

## Taxonomic updates of *Cheilanthes* Sw. (Pteridaceae) in Peru, with a conservation assessment for four endemics

### Actualización taxonómica de *Cheilanthes* Sw. (Pteridaceae) en Perú, con una evaluación de conservación para cuatro endemismos

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#### Abstract

In its most recent concept, the genus *Cheilanthes* encompasses three clades distributed across South America, Africa, and Australasia. Previous studies in Peru recorded 23 species; however, advancements in molecular systematic have led to the segregation of eight of them into at least three genera. In this study, 15 species are recognized in the Peruvian flora based on the examination of 459 herbarium and field specimens, and the evaluation of morphological characters using 131 specimens. The affinities among the lineages proposed in this study are consistent with recent phylogenetic hypotheses, wherein *Cheilanthes* species in Peru are members of two clades, the South American and the Australasian-South American, with taxonomically important characters being the shape of rhizomatous scales and types of frond indumentum (scales, microscales, scumules, and hairs). We found that the genus *Cheilanthes* is present in 20 departments of Peru, with most species having wide distribution in the central-southern Andean regions, four species having endemic status. Meanwhile, *C. cantangensis*, *C. lonchophylla*, and *C. obducta* are poorly represented in the northern region. The first two species are considered endemic and categorized as Endangered (EN), while the other two are classified as Least Concern (LC). Additionally, a taxonomic key is provided.

#### Resumen

El género *Cheilanthes* en su concepto más reciente incluye tres clados distribuidos en Sudamérica, África y Australasia. Trabajos previos para el Perú registraron 23 especies, sin embargo, los avances en sistemática molecular han resultado en la segregación de ocho de ellas en al menos tres géneros. En este trabajo, se reconocen 15 especies en la flora peruana en base al estudio de 459 ejemplares de herbario y campo, y la evaluación de caracteres morfológicos usando 131 especímenes. Las afinidades entre los linajes propuestos en este trabajo son consistentes con la reciente hipótesis filogenética, donde las especies de *Cheilanthes* en el Perú serían integrantes de dos clados, el Sudamericano y el Australásico-Sudamericano, y los caracteres de importancia taxonómica serían: la forma de las escamas rizomáticas y tipos de indumento de la fronda (escamas, microescamas, escuámulas y pelos). Encontramos que el género *Cheilanthes* estaría presente en 20 departamentos del Perú, la mayoría de las especies con amplia distribución en las regiones centro-sur Andinas, cuatro especies con el estatus de endemismo. Mientras que *C. cantangensis*, *C. lonchophylla* y *C. obducta* están pobremente representadas en la región norte. Las dos primeras especies son consideradas endémicas y son categorizadas como En Peligro (EN), y otras dos como de Preocupación Menor (LC). Además, se presenta una clave taxonómica.

#### Keywords:

Ferns, Peru, flora, arid ecosystems, endemism, conservation.

#### Palabras clave:

Helechos, Perú, flora, ecosistemas áridos, endemismo, conservación.

## Introduction

The genus *Cheilanthes* Sw. is currently accepted with over 65 species, of which, 26 are South American including its type species *C. micropteris* Sw. (Ponce & Scataglini 2022). This genus, like other members of the Cheilantheoideae, includes small to medium size terrestrial and saxicolous plants, with pinnate-pinnatifid leaves, and laminae margins mostly revolute and forming a false indusium, homoplastic characters that have hindered its circumscription (Gastony & Rollo 1995).

*Cheilanthes* is a complex genus, whose circumscription is still uncertain. Both, Ponce and Scataglini (2022), and Sosa et al. (2021) had underlined that the delimitation of the genus *Cheilanthes* is still in progress, while its affinities within the cheilanthoid ferns are supported as a member of the hemionitid clade (Windham et al. 2009). Progress in molecular studies have also shown that the delimitation in the treatment of Peru is untenable, in part given by the segregation of several species to *Aleuritopteris*, *Astrolepis*, *Doryopteris*, *Gaga*, and *Myriopteris*. Furthermore, species still in *Cheilanthes* include several lineages that could be treated as distinct genera (Kessler et al. 2017, Ponce & Scataglini 2018); however, as stated by Ponce (2016), there are still difficulties in establishing morphological synapomorphies for distinguishing those genera.

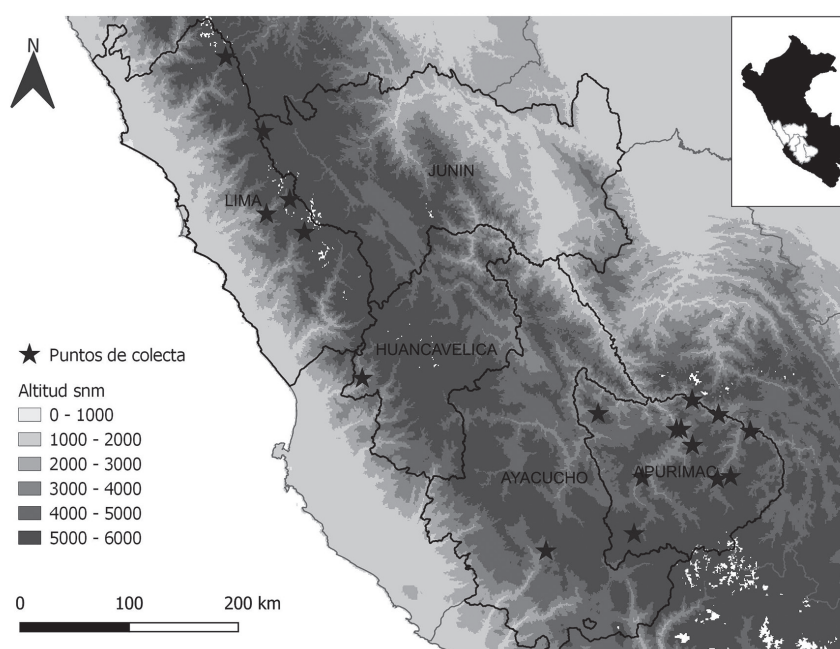
The genus *Cheilanthes* has benefited from several cytological, morphological and molecular phylogenetic studies, like those of Benham and Windham (1992), Gastony (1995), Li et al. (2012), Grusz et al. (2013), Ponce and Scataglini (2018, 2022) and Sosa et al. (2021) allowing for a better definition of its limits and therefore the emerging of a new genus concept. Several genera have been segregated from *Cheilanthes*, which have also implications for composition and richness of the Peruvian fern flora.

In Peru, *Cheilanthes* is mainly found in semiarid environments of the Andean slopes, and interandean valleys. Tryon and Stolze (1989) recognized 23 species and mentioned the contentious limits of the genus. Their taxonomic approach was based on morphological characters, many of which are convergent and are present in all lineages of the cheilanthoids (for example genera *Myriopteris* in Grusz & Windham 2013; and *Baja* in George et al. 2019).

This study aims to provide an update of the taxonomic treatment of *Cheilanthes* from Peru. *Cheilanthes* is presented under the new concept of Ponce and Scataglini (2022), and we complement species observations for several morphological characters not previously discussed. Here we also assessed the conservation status of all four endemic *Cheilanthes*, following the International Union for Conservation of Nature (IUCN) standards, and we provide a brief assessment for those commonly locally traded. This work also includes a taxonomic key both in Spanish and English for the 15 species currently in *Cheilanthes* for Peru.

## Material and methods

A total of 459 specimens were examined from four Peruvian herbaria (HSP, HUSA, HUT, and USM, citations as in Index Herbariorum). Field work in Apurímac, Ayacucho, Huancavelica, Junín, and Lima allowed complete observations on habitat preferences and altitudinal distribution (2019–2021) (Fig. 1). Additional data was obtained from Tryon and Stolze (1989), photographs of type material from international and national herbaria institutions (B, HUT, P), and from digital collections of the Pteridophyte Collections Consortium (<https://pteridophytes.berkeley.edu/> accessed until August 2022). The descriptions include all material examined for this study. For plant collecting, we followed the traditional methods, as described by Cerrate (1969). All collections used for evaluating species conservation status were georeferenced.



**Figure 1.** *Cheilanthes* collection locations in central Peru carried out in this work to make complete observations on habitats and altitudinal distribution.

**Evaluation of morphological characters.** Morphological characters were examined in 131 herbarium specimens, from which one to three samples were taken. Examination of indument required a previous rehydration step.

A total of 46 morphological characters were recorded: six quantitative and forty qualitative. Some of the latter have more than one state, such as rhizome type, varying from erect or short to long creeping or multicapital. Characters were defined based on Lellinger (2002) and complemented with Font Quer et al. (1982). Microcharacters were observed using a Leica DM500 optic microscope and a Leica S9i or Nikon SMZ745T stereoscope.

Descriptions include characterization of scales, ratio between frond and petiole, and spore number.

For rhizome and frond scales, measurements' range and average were taken, considering maximum length and width of one to ten scales, per organ, per specimen. Thirteen species were evaluated for these measurements in the rhizome; we excluded two species (*C. andina* and *C. cantangensis*) due to scarcity of material. In the case of frond scales, we were able to register measurements for all six scaly species.

The ratio between frond and petiole lengths were obtained from specimens representing fourteen species, except for *C. andina*, making one to three measurements, per frond, per specimen.

The number of spores per sporangium was obtained from the examination of 454 sporangia, belonging to 11 species of *Cheilanthes*. Additional information for *C. pruinata*, *C. rufopunctata* and *C. poeppigiana* was obtained from Ponce and Scataglini (2018). All samples were prepared following D'Ambrosio de Argüeso (1986), with samples being embedded in glycerin gel medium, followed by a resting period of 24 hours at room temperature. A single sporangium was mounted and pressed using the crushing technique. Number of spores was recorded under the microscope, by performing repetitive counting across the whole area of the 22×22 mm cover slip.

**Classification and taxonomic identification.** The taxonomic position of *Cheilanthes* in Pteridaceae follows PPG-I (2016), while the genus concept follows Ponce and Scataglini (2022). Protologues were obtained from original sources available in BHL. Also, taxonomic treatments, like those of Ponce (2016) for Argentina, and Kessler et al. (2017) for Bolivia, were used to assess species characteristics and distribution.

A taxonomic key is provided with novel characters for Peruvian species. For each species, nomenclatural history, description, distribution, reviewed specimens, are indicated for the first collector and the herbarium with the acronym in parentheses, additionally accompanied by an illustration. A composed figure for each species was mostly made using Adobe Photoshop CS26, version 13.0.1.

We also reevaluated the proposal of León et al. (2006) for the conservation status of endemic species of *Cheilanthes*. For conservation status, we considered the cri-

terion of geographic range (B) and used the Geospatial Conservation Assessment Tool (GeoCAT; Royal Botanic Gardens, Kew: <http://geocat.kew.org>) to measure extent of occurrence (EOO) and area of occupancy (AOO) to apply IUCN categories (IUCN version 3.1, 2012). We include a detailed description of the assessment requirements (Appendix 1).

## Results and discussion

Taxonomic treatment of genus *Cheilanthes* Sw. in Peru

*Cheilanthes* Sw., Syn. Fil. 5:126. 1806, nom. cons. Lectotype: *Cheilanthes micropteris* Sw. (designated by Maxon, Sci. Surv. Porto Rico and Virgin Islands 6(3): 428. 1926).

**RHIZOMES:** erect, decumbent or short to long-creeping, multicapital (many headed; a cluster of short, ascending rhizome branches), scaly. Scales basifixed, bicolorous (partially or wholly sclerotized central area), concolorous, linear-acicular, sinuate, lanceate-triangular, margins continuous, toothed, uncinata, ciliate, the latter inconspicuous. **PETIOLES:** one vascular bundle near the base, terete, striate, or laevigate, sometimes adaxially sulcate, glabrous, scaly or pilose. Scales sub-basifixed or basifixed, variable in shape, bicolorous or pseudoclathrate (defined cell wall, but not contrasting as clathrate). Hairs simple or branched, eglandular and glandular. **LAMINAE:** unipinnate to tripinnate, linear-lanceolate to triangular ovate, glabrous or with indument (scales, microscales, hairs, squamules). Scales have similar characteristics than ones on the petioles. Microscales on the adaxial surface of the pinnae in some species. Hairs simple or branched, eglandular, and glandular. Rachises terete, striate, sometimes sulcate and winged adaxially. Pinnae petiolate or adnate, mostly alternate, opposite or subopposite (distanced 1mm). Segment adnate, petiolulate, variable in shape, margins of segment revolute. Veinlets widened at apex, visible or hidden. Pseudindusium differentiated (lunate, lunulate, or linear) or sometimes hyaline border (not distinct). Sori discrete, sporangia with 16, 32 and/or 64 spores.

Peruvian *Cheilanthes* are recognized in this updated taxonomic treatment considering the phylogeny of Ponce and Scataglini (2022) as a framework for species affinities. We reexamined the morphological characters historically used for *Cheilanthes* in Peru (Tryon 1964, and Tryon & Stolze 1989) that allows the acceptance of 15 species for Peru's flora, one of which was previously considered in synonymy by Tryon and Stolze (1989). However, further sampling and phylogenetic and chromosomal evaluations are still necessary to define and understand limits in several species, especially those not included in previous molecular assessments. Therefore, for this update we provide as many contrasting frond characters as possible between morphologically similar taxa.

The Peruvian species occupy mainly arid and semi-arid areas of interandean valleys and Andean slopes, extending down to coastal hills. They are found in 20 of the 24 departments of Peru, with two distinct regional



centres, North and Central-South (Rivera 2022). These species frequently inhabit rocky interstices in open sites, more rarely in Andean forests, between (150–) 500–4200 (–5000) m of altitude. They occupy several ecosystems: grasslands, relict forests, shrublands, seasonally dry forests and lomas (MINAM 2019).

### Taxonomic key

[For the use of this taxonomic key, we suggest reviewing illustrations and images provided in this work for each species]

1. Fronds with dense indument, scales on the lamina and axes, or if with hairs, these are scattered to dense on the adaxial surface of the lamina. **2**

1'. Fronds glabrous, glabrescent or with indument of hairs on the lamina and axes, sometimes scattered scales on axes. **7**

2. Rhizomes with lanceate scales; lamina unipinnate-pinnatisect; adaxial surface with eglandular, multicellular hairs.

#### *C. cantangensis*

2'. Rhizomes with linear-acicular scales; lamina bipinnate-tripinnate; adaxial surface without visible hairs. **3**

3. Scales in the abaxial lamina with reduced cell lumen, margins lacinate accompanied with long filaments extending to the adaxial surface, arachnoid-like, ca. 5 cells in the central area (called squamules).

