rachis visible, pinnules stalked *P. ochracea*
 2. Abaxial surface of lamina farinose 6.
 6. Proximal pinnae elongated basiscopically 7.
 7. Rachis tan or straw-colored, farina yellow *P. chrysoconia*
 7. Rachis castaneous or blackish, farina white. *P. ebenea*
 6. Proximal pinnae not elongated basiscopically 8.
 8. Farina white, typically elevations < 1000 m *P. calomelanos*
 8. Farina yellow, typically elevations > 1000 m *P. austroamericana*

ACKNOWLEDGMENTS

Michael Sundue, David Barrington, Art Gilman, Robbin Moran, and Alan Smith provided insight into *Pityrogramma* and encouraged my study of Costa Rican pteridophytes in general; I am thankful for their support. I am also indebted to Alejandra Vasco, Indiana Coronado, Felipe Cardona, and Armando Ruiz for facilitating herbarium work critical to this study. Carl Rothfels and two anonymous reviewers also provided helpful comments on the manuscript. Finally, I thank Valerie Rosiana and Ronald Engel for allowing me to collect on their property and Corrienne Brons for her help in the field.

LITERATURE CITED

- BRAUN, A. 1854. Index Seminum Horto Botanico Berlinensi.
- CORNEJO, X., S. A. MORI, R. AGUILAR, H. STEVENS, and F. DOUWES. 2012. Phytogeography of the trees of the Osa Peninsula, Costa Rica. *Brittonia* 64:76–101.
- DOMIN, K. 1929. The hybrids and garden forms of the genus *Pityrogramma* (Link). *Rozprawy Třída II, České Akademie* 38:3–80.
- SUNDUE, M. A. 2011. *Pityrogramma opalescens* (Pteridaceae), a new species from Cerro del Torrá, Colombia. *American Fern Journal* 101:252–260.
- TRYON, R. 1962. Taxonomic fern notes. II. *Pityrogramma* (including *Trismeria*) and *Anogramma*. *Contributions from the Gray Herbarium of Harvard University* 189:52–76.