#### *C. scariosa*

3'. Scales in the abaxial lamina with translucent visible cell lumen, margins erose, serrate, toothed or lacinate, long filaments absent. **4**

4. Laminae bipinnate-pinnatisect or bipinnate-pinnatifid; ultimate segments oblong-triangular, ovate-triangular. **5**

4'. Laminae bi-tripinnate in the basal pinnae; ultimate segments ovate-triangular, flabellate, and orbiculate.

#### *C. incarum*

5. Petioles length mostly  $\frac{1}{4}$ ,  $\frac{1}{5}$  of the laminae length; basal pinnae gradually reduced or less than  $\frac{2}{3}$  length of central pinnae.

#### *C. lonchophylla*

5'. Petioles length as long as the lamina, or near twice the length, or  $\frac{1}{2}$ , or  $\frac{2}{3}$  of the lamina length; basal pinnae not reduced. **6**

6. Adaxial lamina surface glabrous or occasionally with inconspicuous scales; fertile segment margins not distinctive, hyaline pseudoindusium.

#### *C. arequipensis*

6'. Adaxial lamina surface mostly with clathrate microscale; fertile segment margins distinctive, membranaceous pseudoindusium.

#### *C. peruviana*

7. Laminae hairs branched or acaroid-like, dense to sparse. **8**

7'. Laminae hairs simple, dense, or absent. **9**

8. Rhizome scales lanceate; laminae bi-tripinnate; basal pinnae  $\frac{2}{3}$  in length of longest distal pinnae; hairs radial to pseudoactinomorphic.

#### *C. mollis*

8'. Rhizome scales linear-acicular; laminae bipinnate, rarely bipinnate-pinnatifid at the base; basal pinnae as long as the longest distal pinnae; hairs acaroid-like.

#### *C. obducta*

9. Laminae and axes with eglandular hairs. **10**

9'. Laminae and axes glabrous or with glandular hairs. **11**

10. Laminae triangular, ovate; rhizome short, erect; castaneous, stramineous scales; rachis sulcate and winged; pseudoindusium with hairs; apex of veinlets evident; fronds with short hairs (2–8 cells), sparse to dense.

#### *C. frateri*

10'. Laminae narrowly lanceolate, linear; rhizome creeping; bicolorous (base and central zone blackish brown and castaneous margins) scales; rachis not sulcate nor winged; pseudoindusium glabrous; apex of veinlets not visible; fronds with very long, fine, lanate hairs.

#### *C. fraseri*

11. Petioles and rachises adaxially sulcate, and with green wings at the

rachises; laminae and axes glabrous (except on abaxial side of laminae in *C. rufopunctata*); apex of veinlets conspicuous, widened. **12**

11'. Petioles and rachises adaxially not sulcate; laminae and axes with glandular, multicellular hairs; apex of veinlets not conspicuous. **13**

12. Rhizomes erect or decumbent; laminae unipinnate-pinnatisect, without glands on the abaxial surface of laminae.

#### *C. poeppigiana*

12'. Rhizomes creeping; laminae bipinnate-tripinnate, with reddish glands on the abaxial surface of the laminae.

#### *C. rufopunctata*

13. Laminae subcoriaceous; fronds glutinous, glandular hairs with dark yellow secretion.

#### *C. pruinata*

13'. Laminae herbaceous to chartaceous; fronds glutinous without dark yellow secretion. **14**

14. Rhizome scales bicolorous (base and central zone blackish brown and atrocastaneous margins), sclerotic; fronds with conspicuous hairs ca. 1mm.

#### *C. pilosa*

14'. Rhizome scales, concolorous, castaneous, rarely sclerotic; fronds with inconspicuous hairs.

#### *C. andina*

### Clave taxonómica

[Nota: Para el uso de la clave taxonómica, se sugiere consultar las ilustraciones e imágenes de las especies mostradas en este trabajo]

1. Frondas escamosas, escamas densas en lámina y ejes, si con pelos, estos dispersos a densos en el lado adaxial de la lámina. **2**

1'. Frondas glabras, glabrescentes o con indumento de pelos en láminas y ejes, a veces escamas esparcidas en los ejes. **7**

2. Rizomas con escamas lanceadas; lámina unipinnado-pinnatisecta; superficie adaxial con pelos pluricelulares, eglandulares.

#### *C. cantangensis*

2'. Rizomas con escamas linear-aciculares; lámina bipinnado-tripinnada; superficie adaxial sin pelos visibles. **3**

3. Escamas en la lámina abaxial con lumen celular reducido, márgenes laciniados (acompañado de filamentos largos que se extienden hasta la superficie adaxial, de tipo aracnoides, ca. 5 células en la zona central, llamadas escuámulas).

#### *C. scariosa*

3'. Escamas en la lámina abaxial con lumen celular visible translúcido, márgenes erosos, aserrados, dentados o laciniados, filamentos largos ausentes. **4**

4. Láminas bipinnadas-pinnatisectas o bipinnadas-pinnatifidas; últimos segmentos oblongo-triangular, ovado-triangular. **5**

4'. Láminas bi-tripinnadas en las pinnas basales; últimos segmentos ovado-triangular, flabelados, orbiculares.

#### *C. incarum*

5. Longitud de peciolo principalmente  $\frac{1}{4}$ ,  $\frac{1}{5}$  del largo de las láminas; pinnas basales gradualmente reducidas o menos de  $\frac{2}{3}$  del largo de las pinnas centrales.

#### *C. lonchophylla*

5'. Longitud de peciolo tan larga como las láminas, o casi el doble de la longitud, o  $\frac{1}{2}$  o  $\frac{2}{3}$  de la longitud de las láminas; pinnas basales no reducidas. **6**

6. Superficie adaxial de la lámina glabra u ocasionalmente con escamas inconspicuas; márgenes de los segmentos fértiles no distintivos, pseudoindusio hialino

#### *C. arequipensis*

6'. Superficie adaxial de la lámina con microescamas clatradas; márgenes de los segmentos fértiles distintivos, pseudoindusio membranáceo

#### *C. peruviana*

7. Láminas con pelos ramificados, densos a dispersos **8**

7'. Láminas con pelos simples, densos o ausentes **9**

8. Rizomas con escamas lanceadas; láminas bi-tripinnada; pinnas basales  $\frac{2}{3}$  en longitud de las pinnas distales más largas; pelos radiales a pseudoactinomorfos

#### *C. mollis*

8'. Rizomas con escamas linear-aciculares; láminas bipinnadas, raramente bipinnada-pinnatifidas en la base; pinnas basales tan largas



como las pinnas distales más largas; pelos de apariencia acaroideos.

***C. obducta***

9. Láminas y ejes con pelos eglandulares. 10

9'. Láminas y ejes glabros o con pelos glandulares. 11

10. Láminas triangulares a ovadas; rizomas cortos, erectos; escamas castañas, estramíneas; raquis sulcado y alado; pseudoindusio con pelos; ápice de venas visibles y dilatados; frondas con pelos cortos (2–8 células), dispersas a densas.

***C. fractifera***

10'. Láminas angostamente lanceoladas a lineares; rizomas rastreros, escamas bicoloras (base y zona central marrón negruzco y márgenes castaños); raquis no sulcado ni alado; pseudoindusio glabro; ápice de venas no visible; frondas con pelos muy largos, finos, lanosos.

***C. fraseri***

11. Peciolos y raquises adaxialmente sulcados, y con alas verdes en el raquis; lámina y ejes glabros (excepto el lado abaxial de la lámina de *C. rufopunctata*); ápice de venas visibles, ensanchadas. 12

11'. Peciolos y raquises adaxialmente no sulcados; lámina y ejes con pelos glandulares; ápice de venas no conspicuas. 13

12. Rizomas erecto o decumbente; lámina unipinnada-pinnatisecta, sin glándulas en la superficie abaxial de la lámina. ***C. poeppigiana***

12'. Rizomas rastrero; lámina bipinnada-tripinnada, con glándulas rojizas en la superficie abaxial de lámina. ***C. rufopunctata***

13. Láminas subcoriáceas; frondas glutinosas, pelos glandulares con secreción amarillo oscuro. ***C. pruinata***

13'. Láminas herbáceas a cartáceas, frondas glutinosas sin secreción amarillo oscuro. 14

14. Escamas del rizoma bicoloras (base y zona central marrón y márgenes atrocastaneos), esclerosadas; frondas con pelos conspicuos ca. 1mm. ***C. pilosa***

14'. Escamas del rizoma concoloras, castaño claras, raras veces esclerosadas; frondas con pelos inconspicuos. ***C. andina***

## Description of Peruvian species

### ***Cheilanthes andina* Hook.**

Sp. Fil. 2: 115. 1852. Type: Peru, Andes, J. MacLean s.n. (holotype K – K000633278).

*Cheilanthes valdiviana* Phil., Linnaea 29: 106. 1858. Type: Chile. Valdivia, Huanehue, 1835, C. Gay 2450 (holotype: SGO-82317, photographs BM, SI) syn. nov. designated by M. Ponce and A. Scataglini 2022.

**FRONDS:** 3.8–10 cm long, caespitose. **RHIZOMES:** decumbent to short-creeping, scaly. Scales, mostly castaneous, rarely sclerotic. **PETIOLES:** of length as long as the lamina, sulcate on adaxial side, sometimes with lateral ribs, scales and hairs dispersed in the axes. **LAMINAE:** herbaceous to chartaceous, deltoid-oblong or narrow lanceate, bipinnate-pinnatifid or tripinnate at the base, inconspicuous hairs similar to the petiole. Rachis with short lateral ribs, with scattered scales and few glandular hairs. Pinnae deltate-ovate to oblong, basal pinnae as long as the central pinnae, with 4–5 sessile lobate pinulae 0.5–1 mm apart, lobes roundish, with slightly crenulate or entire and revolute margins. Pseudoindusium distinct, scarious, fimbriate-ciliate margins.

**Observations.** This species was described by John MacLean from a specimen collected probably east of Lima, since other plant collections were made by him in Cajamarquilla and Langa (cfr. Trujillo and Paredes-Burneo 2021), and for Peru, it was the only collection avail-

able to us. Tryon (1964) and Tryon and Stolze (1989) considered it a synonym of *Cheilanthes pilosa* Goldm., observing narrower ultimate segment and thicker texture, explained as a probable response to drier environmental conditions.

Ponce and Scataglini (2022) and Sosa et al. (2021) accepted *C. andina* as a distinct species from *C. pilosa*, based on few morphological characters. *Cheilanthes andina* is characterized by its small frond size, adaxially sulcate petiole with dispersed scales, and with scarce indument in the adaxial surface of the lamina (Ponce, pers. comm. 2022) vs. petiole and raquis terete and rachis scales absent in *C. pilosa*. We found, however, that frond size and petiole characters varied similarly in more “typical” *C. pilosa* plants. But a combination of basal pinnae size and spread indument in the adaxial side provides easier separation from *C. pilosa*. However, further botanical exploration and studies will be required to confirm its distribution range in Peru.

*Cheilanthes andina* was reported to have 64 spores per sporangium (Sosa et al. 2021). It was proposed as belonging to the Australasian-South American clade based on morphological features (Ponce & Scataglini 2022), and therefore, its affinities are not close to *C. pilosa* (in the South American clade) as its morphology implies.

**Distribution and habitat.** *Cheilanthes andina*, originally described from Peru, is only known from the department of Lima, and it is also reported from Bolivia (Sosa et al. 2021), and from Chile (Ponce & Scataglini 2022) based on synonymizing *C. valdiviana* Phil., whose type was collected in Valdivia, southern Chile. Therefore, suggesting a wider distribution in Peru, as described here. Ponce and Scataglini (2022) suggested probable affinities with *C. sarmientoi* Ponce from Argentina, the latter is a small fern with subcarnose laminae and strongly round lobes.

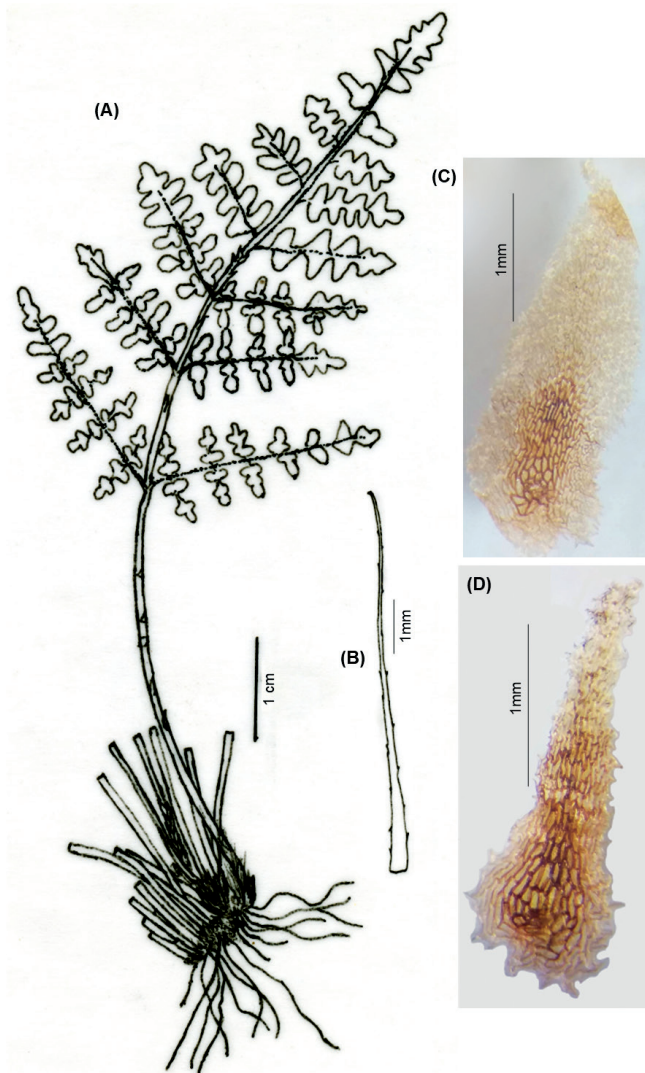
### ***Cheilanthes arequipensis* (Maxon) R.M. Tryon & A.F. Tryon**

Rhodora 83: 133. 1981.

*Notholaena arequipensis* Maxon, Smithsonian Misc. Coll. 65(8): 9. 1915. Type: Peru, Arequipa, near Tingo, 5 August 1914, Ms. Rose and J. N. Rose 18797 (holotype US–US761435; isotype NY–NY00144380).

**FRONDS:** 5.6–17 cm (x 10.55 cm) long. **RHIZOMES:** erect, short, scaly. Scales 2.4–9 mm (x 5.08 mm) x 0.15–1 mm (x 0.43 mm), basifixed, brown to ferrugineous, linear-acicular, straight, or slightly sinuate, margins shortly toothed, inconspicuously uncinat. **PETIOLES:** 2.3–9 cm (x 5.71 cm), of length as long as the lamina, or near twice the length of the lamina, terete, striate, dark brown. Scales sub-basifixed, scattered, pseudoclastrate around insertion, lanceate, oblong, round, ovate-triangular, margins toothed, arose to lacinate. **LAMINAE:** 2.5–8 cm (x 4.81 cm) long, lanceate, lanceolate, rhomboidal, lanceate-triangular, bipinnate to bipinnate-pinnatisect, scaly. Rachises striate. Pinnae opposite or subopposite; proximal pinnae petiolate, distal pinnae adnate, pinnae adaxially glabrous

or with indument of scattered scales. Ultimate segment oblong to ovate-triangular. Scales 1.2–4.5 mm ( $\times$  2.69 mm)  $\times$  0.5–1.5 mm ( $\times$  0.98 mm), apices curving towards the adaxial side, imbricate, sub-basifixed, light castaneous, pseudoclathrate at the base, narrowly lanceate, narrowly ovate, elliptic, triangular, slightly subulate, margins laciniate to erose with acute marginal not prolonged tooth. Segment margins revolute, fertile margins not differentiated or sometimes hyaline. Sori discrete, sporangia with 16, 32 y/or 64 spores (Fig. 2).



**Figure 2.** *Cheilanthes arequipensis*: A. Habit; B, C and D. Scales of rhizome, petiole and abaxial side of lamina respectively.

**Observations.** *Cheilanthes arequipensis* is a scaly taxon with close affinities to *C. incarum* Maxon, *C. lonchophylla* (Weath. ex R.M. Tryon) R.M. Tryon & A.F. Tryon, *C. peruviana* (Desv.) T. Moore and *C. scariosa* (Sw.) C. Presl, all members or putative members of the South American-Australasian clade (Ponce & Scataglini 2022). From *C. peruviana*, it can be distinguished by its laminar scales with toothed acute margins and not distinctive pseudopindusium as shown in the key. It differs from *C. incarum* by having oblong segment and adaxially glabrous or with indument of scattered scales (vs. orbicular segment and linear or acicular, dispersed microscales).

*Cheilanthes arequipensis* and allied Peruvian species were proposed as closely related to the non-Peruvian species *C. squamosa* Gillies & Hook. ex Grev. (Ponce & Scataglini 2022). These two species can be morphologically distinguished by having rhizome scales linear-acicular, straight, or slightly sinuate, margins shortly toothed in *C. arequipensis* vs. triangular scales, conspicuous, retrorse toothed margin in *C. squamosa*. *Cheilanthes arequipensis* has a partial sympatric distribution with *C. squamosa* in Chile and Argentina.

**Distribution and habitat.** *Cheilanthes arequipensis* is mostly known from southern Peru, extending its range around and above 3000 m a.s.l. to northern Chile and northwestern Argentina A. In Peru, this species has been recorded in Arequipa, Lima, Moquegua and Tacna from 2400 to 3480 m a.s.l. It grows in rocky slopes, and humid ravines within shrublands.

**Examined specimens.** **Arequipa:** Arenas G.102 (USM); Cáceres F. 5333, 1605, 8518 (HUSA); Cueva M. 31 (HUSA); León B. 5737b (USM); Munz P. 15500 (GH); Pennell F. 13198 (B. F. GH, US); Quipuscoa V. 1744, 2512, 2526 (HUSA); Roque J. 906 (USM); Stafford D. 570 (BM); Vargas 8019 (UC); Williams R. 2638 (GH, NY, US). **Lima:** Beltrán H. 2952 (USM); Saunders 612 (F). **Moquegua:** Montesinos T. 2097 (WAG). **Tacna:** La Torre M. 1844 (USM).

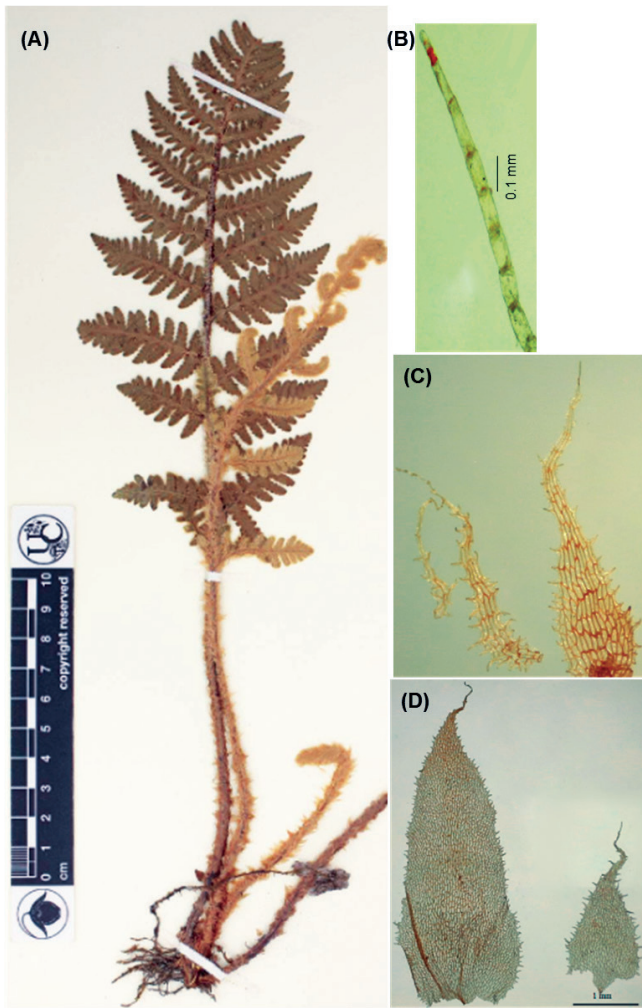
#### *Cheilanthes cantangensis* (R.M. Tryon) R.M. Tryon

Fieldiana Bot., n.s. 22 (2): 32. 1989.

*Notholaena cantangensis* R.M. Tryon, Rhodora 63: 81. 1961. Type: Peru, Dep. Cajamarca, Prov. Celendin, Cantange, Ruta Celendin-Rio Marañon, 4 June 1960, A. López and A. Sagástegui 3366 (holotype GH; isotype 3366–HUT).

**FRONDS:** 13–44.2 cm ( $\times$  30.63 cm) long. **RHIZOMES:** short, erect. Scales bicolorous (sclerotic central portion and brown), dark castaneous, basifixed, lanceate, margins dentate to serrulate. **PETIOLES:** 4.8–20 cm ( $\times$  12.93 cm), near of length as long as the lamina, or  $\frac{1}{2}$ ,  $\frac{2}{3}$  of the lamina length, terete, striate, scabrous or muricate, brown. Scales sub-basifixed or basifixed, non-clathrate or pseudoclathrate, lanceate to triangular or ovate, margins serrate, dentate, ciliate to laciniate. **LAMINAE:** 8.2–24.2 cm ( $\times$  17.70 cm) long, lanceate or triangular to elliptic, pinnate-pinnatisect to bipinnate-pinnatifid. Scales 1.2–2.7 mm ( $\times$  2.17 mm)  $\times$  0.2–0.9 mm ( $\times$  0.52 mm), light castaneous and dark. The axes are densely scaly. Pinnae oblong, lanceate, petiolulate, proximal and central pinnae subopposite (distanced 1mm) and slightly asymmetrical. Segment adnate, adaxially pubescent, dense or spread, and abaxially densely scaly. Scales imbricate, non-clathrate or pseudoclathrate, lanceate or slightly subulate, margins laciniate, apices caudate. Hairs non-glandular, multicellular with 12–15 rectangular cells, distal cell smaller or shorter than the rest. Segment margins revolute, fertile margins not differentiated or sometimes hyaline. Sori discrete, 64 spores per sporangium (Fig. 3).





**Figure 3.** *Cheilanthes cantangensis*: A. Specimen of Werff H. 14607 (Pteridoportal.org); B and C. Scales of petiole and abaxial side; D. Hair of adaxial side.

**Observations.** This species is easily recognized by the combination of non-glandular, long hairs on the adaxial surface and densely imbricate scales abaxially. Tryon (1956) proposed this taxon under *Notholaena*, commenting on its affinities to Paraguayan *N. hassleri* Weath. (later recognized as *Cheilanthes hassleri* (Weath.) Ponce), because of the presence of similarly sparse hairs in laminae. These species are morphologically very similar, differ because in *C. hassleri* the pinnae are more developed basiscopically, are elongated in the proximal pinnatifid (vs. proximal and central pinnae subopposite and slightly asymmetrical in *C. cantangensis*, although this character needs further verification with fresh material). Affinities of *C. cantangensis* are currently more clearly understood. Ponce and Scataglini (2018) included *C. hassleri* but not *C. cantangensis* in their two-chloroplast marker phylogeny, resolving it as a member of the “*C. obducta* group”, a group sister to *Hemionitis*. This lineage was later not supported apart from *Cheilanthes* by Ponce and Scataglini (2022), who also suggested *C. cantangensis* and *C. hassleri* to belong to the South American-Australasian clade, due to their morphological similarities to species in this clade, like *C. obducta* and the Brazilian *C. pantanalensis* E.L.M. Assis, Ponce & Labiak.

**Distribution and habitat.** *Cheilanthes cantangensis* is a Peruvian endemism, only known from northern Peru (Amazonas and Cajamarca). The original locality remains the single record for its presence in Cajamarca, while other collections have confirmed its range extension to the north along the Marañón and the Utcubamba basin. It has been recorded from 500–1900 m a.s.l., inhabiting seasonally dry forest ecosystems in areas dominated by shrubs.

**Examined specimens.** **Amazonas:** Gonzáles P. 6067 (USM); van der Werff H.14607, 14670 (USM). **Cajamarca:** López A. 3366 (HUT).

### *Cheilanthes fractifera* R.M. Tryon

Rhodora 62: 7, t. 1252. 1960. Type: Peru, Dep. Ayacucho, 45 km from Nasca to Puquio, 14 February 1958, D.S. Correll and E.E. Smith P169 (holotype GH-GH00020739; isotype TEX-L0037001).

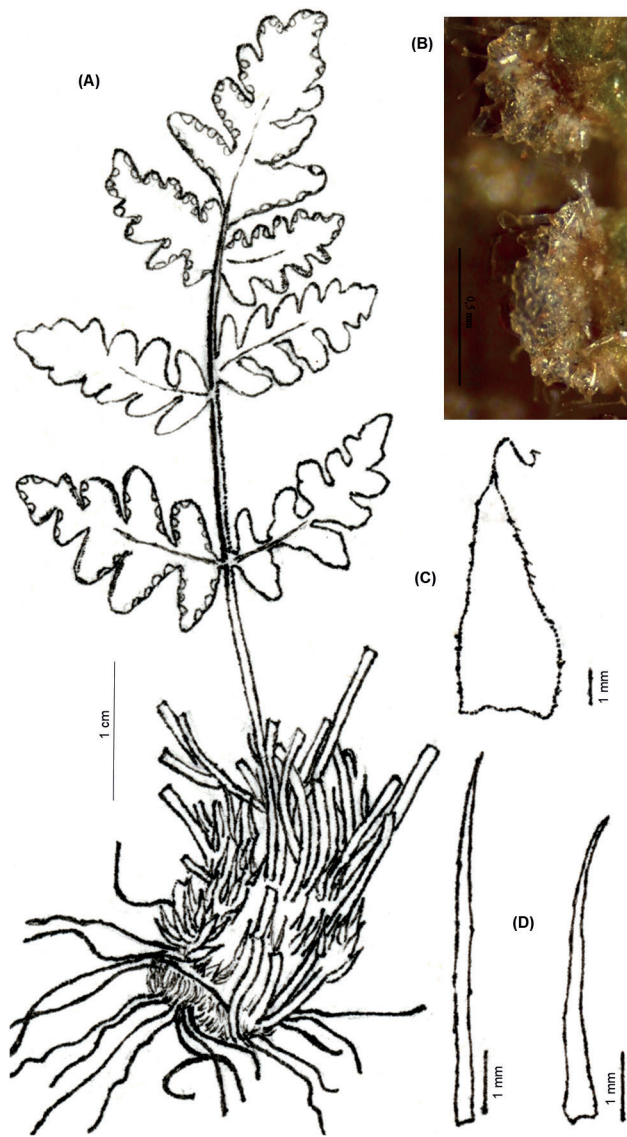
*Cheilanthes saundersii* Alston, Lilloa 30: 110, t. 6. 1960. Type: Peru, Dep. Lima, Huarochiri, km 64 Central Highway, 28 April 1957, S.G.E. Saunders 353 cited as “350” (holotype BM-BM00936608; isotype US-US236049).

**FRONDS:** 7.5–15 cm (x 11 cm) long. **RHIZOMES:** short, erect. Scales 1.5–8.0 mm (x 4.13 mm) × 0.2–1.2 mm (x 0.59 mm), basifixed, sub-basifixed, concolorous, castaneous, stramineous, linear, or acicular, lanceate or triangular, margins entire or toothed, uncinuate, ciliate. **PETIOLES:** 2.0–5.0 cm (x 4.0 cm), of length as long as the lamina, or  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{2}{3}$  of the lamina length, terete, laevigate, or striate, brown to dark, ebeneous, pubescent, hairs like those of the laminae, petiole base fractiferous with conspicuous persistent scales, the latter lanceate to triangular, caudate apices. **LAMINAE:** 3.5–10 cm (x 7.0 cm) long, triangular, ovate, unipinnate-pinnatisect to bipinnate-pinnatifid, pubescent. Rachises sulcate and wings adaxially, ebeneous color limited to the first pinnae pair, distal portions green. Pinnae, ovate to triangular, sessile to shortly petiolulate 1–2 mm long, proximal pair opposite to subopposite, and distal ones alternate, both sides with eglandular hairs, the latter simple, 2–8 cells, spreading. Segment margins revolute. Veinlets with broad apices and visible. Pseudindusium membranaceous, lunulate, margin crenate, lobed, erose, and pubescent. Sori discrete, sporangia with 32 spores (Fig. 4).

**Observations.** *Cheilanthes fractifera* is easily recognizable from other Peruvian *Cheilanthes* by the combination of its characters: ebeneous, fractiferous petioles with dispersed whitish hairs and spread scales, and pubescent laminae. The presence of 32 small spores supports its definition as having a sexual reproduction system.

Its morphology resembles that of the western North American *C. brandegeei* D.C. Eaton, currently recognized as *Baja brandegeei* (D.C. Eaton) Windham & L.O. George, that made Tryon and Tryon (1982) to propose their close affinity. However, laminae outline shape, fractiferous petiole, and pseudindusium are homoplasious characters; molecular data supported the recognition of *B. brandegeei* apart from *Cheilanthes* and any of the hemionitid ferns (George et al. 2019).





**Figure 4.** *Cheilanthes fractifera*: A. Habit; B. Pseudoindusium; C and D. Scales of petiole base and rhizome.

Morphologic differences exist in each life stage of *B. brandegeei* and *C. fractifera*. The sporophyte of *B. brandegeei* has unicellular, acicular hairs from a dilate, multicellular base; while the sporophyte of *C. fractifera* has hairs made of single row cells. The gametophyte growth in *B. brandegeei* is typically bommeriid, while in *C. fractifera* is typically hemionitid (George et al. 2019).

**Distribution and habitat.** *Cheilanthes fractifera* is a Peruvian endemism. It is known from Arequipa, Ayacucho, La Libertad, and Lima. It grows in rocky slopes and in dry ravines among interstices, and with an altitudinal range of 1450–2900 m a.s.l.

**Examined specimens.** **Arequipa:** Cáceres F. 1629 (HUSA); Cano A. 6419 (USM); \*Muller G. 12592 (GH); Montesinos D. 3351 (HUSA, USM), 3347 (USM); Obando Y. 21 (USM); \*Rauh W. P570 (B); Weigend M. 9864/ MW 19-54 (HUSA, USM). **La Libertad:** Sagástegui A. 4482 (HUT). **Lima:** León B. 5712 (USM); Rauh W. P143 (B); Saunders S. 219 (BM), 1050 (GH). \*Records not used for conservation status assessment.

### *Cheilanthes fraseri* Mett. ex Kuhn

Linnaea 36: 83. 1869. Syntypes: Peru, H. Ruiz and J.A. Pavón s.n. (B-B200101079a). Ecuador, J. Fraser s.n. (B-B200101078); Ecuador, M. Wagner s.n. (Type fragment: B-B200101079b).

*Notholaena fraseri* (Mett. ex Kuhn) Baker, Syn. Fil. (Hooker and Baker) ed. 2, 514. 1874.

**FRONDS:** 8.1–33.5(–38.5) cm (x 20.85 cm) long. **RHIZOMES:** short or long-creeping, entire or branched, 1–10 mm distance between fronds. Scales 1.0–2.6 mm (x 1.83 mm) × 0.1–0.5 mm (x 0.25 mm), basifixed or adpressed, bicolorous (base and central zone blackish brown and castaneous margins), lanceate with caudate translucent apices, margins toothed or slightly uncinat. **PETIOLES:** 3.6–15.5(–25) cm (x 8.52 cm), of length as long as the lamina, or longer than the length of the lamina, or ½ to ½ of the lamina length, terete, brown, villose, or tomentose, hairs similar to those of the laminae, or glabrescent. **LAMINAE:** 3.9–21.3(–24.5) cm (x 12.30 cm) long, linear or narrowly lanceolate, unipinnate-pinnatifid to bipinnate-pinnatifid at the base, simple glandular hairs, sericeous, villous, tomentose, lanate, or glabrescent. Rachises terete, striate and indument similar to the petiole. Pinnae ovate or triangular, asymmetric having larger basiscopic side, proximal and central pinnae petiolulate, proximal pinnae slightly reduced with 3–5 segments per side, while central and distal pinnae with up to 5 segments per side. Segment margins revolute. Veinlets with visible and broad apices. Pseudoindusium membranaceous, linear or lunate, margins erose. Sporangia with 32 and 64 spores (Fig. 5).

**Observations.** *Cheilanthes fraseri* is one of seven species resolved as members of the South American clade (Ponce & Scataglini 2022), all sharing multicellular hairs.

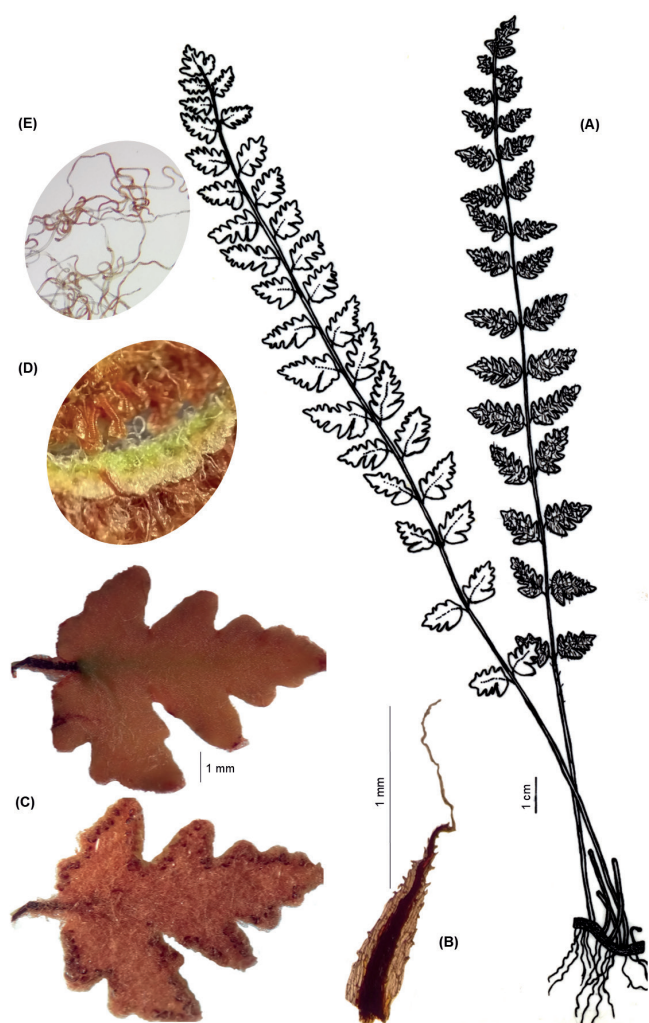
*Cheilanthes fraseri* was considered morphologically similar to *C. bonariensis* (Willd.) Proctor (Tryon and Stolze 1989), however, Grusz and Windham (2013) transferred it to *Myriopteris*, as *M. aurea* (Willd.) Grusz & Windham, a segregated genus encompassing a monophyletic group earlier recognized as the “myriopterid clade” (Windham et al. 2009), and distantly related to the type species of *Cheilanthes*. Both, *C. fraseri* and *M. aurea* share general lamina morphology and indument, however, they differ by creeping rhizomes and scales with translucent apices in the former vs. nodose rhizomes and scales with sclerosed apices in the latter.

Two other species of *Cheilanthes*, not found in Peru, are also similar to *C. fraseri*, these species are *C. buchtienii* (Rosenst.) R.M. Tryon from Bolivia and Argentina, and *C. hypoleuca* (Kunze) Mett. from Chile and Argentina (Ponce 2016). Tryon and Stolze (1989) cited *C. buchtienii* and *C. hypoleuca* as probably present in the Peruvian flora. *Cheilanthes buchtienii* can be distinguished of *C. fraseri* by having narrowly triangular laminae, and few deciduous scales among hairs on the rachises (vs. linear or narrowly lanceolate and no scales); while *C. hypoleuca* has canaliculate petiole and rachis, and subulate rhizome scales (vs. terete axes and lanceate rhizome scales).

*Cheilanthes incarum* Maxon

Smithsonian Misc. Coll. 65(8): 5. 1915. Type: Peru, Cuzco, 1 September 1914, J.N. Rose and Rose 19061 (holotype US-US761644; isotype NY-NY0014436, fragment P-P00584337).

**FRONDS:** 12.5–37.5 cm (x 23.82 cm) long. **RHIZOMES:** multicapital, compact, erect or short-creeping. Scales 5.2–11 mm (x 8.20 mm) × 0.15–0.8 mm (x 0.33 mm), basifixed, castaneous to atrocastaneous, linear to acicular, sinuate, margins toothed, occasionally inconspicuously uncinata. **PETIOLES:** 3.8–14.2 (–14.5) cm (x 7.72 cm) long, of length as long as the lamina, or  $\frac{2}{3}$ ,  $\frac{1}{2}$ ,  $\frac{1}{3}$  to  $\frac{1}{4}$  of the lamina length, brown, terete, striate, scaly. Scales sub-basifixed, pseudoclathrate, lanceate-ovate, lanceate-triangular, or pyriform, apices acuminate, acute, cuneate or caudate, margins erose, serrate, toothed or lacinate. **LAMINAE:** 8.5–23.3 cm (x 16.16 cm) long, narrowly lanceate, lanceolate, bipinnate-pinnatifid basally tripinnate (basal segment basiscopically divided), scaly. Scales 1.3–4.5 mm (x 2.95 mm) × 0.5–1.8 mm (x 1.08 mm). Rachises terete, striate, scales similar to those of the petioles. Pinnae, ovate-triangular, petiolulate, basal pinnae subopposite (distanced 1 mm) and near same length as central pinnae. Apices of abaxial scales extending to the adaxial side. Scales similar to petioles, sub-basifixed, imbricate, pseudoclathrate, light castaneous and grayish. Microscales, sinuate, linear or acicular, dispersed on the adaxial side, ca. 1–4 mm long, ca. 4 cells wide, margins uncinata, toothed. Segment ovate to triangular, flabellate, orbicular. Segment margins revolute. Pseudindusium distinct, membranaceous, scarious, lunulate, margins erose. Sori discrete, sporangia with 32 spores (Fig. 6).



**Figure 5.** *Cheilanthes fraseri*: A. Habit, abaxial side right and adaxial side left frond; B. Scales of rhizome; C. Pinnae, adaxial side (upper) and abaxial (lower); D. Pseudindusium; E. Indument of lamina.

**Distribution and habitat.** From Ecuador to Bolivia. In Peru is found in Amazonas, Ancash, Apurímac, Ayacucho, Cajamarca, Cusco, Huancavelica, Huanuco, Junín, La Libertad, Lima, and Piura. It grows in rocky slopes of seasonally dry tropical forests and shrublands, between 800–2600 m a.s.l.

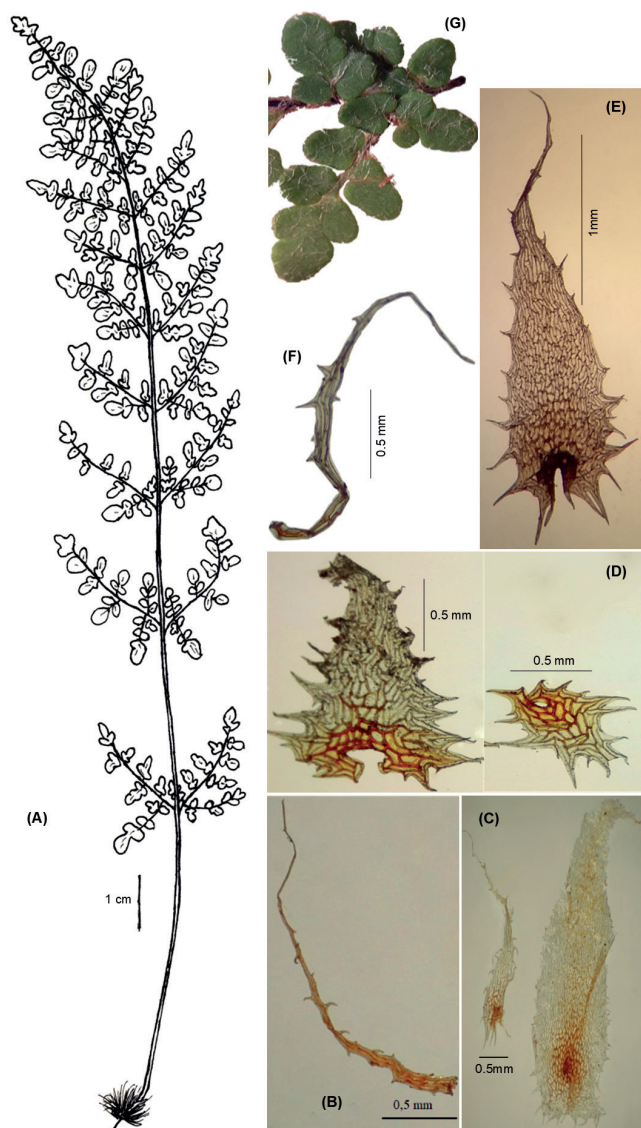
**Examined specimens.** without locality, Raimondi A. s.n. (USM). **Amazonas:** Werff H. 16878 (USM). **Ancash:** Cerrate E. 4049, (USM); Weberbauer A. 3020 (USM). **Apurímac:** Rivera S. 65, 73, 81, 87, 100, 101 (USM); Vargas 8910 (MO, UC); Zúñiga V. 640 (USM). **Ayacucho:** Velarde 4951 (GH). **Cajamarca:** Correll D. P909 (GH, US); Gonzáles P. 5388 (USM); Weberbauer A. 4139 (USM). **Cusco:** Mexia Y. 8055 (USM); Stork 10449 (F, GH, UC); Vargas C. 22365 (USM). **Huancavelica:** Huamán E. s.n. (USM); Hutchison P. 1684 (USM); Rivera S. 103 (USM); Tovar O. 3848 (USM). **Huanuco:** Macbride J. 2328 (F, GH, US); Calderón S. s.n. (USM); Ferreyra R. 6912, 19401 (USM); Mantel M. 1873, s.n. (USM). **Junín:** Weberbauer A. 1991 (USM). **La Libertad:** Castillo H. 152a; Gonzáles P. 5894, 683, 6847, (USM). **Lima:** Rauh W. 145, 146 (USM). **Piura:** Scolnik R. 1435 (UC).

**Observations.** *Cheilanthes incarum* is morphologically similar to other four Peruvian species, *C. arequipensis*, *C. peruviana*, *C. lonchophylla*, and *C. scariosa*, by being densely scaly on the axes and on the abaxial side of the laminae. It differs from *C. scariosa* by microscales on the adaxial surface of segments (vs. absent). Ponce and Scataglini (2022) suggested affinities of *C. incarum* to *C. squamosa* as part of the South American-Australasian clade that also includes those Peruvian species discussed above. *Cheilanthes incarum* shares similar indument of microscales on the adaxial side of laminae with *C. squamosa*; and differs by oblong ultimate segment in the latter vs. orbicular segment in the former.

**Distribution and habitat.** *Cheilanthes incarum* occurs in Peru and Bolivia, probably in northwest Argentina, although it was not included by Ponce (2016) for its pteridoflora, and it is not listed for Zuloaga (2018). In Peru, it has been recorded in Ancash, Apurímac, Arequipa, Cusco, Huancavelica, Junín, Moquegua and Puno. It grows in open, exposed xerophytic sites, in rocky slopes and dry ravines, between 2200–4200 m a.s.l.

**Examined specimens.** without locality, Tovar O. 1391 (USM). **Ancash:** Griffin D. s.n. (USM); Weberbauer A. 3021a (USM). **Apurímac:** Hutchison 1690 (GH); Lehnert M. 340 (USM); Rivera S. 94 (USM); West 3903 (UC). **Arequipa:** Montesinos D. 2978 (USM, HUSA). CU: Davis W. 1455 (USM); Ferreyra R. 2668 (USM); Núñez P. 7939,





**Figure 6.** *Cheilanthes incarum*: A. Habit; B, C, D and E: Scales of rhizome, raquis, petiole and abaxial side of lamina respectively; F. Microscales of adaxial side of lamina; G. Pinnula basiscopically, adaxial side.

7332 (USM); Tryon R. 5343 (USM). **Huancavelica:** Tovar O. 1014 (USM). **Junin:** Cerrate E. s.n. (USM). **Moquegua:** Montesinos D. 2244 (USM). **Puno:** Tutin 1032 (BM).

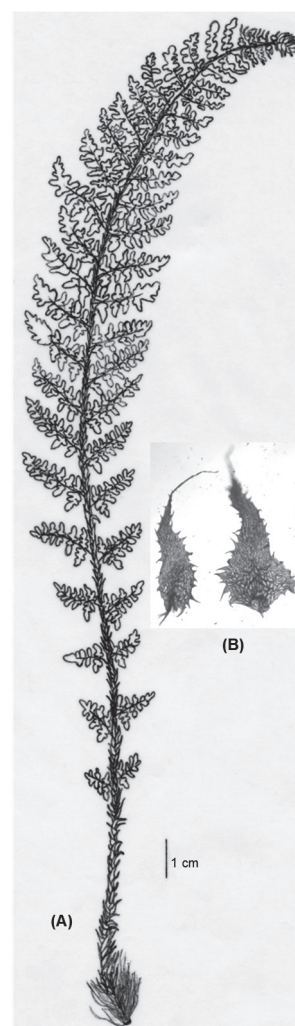
***Cheilanthes lonchophylla*** (Weath. ex R.M. Tryon)  
R.M. Tryon & A.F. Tryon

Rhodora 83: 133. 1981.

*Notholaena lonchophylla* Weath. ex R.M. Tryon, Contr. Gray Herb. 179: 19. 1956. Type: Peru, Chachapoyas, 1939, B.F. \*Mathews 610 (holotype K-K000633281; isotype P-P00586992).

**FRONDS:** 19.4–27 cm (x 22.47 cm) long. **RHIZOMES:** short, scaly. Scales 6–9.5 mm (x 8.56 mm) × 0.1 mm, basifixed, castaneous to atrocastaneous, linear or acicular, sinuate, margins toothed, uncinata. **PETIOLES:** 3.4–5 cm (x 4.47 cm), petiole length mostly < ¼ length of the lamina or ½, striate, terete, brown. Scales dark castaneous in the center with lighter margins, sub-basifixed, pseudoclathrate, lanceate, or elliptic, margins erose to serrate

or lacinate, apices caudate. **LAMINAE:** 16–22 cm (x 19 cm) long, narrowly lanceolate or lanceolate, bipinnate-pinnatifid, basal pinnae gradually reduced or less than ⅔ length of central pinnae, scaly. Scales 2–3.2 mm (x 2.64 mm) × 0.7–1.2 mm (x 0.96 mm). Rachises striate, scales similar to those of the pinnae. Pinnae, ovate to triangular, petiolulate. Segment oblong to triangular. Abaxial scales apices curved to the adaxial side. Abaxial side densely scaly, scales, sub-basifixed, imbricate, dark castaneous in the region central and margins light, lanceate to triangular, margins toothed, lacinate, apices caudate. Adaxial side with spreading microscales or glabrescent, microscales linear or acicular. Segment margins revolute. Pseudindusium distinct, membranaceous, scarious. Sori discrete, sporangia with 32 spores (Fig. 7).



**Figure 7.** *Cheilanthes lonchophylla*: A. Habit; B. Scales of abaxial side of lamina.

**Observations.** *Cheilanthes lonchophylla* is related to other scaly Peruvian species, *C. arequipensis*, *C. incarum*, *C. peruviana* and *C. scariosa*, all members of the South American-Australasian clade (Ponce & Scataglini 2022). It is recognized as distinct from the other members mentioned in the taxonomic key. *Cheilanthes scariosa* differs too from *C. lonchophylla* by its orbiculate ultimate segment. Ponce and Scataglini (2022) also proposed affinities to *C. squamosa* as part of the South American-Australasian



clade. *Cheilanthes lonchophylla* shares similar indument of microscales on the adaxial side of laminae with *C. squamosa*, but they differ by narrowly lanceolate laminae in the former vs. ovate lanceolate in the latter.

**Distribution and habitat.** *Cheilanthes lonchophylla* is a Peruvian endemic, known from Amazonas, Cajamarca and La Libertad. It is known from 2200–2950 m a.s.l. It inhabits rocky sites associated to seasonally dry tropical forest.

**Examined specimens.** **Cajamarca:** \*Aguado H. 6791 (HUT); Hutchinson P. 5297 (UC); López A. 7653 (HUT); Mostacero J. 881 (HUT). **La Libertad:** Gonzáles P. 7193 (USM). \*Records not used for conservation status assessment.

### *Cheilanthes mollis* (Kunze) C. Presl

Tent. Pterid. 160. 1836.

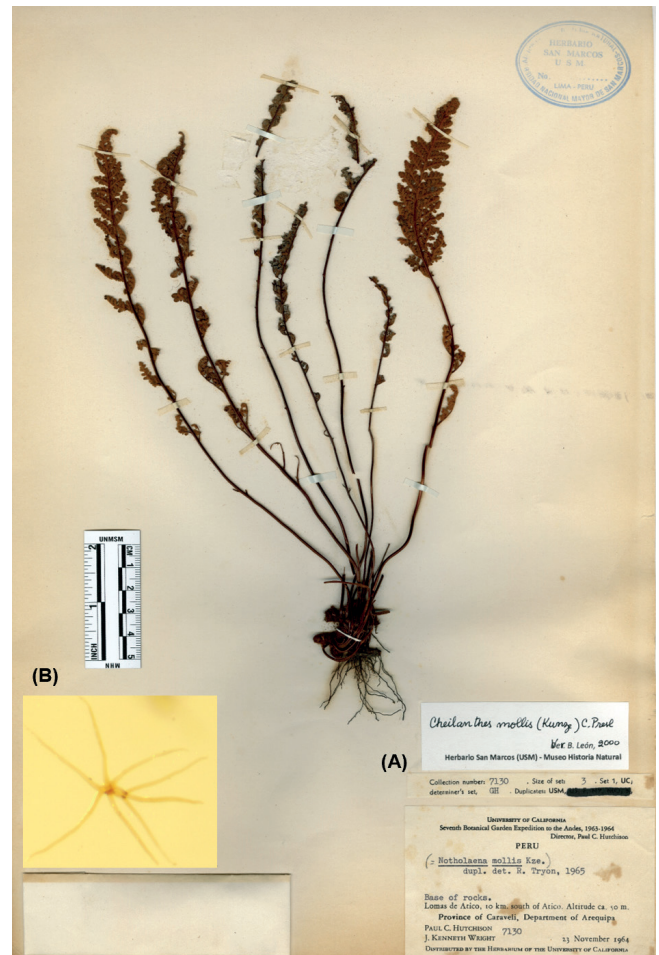
*Notholaena mollis* Kunze, Linnaea 9: 54. 1834. Type: Chile (Valparaíso), near Valparaíso, Playa Ancha, June 1827, E.F. Poeppig s.n. (LZ, destroyed) (lectotype designated by M. Ponce and A. Scataglini 2022 as LE-00008529; and isolectotype: BM-001067980).

**FRONDS:** 10.5–27 (x 18.17 cm) long. **RHIZOMES:** short or long-creeping, nodose, scaly. Scales 2.2–3 mm (x 2.58 mm) × < 1mm, lanceate, basifixed, adpressed, bicolourous (base and central zone blackish brown and light castaneous margins), margins inconspicuously toothed. **PETIOLES:** 3.5–9 (x 6.25 cm), ½ to ⅓ of the lamina length, terete, laevigate, or striate, brown, pubescent to glabrescent, eglandular hairs, branched, stellate or pseudactinomorphs, sparse scales spreading along the axes base similar to those of the rhizome. **LAMINAE:** 7–18 (x 12 cm) long, lanceolate, bi-or-tripinnate, pubescent. Pinnae petiolulate. Segment orbiculate, or oblong. Abaxial surface densely hairy, tomentose, pluricellular eglandular hairs, stellate or pseudactinomorphs, with (8–) 9–12 long branches around an axis of few articulate cells, whitish or ferrugineous. Adaxial surface glabrescent or with spreading hairs similar to those abaxially. Segment margins revolute, fertile margins not differentiated or sometimes hyaline. Sori discrete on vein apices, sporangia with 32 spores (Fig. 8).

**Observations.** *Cheilanthes mollis* is easily distinguished from other Peruvian species by its fronds: laminae tomentose on the abaxial surface with stellate hairs. It was included in the phylogeny of Ponce and Scataglini (2022) and resolved within the South American clade that included another five Peruvian species (*C. fraseri*, *C. pilosa*, *C. poeppigiana* Mett. ex Kuhn, *C. pruinata* Kaulf., and *C. rufopunctata* Rosenst.).

**Distribution and habitat.** It is known from Peru and Chile. In Peru, it has been found in Arequipa, growing in rocky sides and ravines of lomas ecosystem, between 50–1050 m a.s.l. In Chile, it also occupies low elevation sites below 1300 m (Rodríguez et al. 2009).

**Examined specimens.** **Arequipa:** Cano Y. 33 (HUSA); Ellenberg H. 4153 (GH); Hutchison P.C. 7130 (USM); Weberbauer A. 1545 (B).



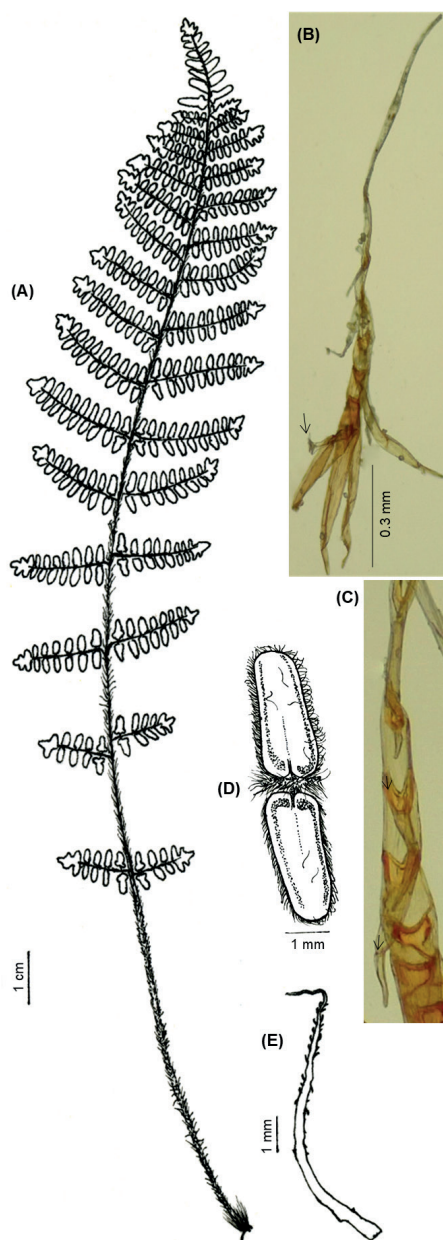
**Figure 8.** *Cheilanthes mollis*: A. Specimen (USM); B. Indument of lamina.

### *Cheilanthes obducta* Mett. ex Kuhn

Linnaea 36: 83. 1869. Type: Bolivia, La Laguna, June 1907, C. D. D'Orbigny 386 (holotype B–B200102214; isotype P–P00586581, P–P00586582).

*Notholaena obducta* (Mett. ex Kuhn) Baker, Syn. Fil., ed. 2, 515. 1874.

**FRONDS:** 8.7–33 cm (x 21.39 cm) long. **RHIZOMES:** short-creeping, compact, scaly. Scales 4–12 mm (x 6.54 mm) × 0.1–0.3 mm (x 0.18 mm), basifixed, castaneous or atrocastaneous, linear or acicular, slightly sinuate, margins apically uncinata or toothed. **PETIOLES:** 1.5–(2.7–5.5) –7.5 cm (x 4.18 cm) long, near ⅓, ¼, ⅕, ⅙ of the lamina length, brown, terete, laevigate or striate, pubescent, lanate, eglandular, acaroid-like hairs. **LAMINAE:** 7.2–22.5 (x 16.44 cm) long, lanceolate, lanceate or elliptic, bipinnate, rarely bipinnate-pinnatifid at the base, pubescent with hairs similar to those on petioles, lanate. Segment adnate or shortly petiolulate, oblong-deltoid, margins revolute. Abaxial surface with multicellular, eglandular, sometimes they have a capitate terminal cell, acaroid-like hairs, the latter short multicellular base (1–2 cells), main axes in a single row of caudate or pectinate cells, with tangential walls embedded into the neighboring distal cell. Adaxial surface glabrescent or villous, hairs similar to those on opposite side. Segment margins fertile not differentiated or sometimes hyaline. Sori discrete, sporangia with 32 spores (Fig. 9).



**Figure 9.** *Cheilanthes obducta*: A. Habit; B. Acaroid-like hair, arrow indicate fixing point, short multicellular base (1–2 cells); C. Arrows indicate main axes in a single row of caudate or pectinate cells, with tangential walls embedded into the neighboring distal cell; D. Segment of lamina; E. Scale of rhizome.

**Observations.** *Cheilanthes obducta* is distinguished from other hairy Peruvian species by its lanceate bipinnate laminae with acaroid-like hairs, these hairs have a 1–2 cells base, main axes in a single row of caudate or pectinate cells, with tangential walls embedded into the neighboring distal cell (Fig 9D). Ponce and Scatagliini (2018), in their two-chloroplast marker phylogeny, recognized the “*C. obducta* group”, that also included *C. hassleri* and the Brazilian *C. pantanalensis*, as a group sister to *Hemionitis*. Nevertheless, this lineage was later not supported apart from *Cheilanthes* by Ponce and Scatagliini (2022), but instead was well-resolved in *Cheilanthes* with the inclusion of Argentinian *C. sarmientoi* Ponce, and suggesting *C. cantangensis* and *C. hassleri* as members of this lineage, all together members of the South American-Australasian clade.

**Distribution and habitat.** This species occurs from Colombia and Venezuela to Bolivia, Amazonian Brazil, Paraguay, and Argentina. In Peru is known from Amazonas, Cajamarca, and La Libertad, from 600–1700 m a.s.l. It grows between rocks in open sites or forested areas in the seasonally deciduous dry tropical forest ecosystem.

**Examined specimens.** **Amazonas:** Gonzáles P. 5618 (USM); Mendoza W. 6614 (USM). **Cajamarca:** Gonzáles P. 5373, 6214 (USM); Hutchison P.C. 1425 (USM). **La Libertad:** Arroyo S. 236 (HUT); Gonzáles P. 6559 (USM); Pillaca L. MA18 (USM).

### *Cheilanthes peruviana* (Desv.) T. Moore

Index Fil. 250. 1861.

*Notholaena peruviana* Desv., Mém. Soc. Linn. Paris 6: 220. 1827.

Type: Peru, locality unknown, \*J. Dombey s.n. (holotype P–P00586588; isotype B–B200127985; fragment P–P00586540).

*Notholaena sinuata* var. *bipinnata* Hook., Sp. Fil. 5: 108. 1864.

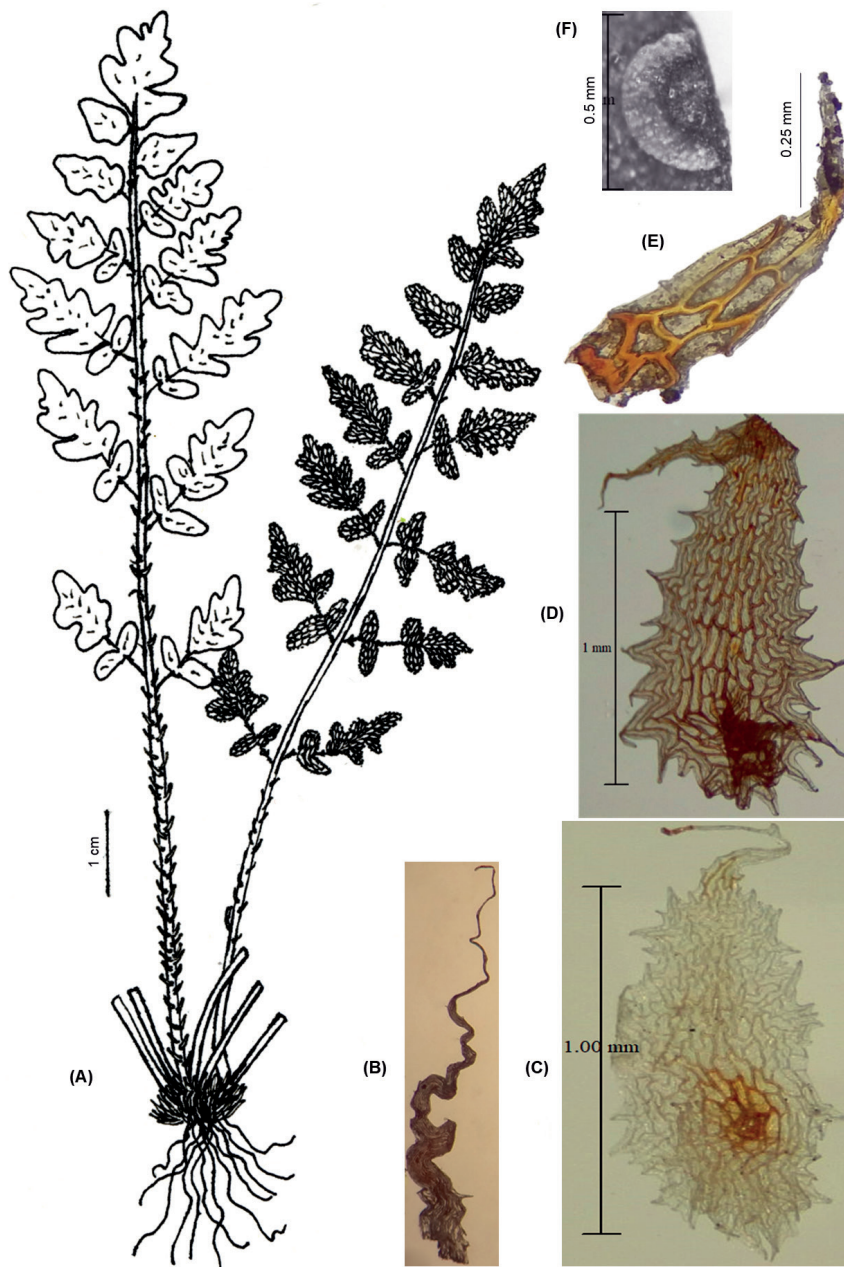
Type: Peru, (Huanuco), “Andes of Peru”, Baños, Brackenridge (Wilkes, U.S. Exploring Expedition) (holotype K).

*Notholaena brackenridgei* Baker, Syn. Fil. 371. 1868. Type: the same as for *N. sinuata* var. *bipinnata* Hook.

**FRONDS:** 7.8–29.9(–31.3) cm (x 16.25 cm) long. **RHIZOMES:** multicipital, compact, short, scaly. Scales 3.5–10.5 mm (x 5.57 mm) × 0.1–1 mm (x 0.25 mm), basifixed, concolorous, brown, pale castaneous in group, linear to acicular, sinuate, margins uncinata and inconspicuously toothed. **PETIOLES:** 3–17.9 cm (x 8.11 cm), of length as long as the lamina, or near twice the length, or  $\frac{1}{2}$ ,  $\frac{2}{3}$  of the lamina length, terete, brown, castaneous, striate with scars, indument scaly or glabrescent. Scales sub-basifixed, pseudoclathrate, lanceate or triangular, or acicular, elliptic or ovate, apices attenuate or caudate, margins toothed or lacinate, inconspicuously uncinata. **LAMINAE:** 3–16.8 cm (x 8.15 cm) long, narrowly lanceate to narrowly elliptic, bipinnate-pinnatifid, scaly. Scales 1–2.5 mm (x 1.73 mm) × 0.1–0.9 mm (x 0.62 mm), castaneous light and dark. Rachises striate with indument similar to petioles. Pinnae, ovate, petiolulate, mostly alternate. Abaxial surface densely scaly, similar to those on petioles, pale castaneous or dark, scale apices curved towards the adaxial surface, pseudoclathrate, sub-basifixed, imbricate, marginal apiculate tooth. Adaxial side with microscsles clathrate, scattered, light castaneous and dark (ca. 1 mm long, ca. 3 × 5 cells). Segment ovada-triangular, margins revolute. Pseudindusium membranaceous, lunulate, margins erose. Sori discrete, sporangia with 16, 32 and/or 64 spores (Fig. 10).

**Observations.** *Cheilanthes peruviana* is a scaly species with close affinities to *C. arequipensis*, *C. incarum*, *C. lonchophylla*, and *C. scariosa*, all members or putative members of the South American-Australasian clade (Ponce & Scatagliini 2022). It is confused with *C. arequipensis*, but it can be distinguished: laminar scales with marginal apiculate tooth, clathrate microscsles and pseudindusium differentiated (vs. laminar scales with marginal acute tooth, without microscsles and with pseudindusium not differentiated in *C. peruviana*). Tryon and Stolze (1989)





**Figure 10.** *Cheilanthes peruviana*: A. Habit, right abaxial side and left adaxial side frond; B, C, D. Scales of rhizome, petiole and abaxial side of lamina respectively; E. Microscale of adaxial side of lamina; F. Pseudoindusium.

distinguished *C. peruviana* from *C. arequipensis* based on the color of rhizome scales, and laminae to petiole ratio length; however, these characters are plastic. *Cheilanthes peruviana* also differs from *C. incarum* by its adaxial side with clathrate microscales (vs. pseudo-clathrate microscales); and ovate-triangular ultimate segment (vs. mostly orbicular, flabellate or ovate a triangular).

**Distribution and habitat.** *Cheilanthes peruviana* is a Peruvian endemic. It is known from Ancash, Arequipa, Cajamarca, La Libertad, Lambayeque, Lima and Moquegua, from 400–3900 m a.s.l. It grows in rocky slopes, in ravines, and shrublands associated to lomas and relict Andean forests ecosystems.

**Examined specimens.** **Ancash:** Cerrate E. 6638 (USM); Smith D. 10896 (USM). **Arequipa:** Cano Y. 48

(HUSA); Coronado P. 39 (US); Del Carpio C. 140 (USM); Ferreyra R. 1426 (USM), 11968 (GH); Montesinos D. 3465 (USM); Quispe E. 124 (HUSA); Whaley O. 1840 (USM). **Cajamarca:** López A. 3688 (HUT), Sagástegui A. 3892, 5073, 6392, 7723, 8379, 9146, \*9271, \*10599, 12530, 10631a (HUT); Vargas M. 2220 (HUT). **La Libertad:** Sagástegui A. 3913 [before as Cajamarca] (HUT); Arroyo S. 242 (HUT); López A. 2665 (HUT); Weigend M. 97/210 (USM). **Lambayeque:** Correll D.S. P822 (US). **Lima:** Acleto C. 40 (USM); Cerrate E. 5753, 5775, 6344, 6358, (USM); Ferreyra R. 3458, 9742, 15464 (USM); Gonzáles P. 20 (USM, HUSA), 586b (USM); León B. 904 (USM); \*Meza I. 12 (USM). **Moquegua:** Stafford D. 993 (BM). \*Records not used for conservation status assessment.



***Cheilanthes pilosa* Goldm.**

Nov. Act. Acad. Caes. Leopold. Carol. Nat. Cur. 19 (suppl. 1): 455. 1843. Type: Peru, F.J.F. Meyen s.n. (lectotype designated by Ponce 2016: B-20-0038096; isolectotype: B-20-0038097).

*Cheilanthes macleanii* Hook., Sp. Fil. 2: 93, t. 110 B. 1852. Type: Andes of Peru, J. MacLean s.n. (holotype K- K000633286; isotype GH-GH00571977).

**FRONDS:** 7–25.2 (–45) cm (x 22.98 cm) long. **RHIZOMES:** short or long-creeping, scaly. Scales 2.8–4.5 mm (x 3.52 mm) × 0.25–0.5 mm (x 0.36 mm), lanceate, basifixed, adpressed, bicolorous (base and central zone blackish brown and atrocastaneous margins), shining in mass, rigid, apices caudate, margins lacerate with glands. **PETIOLES:** 2.5–16 cm (x 8.72 cm), of length as long as the lamina, or near twice the length, or ½ of the lamina length, terete, light and dark castaneous, sometimes brown dark, striate, glabrescent or glandular-pilose. Hairs, ca. 5 cells long, glandular, simple, few inconspicuous spreading scales to base of axes. **LAMINAE:** 4.5–23.5 (–26.5) cm (x 13.21 cm) long, herbaceous to chartaceous, narrowly ovate, linear a lanceate, lanceolate, glutinous (without dark yellow secretion), bi-tripinnate. Rachises terete and sulcate adaxial towards apex, hairs similar to the petiole, ca 1 mm long. Pinnae, petiolulate, lanceate, triangular. Segment petiolulate or adnate, margins lobulate, revolute, with visible apices veinlets. Abaxial surface glandular-pilose with hair apices cup-shaped and adaxially scattered glandular hairs. Pseudindusium distinct, membranaceous, scarious, lunulate or lunate, margins erose with scattered hairs. Sori discrete, sporangia with 64 spores (Fig. 11).

**Observations.** *Cheilanthes pilosa* is one of two glandular hairy species in the Peruvian pteridoflora. Here, *C. pilosa* is provisionally recognized as a single species. It is a morphological variable species along its range, mainly in frond size and indument density (Ponce 2016, Kessler et al. 2017). We also found that characters of frond length, persistence of scales on axes and petiole morphology require a more detailed evaluation.

Two specimens from southeastern Peru (León 2233 and 2340) are included in the broad concept of *C. pilosa*, and show the need of further studies to clarify their identities. These specimens have the following characteristics: large size specimens, long-creeping rhizomes, rhizome scales, lanceate-lineal, caudate, dark castaneous, sclerotic, margin entire sometimes lacerate with glands on each laciniae; petiole terete, dark brown to dark reddish, 1/2 of lamina length, apparently almost glabrous but has spreading hairs of 1–2 cells (0.1 mm, 1 mm, 1.5 mm long) with apical gland, and with inconspicuous scattered scales that spread towards the rachis; rachis terete, only sulcate adaxially towards the most distal parts, hairs of 1–3 cells (0.1 mm, 0.5 mm, 1 mm, 1 mm long) with apical gland, and denser with respect to the petiole; pinnae with hairs of 0.1 mm, 0.5 mm, 1mm, denser, and adaxially their segments may be glabrescent; visible and broad apices veinlets; pseudindusium distinct, membranaceous.



**Figure 11.** *Cheilanthes pilosa*: A. Habit (P. Gonzáles, PG); B. Pinnae with black sori; C. Indument of petiole.

These specimens have some morphological similarities with the Bolivian endemic *C. glutinosa* Kessler & A.R. Smith by presence of septate short hairs on the axes, and dark castaneous, sclerotic rhizome scales; they are also morphological similar to the Ecuadorian endemic *C. ecuadorensis* Windham & K. Sosa by having short and long hairs on the lamina and scales on the rhizome.

*Cheilanthes ecuadorensis* belongs to a different clade than *C. pilosa*, and thus they are not phylogenetically close (Sosa et al. 2021). *Cheilanthes glutinosa* has also affinities with *C. pilosa*, and it is suspected to occur in Peru (Kessler et al. 2017).

Another morphologically similar species, *C. andina*, belongs in a different clade than *C. pilosa*, and thus they are also not phylogenetically close (Ponce & Scataglini 2022).

In addition, phylogenetic studies have shown strong support for the close affinities of *C. pilosa* to *C. pruinata* Kaulf. (Ponce & Scataglini 2018, 2022, and Sosa et al. 2021), both species are members of the South American clade.

**Distribution and habitat.** *Cheilanthes pilosa* ranges from Peru and Bolivia to Argentina. In Peru, it is known in 11 departments of the central and southern Peruvian Andes (Ancash, Apurímac, Arequipa, Ayacucho, Cusco,

Huancavelica, Junin, Lima, Moquegua, Puno, and Tacna), between 2600–5010 m a.s.l. It grows in rock interstices and rocky sites associated to relict *Polylepis* forests, high Andean grasslands, and cryoturbated soil ecosystems.

**Examined specimens.** without locality, Rauh W. 1237 (USM). **Ancash:** Cerrate E. 1548, 2337, 3341, 3907, 6505, 7422, 8308, (USM); Sagástegui A. 12343 (HUT); Smith D. 11554, 11713, 11459a (USM), and 12141 (HUT); Weberbauer A. 2883 (USM). **Apurimac:** Rivera S. 96 (USM). **Arequipa:** Werff H. 20758 (HUSA). **Ayacucho:** Cano A. 11924, 12004, 19809 (USM); Lehnert M. 335 (USM); Morales M. 4085 (USM); Rivera S. 97 (USM); Tovar O. 6701 (USM). **Cusco:** Cano A. 20583 (USM); León B. 2233, 2340 (USM); Pennell 13994 (F, GH, US); Vargas 6541 (CUZ); Bües 1825 (US). **Huancavelica:** Rauh W. 359 (USM); Tovar O. 3117, 3126 (USM); Weigend M. 97/606 (USM). **Junin:** Beltrán H. 7135 (USM); Cerrate E. 5408 (USM); Killip E. P.23365 (US); Rivera S. 001 (USM); Saunders 647 (GH); Tryon 5467 (F). **Lima:** Beltrán H. 8248 (USM); Cerrate E. 4412 (USM); Gonzáles P. 2661 (SUM); León B. 905 (USM); Rivera S. 31 (USM). **Moquegua:** Blanchard M. 86 (HUSA, USM); Montesinos D. 2025, 2176 (USM). **Puno:** Acleto C. 11185 (USM); Aguilar P. s.n. and s.n. (USM); Iltis H. 1317, 1320 (USM); Helena M. s.n. (USM); Mexia Y. 7783 (F, GH, MO, UC, US); Montesinos D. 2672 (HUSA, USM); Pennell F. 13454 (F, GH, US); Vilca S. 48 (HUSA); Weberbauer A. 717 (B); 909 (USM); **Tacna:** Cano A. 8235 (USM).

### *Cheilanthes poeppigiana* Mett. ex Kuhn

Linnaea 36: 84. 1869. Syntypes: Peru, E.F. Poeppig s.n., and Bolivia, H. Cuming s.n. (B–B200038108a is determined by Mettenius and is doubtless part of the original materials).

**FRONDS:** 10.7–33 cm (x 21.04 cm) long. **RHIZOMES:** short, erect or decumbent, scaly. Scales 3–6.5 mm (x 3.88 mm) × 0.3–0.7 mm (x 0.43 mm), basifixed, bicolorous (base and central zone blackish brown and light castaneous margins), lanceate, apices caudate and sinuate with extended apical gland, margins inconspicuously uncinuate, toothed or entire. **PETIOLES:** 5–17 cm (x 11.64 cm), of length as long as the lamina, or near twice the length, laevigate or striate, terete, sulcate adaxially without wings, atrocastaneous to atropurpureous (extending to the rachises), glabrous, inconspicuous spreading scales. **LAMINAE:** 5.7–17 cm (x 9.4 cm) long, ovate to triangular, unipinnate-pinnatisect to bipinnate-pinnatifid, glabrous. Rachises adaxially sulcate and wings, spreading scales. Pinnae triangular or lanceate-triangular. Ultimate segment adnate, lanceate, revolute margins, visible and broad apices veinlets. Pseudindusium, membranaceous, short ending at the base of the segment, linear, margins erose or laciniate. Sori discrete, sporangia with 64 spores (Fig. 12).

**Observations.** *Cheilanthes poeppigiana* is an easily distinguishable species from others in the genus in Peru, by its glabrous laminae with modified margins only along segments. Because of its elongated pseudindusium, Tryon and Tryon (1982) suggested affinities in the “*C. mar-*



Figure 12. *Cheilanthes poeppigiana*: Specimen (USM).

*ginata* group”, however, this latter species was later recognized in the segregated genus *Gaga*, as *G. marginata* (Kunth) Fay W. Li & Windham (Li et al. 2012), having a modified margin that runs from segment to rachis.

**Distribution and habitat.** *Cheilanthes poeppigiana* is known from Ecuador to Argentina. In Peru occurs in Cajamarca, Cusco, Huanuco, Junin, La Libertad, Lambayeque, Piura, Puno and Tumbes, between 150–3500 m a.s.l. It grows in protected and humid rocky slopes, can be associated to *Selaginella* subg. *Rupestrea*, and shrublands.

**Examined specimens.** **Cajamarca:** Diaz A. 5070 (USM); López A. 3681, 3725, 5217 (HUT); Sagástegui A. 10596 (HUT). **Cusco:** Ferreyra R. 2684 (USM); León B. 455 (USM); Rauh W. 778, 876 (USM); Tryon R. 5396 (USM). **Huanuco:** Macbride J. 3672 (F). **Junin:** Cerrate E. 2808 (USM), Tryon R. 5436 (USM). **La Libertad:** Sagástegui A. 194 (HUT). **Lambayeque:** López A. 4042 (HUT). **Piura:** López A. 7703 (HUT). **Puno:** Weberbauer A. 566 (B). **Tumbes:** Coronado P. 226 (GH, UC); Schunke J. 3031 (F, GH, US).

### *Cheilanthes pruinata* Kaulf.

Enum. Filic. 210. 1824. Type: Peru, non-designated locality, A. d. Chamisso s. n. (not located). “Note: Until now we have not been successful in the search of the specimen A. d. Chamisso s. n. cited by Kaulfuss in the original description, in the oldest herbaria of Europe, such as B, BM, BR, C, HAL, HBG, K, KIEL, L, LE (main collection), LZ (destroyed), M, P, S, W (Ponce & Scatagliini 2022)”.



*Cheilanthes mathewsii* Kunze, Farrnkräuter 1: 50, t. 25. 1840. Type: Peru, A. Mathews 605 (holotype B-B200C38153).

*Cheilanthes fasciculata* Goldm., Nov. Act. Acad. Caes. Leopold.-Carol. Nat. Cur. 19 (suppl. 1): 456. 1843. Type: Peru, F.J.F. Meyen (holotype B-B200038142).

**FRONDS:** 15.8–37(–41.2) cm (x 26.91 cm) long. **RHIZOMES:** multicapital, short or long-creeping, nodose. Scaly; scales 3–3.6 mm (x 3.27 mm) × 0.3–0.6 mm (x 0.42 mm), lanceate, basifixed, adpressed, bicolorous (base and central zone blackish brown and light castaneous margins), shining in mass, rigid, margins entire, apices caudate with extended apical gland. **PETIOLES:** 5.8–13.6(–15.5) cm (x 9.29 cm) long,  $\frac{1}{2}$ ,  $\frac{2}{3}$  of the lamina length, castaneous and dark brown, terete, striate, glabrescent, glandular-pilose. Hairs simple with an apical modified glandular cell, scales spreading toward the rachis. **LAMINAE:** 10–28.5 cm (x 17.62 cm) long, subcoriaceous, linear or narrowly lanceolate, bipinnate-pinnatifid, glandular-pilose, glutinous (with dark yellow secretion), hairs as those on petiole. Rachises with hairs of different sizes, terete. Pinnae ovate to triangular, petiolulate. Segment adnate or shortly petiolulate, margins lobulate, revolute, apices veinlets mostly not visible. Abaxial surface glandular-pilose, glutinous, hairs simple with 1–2 cells up to 8 and adaxially with spreading hairs or glabrescent. Pseudindusium distinct, membranaceous, scarious, lunate or lunulate, margins erose. Sori discrete, sporangia with 64 spores (Fig. 13).



Figure 13. *Cheilanthes pruinata*: Specimen (S. Rivera 028, USM).

**Observations.** *Cheilanthes pruinata* is one of the most common species in Peru, and is easily distinguished by its glandular hairs and glutinous fronds. It was considered within the “*C. micropteris group*”, based on the presence of glandular hairs; however, molecular phylogenetic studies (Ponce & Scataglini 2018, 2022, and Sosa et al. 2021) strongly support its close affinity to *C. pilosa*. *Cheilanthes pruinata* is easily recognized from *C. pilosa* by its usually lineate and glutinous laminae with dark yellow secretion vs. ovate-triangular and glutinous laminae without dark yellow secretion. Both species belong to the South American clade (Ponce & Scataglini 2022).

**Distribution and habitat.** *Cheilanthes pruinata* is found from Peru to Argentina. In Peru grows in all departments with Andean territory, except Pasco and Piura. It grows in crevices among rocks in slopes and ravines associated to relict *Polylepis* forests, seasonally dry tropical forests, Andean grasslands, Andean shrublands and *Puya*-stands ecosystems, between 1400–4580 m a.s.l.

**Examined specimens.** without locality, Rauh W. 578 (USM). **Ancash:** Cano A. 12382, 13364, 13432 (USM); Cerrate E. 162, 306, 500, 637, 654, 691, 791, 2174, 2523, 3103, 3287, 3382, 3874, 6498, 8013, 8292, 572a, s.n. (USM); Ferreyra R. 3287, 7490, 14539, 16876 (USM); Gonzáles P. 3257 (USM); La Torre M. 160, 161 (USM); Pérez E. 92 (USM); Smith D. 9058, 9344, 9398, 9862, 10460, 10593, 10772, 11285, 11550, 11941, 12408 (USM); Tovar O. 9601 (USM); Weberbauer A. 2670, 2864 (USM). **Apurímac:** Espinoza B. 499 (USM); Hocking P. 13a (USM). **Arequipa:** Aedo C. 10992, 11087 (USM); Arenas G. 104 (USM); Arenas L. 53 (HUSA); Cáceres F. 271, 1594, 2837, 5511, 8533 (HUSA); 5335 (USM, HUSA); Cano A. 22318 (USM); Castillo G. 8 (HUSA); Clostre G. 72 (USM); Cueva M. 35 (HUSA); La Torre M. 3338 (USM); León B. 5739b (USM); Mariño L. 4 (HUSA); Montesinos D. 3407 (HUSA), 3464 (USM, HSP); Museo de Historia Natural 2 (USM); Nuñez E.M. 65 (USM); Pauca A. 41 (HSP); Quipuscoa V. 2521 (HUSA, HSP), 2547 (HUSA), 5920 (HSP, USM), 5945 (HSP, USM), 6885 (HSP, USM), 7374 (HSP); Ramos D. 1731, 1950 (HSP); Solomon J. 2858 (USM); Treviño I. 741 (HSP); Weibel M. 6 (USM); Weigend M. 2000/518 (USM, HUSA), 9911/ MW 19-99 (USM, HUSA). **Ayacucho:** Cano A. 11863, 12006, 12030, 12069 (USM); Ferreyra R. 7214 (USM); La Torre M. 3277 (USM); Lehnert M. 331 (USM); Roque J. 3136, 3148, 3152, 5442 (USM); Tejada C. 294 (HSP); Tovar O. 5667 (USM); Treviño I. 1561 (HSP). **Cajamarca:** Douglas W. 22037 (USM); Ferreyra R. 3224, 3322 (USM); Gutte P. 8748 (USM); Henning T. 20 (USM); Hutchison P. 5131 (USM); Pennell F. 15128, 15134 (USM). **Cusco:** Bonino E. 1005 (USM); Cano A. 20584 (USM); Davis E. 1514, 1654, 1661 (USM); Gutte P. 9498 (USM); Iltis H. 935a (USM); León B. 444 (USM); Nuñez P. 6694, 7417, 7977, 5362 (USM); Tryon R. 5362 (USM); Weberling F. 6529 (USM). **Huancavelica:** Cano A. 21872 (USM); Tovar O. 920, 926, 2029 (USM). **Huanuco:** Ferreyra R. 1943 (USM); Moya T. 2135 (USM). **Junín:** Cerrate E. 2901, 5409 (USM); Iltis H. 130 (USM); Soukup J. 3147 (USM); Sullivan G. 1033 (USM); Tovar O. 5074 (USM); Yarupaitán G. 1133 (USM). **La Libertad:** Morales M. 3790 (USM); Pulido V. s.n. (USM); Roque J. 5002



(USM); Smith D. 2219, 3323 (USM); Weigend M. 97330, 97/248 (USM); Young K. 2917 (USM). **Lima:** Acleto C. 47 (USM); Baldeón S. 8120, 8122 (USM); Beltrán H. 8254 (USM); Cerrate E. 1005, 1740, 4224, 4260, 4485, 4713 (USM); Exp. Científica Univ. Varsovia Polonia 59 (USM); Ferreyra R. 5311 (USM); Gonzáles P. 489, 671, 3701, 3754 (USM), 672 (USM, HUSA); Rivera S. 28, 30 (USM). **Moquegua:** Blanchard M. s.n. (USM, HUSA); Cáceres F. 708 (USM); Montesinos D. 514 (USM). **Puno:** Aedo C. 11111 (USM); Aguilar P. 111 s.n. (USM); Arteta M. 324 (HUSA); Del Carpio C. 725 (USM); Iltis H. 1318 (USM); Mexia Y. 7780 (USM); Montesinos D. 2669 (HUSA, USM), 4162 (HSP); Quipuscoa V. 2498 (HUSA); Rauh W. 656 (USM); Solomon J. 2894 (USM); Tessene M. 1999 (USM); Tovar O. 5341 (USM); Vilca S. 41 (HUSA); Zúñiga E. s.n. (USM). **Tacna:** Cano A. 8172, 8238, 8308 (USM); La Torre M. 1920, 2006. 2268, 2367, 2371 (USM).

### *Cheilanthes rufopunctata* Rosenst.

Meded. Rijks-Herb. Leiden 19: 9. 1913. Type: Bolivia, (La Paz), Araca, October 1911, T. Herzog 2366 (holotype L-0063079; isotype UC-UC478369, US-US1187797).

**FRONDS:** 17.5–37.8 cm (x 22.13 cm) long. **RHIZOMES:** short or long-creeping, nodose, scaly. Scales 1.4–3 mm (x 2.03 mm) × 0.3–0.5 mm (x 0.39 mm), basifixed, adpressed, rigid, dark castaneous, partially sclerotic, lanceate, apices slightly caudate, margins entire. **PETIOLES:** 7.3–16.5 cm (x 11.2 cm) long, of length as long as the lamina, or near twice the length, brown or atrocastaneous, terete, laevigate, striate, adaxially sulcate, glabrescent, inconspicuous spreading scales. **LAMINAE:** 7.5–11.3 cm (x 9.42 cm) long, lanceate, ovate to triangular, bipinnate-pinnatifid to tripinnate-pinnatifid at the base, glabrous (except by reddish glands on abaxial side). Rachises adaxially sulcate and wings. Pinnae petiolulate (and wings). Adnate segment, lanceate, elliptic, lobed, segment margins revolute. Veinlets with broad apices, adaxially visible. Pseudoindusium broad, membranaceous, restricted to the segment, margins erose, lacinate. Sori discrete, sporangia with 64 spores (Fig. 14).

**Observations.** *Cheilanthes rufopunctata* is easily recognized by its mostly tripinnate-pinnatifid laminae with wings rachises, and abaxial surface of lamina with reddish glands. Its morphology resembles *C. marginata* Kunth, a species later included in the segregated genus *Gaga*, as *G. marginata* (Li et al. 2012); however, the latter has short creeping to erect rhizome and a pseudoindusium that extends to axes of the segment.

Affinities of *C. rufopunctata* have been proposed within the South American clade (Ponce & Scataglini 2022, Ponce et al. 2023). Ponce et al. (2023) proposed *C. volcanensis* de la Sota sister to *C. rufopunctata*, based on molecular studies. Morphologically, both species are similar, *C. volcanensis* can be differentiated by the few glandular hairs on the abaxial surface (vs. conspicuous reddish hairs in *C. rufopunctata*).

**Distribution and habitat.** *Cheilanthes rufopunctata* is known from Peru and Bolivia. In Peru, it occurs in Apu-



Figure 14. *Cheilanthes rufopunctata*: Specimen (USM).

rimac, Cusco, Huancavelica, Junin, Lima, and Puno, between 2400–3450 m a.s.l. It occupies rocky slopes.

**Examined specimens.** **Apurimac:** Hocking P. 7 (USM). **Cusco:** Soukup 29 (F, US); Vargas C. 4004 (CUZ, UC, US). **Huancavelica:** Tovar O. 316 (USM). **Junin:** Kunkel G. 4821/2 (GH). **Lima:** Acleto C. 45 (USM); Ferreyra R. s.n. (USM); Macbride J. 285 (F, GH, US); Muller G. 12474 (GH). **Puno:** Soukup J. 29 (UC); Vargas 29 (MO).

### *Cheilanthes scariosa* (Sw.) C. Presl

Reliq. Haenk. 1(1): 65. 1825.

*Acrostichum lanuginosum* Willd., nom. illeg., Schr. Acad. Erf.: 31, t.3, f.4, 1802, non Desf. 1800. Type: Peru, Malaspina Expedition (holotype B-W 19554010).

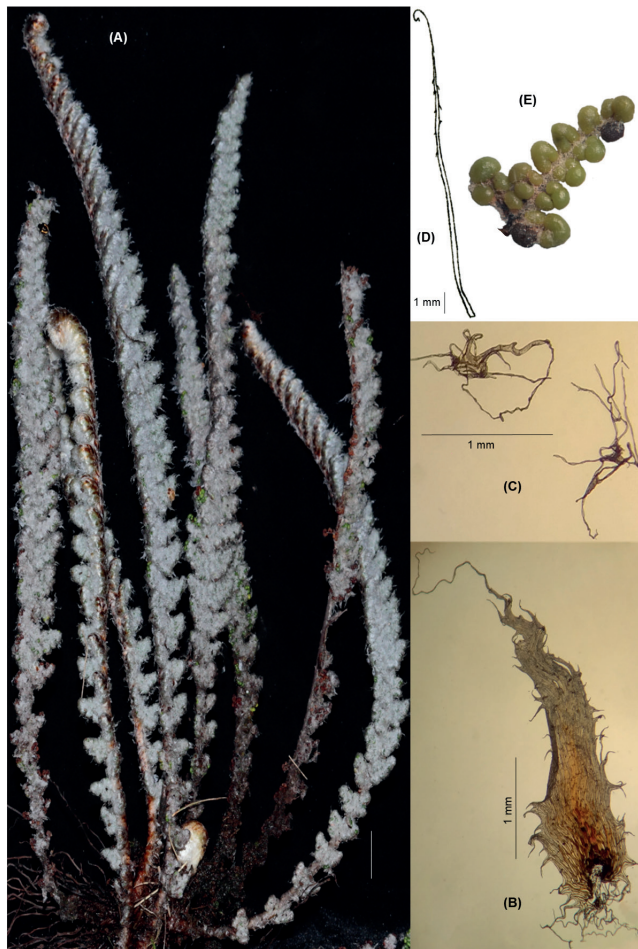
*Acrostichum scariosum* Sw., Syn. Fil. (Swartz) 16. 1806, nom. nov. for *A. lanuginosum* Willd.

*Cheilanthes ornatissima* Maxon, Smithsonian Misc. Coll. 65(8): 3. 1915. Type: Peru, Lima, mountains back of Lima, March 1892, W.E. Safford 996 (holotype US; isotypes F, GH-GH0002748, MO, UC, US).

*Cheilanthes tripinnata* Copel., Univ. Calif. Publ. Bot. 19: 301, t.58. 1941. Type: Peru, Dep. Apurimac, Chincheros to Andahuaylas, J. West 3724 (holotype UC).

**FRONDS:** 12–32.2 cm (x 21.24 cm) long. **RHIZOMES:** multicapital, short-creeping or erect, compact, scaly. Scales 5.8–19 mm (x 9.40 mm) × 0.05–0.8 mm (x 0.37 mm),

basifixed, castaneous, atrocastaneous, ferrugineous, linear-acicular, with slightly sinuate apices, margins toothed, inconspicuously uncinat. **PETIOLES:** 3.4–9 cm (x 5.98 cm) long,  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$  to  $\frac{1}{5}$  or sometimes of length as long as the lamina or  $\frac{2}{3}$  of the lamina length, terete, dark brown, striate or scabrous. Scales sub-basifixed or basifixed, variable shape, color (atrocastaneous or castaneous center and whitish margins), margins irregularly lacinate, apices cuneate caudate. Squamules ca. 5 cells in the central area, light castaneous, arachnoid-like, filamentous. **LAMINAE:** 9–26 cm (x 15.26 cm) long, linear or narrowly lanceolate, bi-or-tripinnate, scaly. Scales 2.3–5.5 mm (x 3.68 mm)  $\times$  0.6–2.0 mm (x 1.22 mm), imbricate, basifixed, or sub-basifixed along axes. Rachises striate, scabrous, indument of all lamina axes as their petioles. Pinnae petiolulate. Segment petiolulate, orbiculate or flabellate, margins revolute. Abaxial surface scales with reduced cell lumen, castaneous or greyish, lanceate, triangular, ovate or elliptic, apices caudate, acute, margins lacinate accompanied with long filaments extending to the adaxial surface, arachnoid-like, ca. 5 cells in the central area (called squamules). Pseudindusium not differentiated or sometimes hyaline. Sori discrete, sporangia with 32 spores (Fig. 15).



**Figure 15.** *Cheilanthes scariosa*: A. Habit, (PG 6012, USM); B, D. Scales of lamina and rhizome; C. Squamulae of lamina; E. Pinnae.

**Observations.** *Cheilanthes scariosa* can be recognized from other scaly species by its mostly orbiculate ultimate segment, laminar scales with margins lacinate accompanied with long filaments extending to the adaxial surface, arachnoid-like, ca. 5 cells in the central area (see in taxonomic key), and with reduced cell lumen. Together with other densely scaly Peruvian species, that include *C. arequipensis*, *C. incarum*, *C. lonchophylla* and *C. peruviana*, is recognized as members of the South American-Australasian clade (Ponce & Scataglini 2022).

**Distribution and habitat.** *Cheilanthes scariosa* is known from Peru and Bolivia. In Peru, it occurs in Ancash, Apurimac, Cusco, Huancavelica, Junin, La Libertad, Lima, Pasco and Puno, between 2450–4400 m a.s.l. It occupies calcareous rocky sites with Andean grasslands and high Andean shrublands and relict *Polylepis* forests ecosystems.

**Examined specimens.** **Ancash:** Cano A. 13222 (USM); Cerrate E. 2200, 12145 (USM); López A. 2388 (USM, HUT); Zósimo s.n. (HUT). **Apurimac:** Rivera S. 51, 52, 53, 54 (USM); Vargas 8792 (CUZ, UC). **Cusco:** Vargas C. 23239 (GH). **Huancavelica:** Tovar O. 113, 798, 2087 (USM). **Junin:** Cerrate E. 2909 (USM, HUT); Gentry A. 39760 (USM); Iltis H. 60, 117 (USM); Hodge W. s.n. (USM); Petersson U. s.n. (USM); Tryon R. 5457 (USM); Tvlls 804 (USM); Weberbauer A. 2531 (USM). **La Libertad:** Gonzáles P. 6012 (USM); López A. 3395 (HUT); Sagástegui A. 17344 (HUT). **Lima:** Goodspeed T. 11347 (GH, UC); Macbride J. 424 (F, US); Rauh W. 153, 1833 (USM); Rivera S. 23 (USM). **Pasco:** Baldeón S. 1444, 3853, 7517, 7532 (USM); Gentry A. 37495 (USM). **Puno:** Weberbauer A. 425 (B).

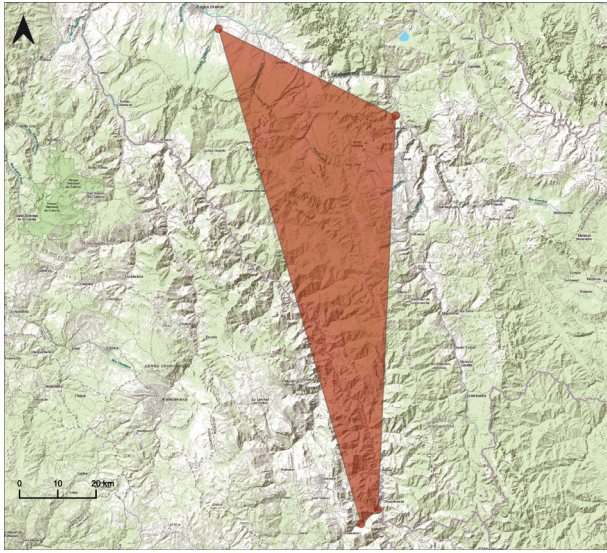
#### Conservation status of Peruvian endemic *Cheilanthes*

Levels of endemism among Peruvian ferns is lower compared to other vascular plants, however, there are important patterns, for example richness, as in the case of *Cheilanthes*, with 25% of its species (i.e., *C. cantangensis*, *C. fractifera*, *C. lonchophylla*, and *C. peruviana*) being restricted to Peru.

None of these species are listed by the IUCN, even though they were evaluated earlier by León (2006). Here we reassessed their conservation status following the IUCN criteria (version 3.1, 2012). The justification for the reevaluation is found in technical sheets developed per species (Appendix 1). Two species are considered Endangered (EN), and two of Least Concern (LC).

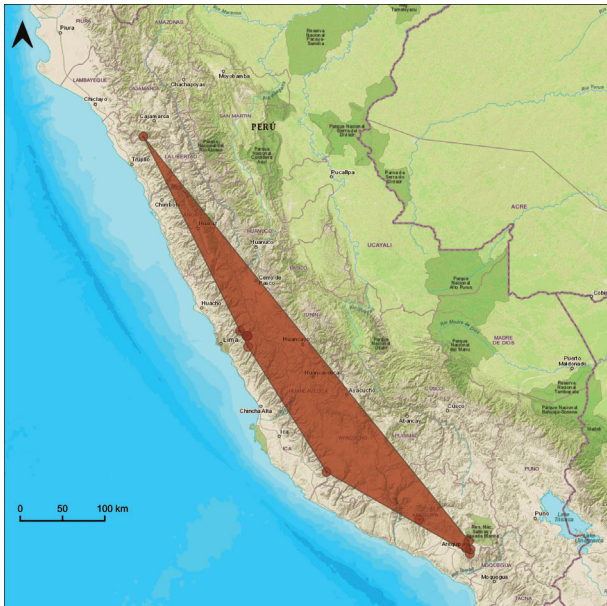
- *Cheilanthes cantangensis* is here proposed as Endangered (EN) B1ab(iii). It was previously categorized by León (2006) as Critically Endangered (CR), B1ab (iii) because at that point in time, it was known only from a single collection made in the 1960's. This terrestrial species is currently known from two localities in the Marañon and Utcubamba basins (Fig. 16). It occupies seasonally dry forests and scrub vegetation, in the departments of Cajamarca and Amazonas, and it might occur in other sites within its range.





**Figure 16.** Extent of occurrence (EOO) of *C. cantangensis* represented by an orange polygon.

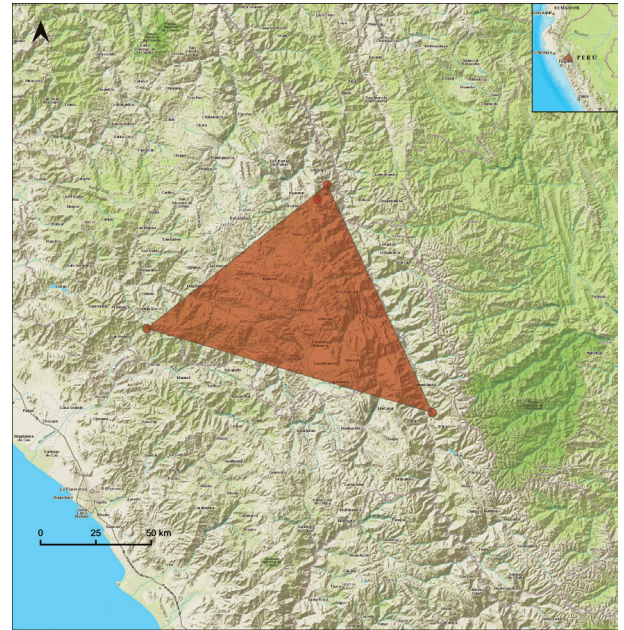
— *Cheilanthes fractifera* is proposed as of Least Concern (LC). It was previously categorized by León (2006) as Vulnerable (VU) B2ab(iii). This species occurs in dispersed and highly fragmented populations on the Pacific basin, from La Libertad to the north, Lima and Ayacucho in the center, to Arequipa in the south (Fig. 17). Possibly, the species occupies other areas within its range on the Pacific slopes. The type specimen was collected at 2200 m asl, 45 km from Nasca, on the road to Puquio, Ayacucho, in 1958, but unfortunately no additional records exist for this site.



**Figure 17.** Extent of occurrence (EOO) of *C. fractifera* represented by an orange polygon.

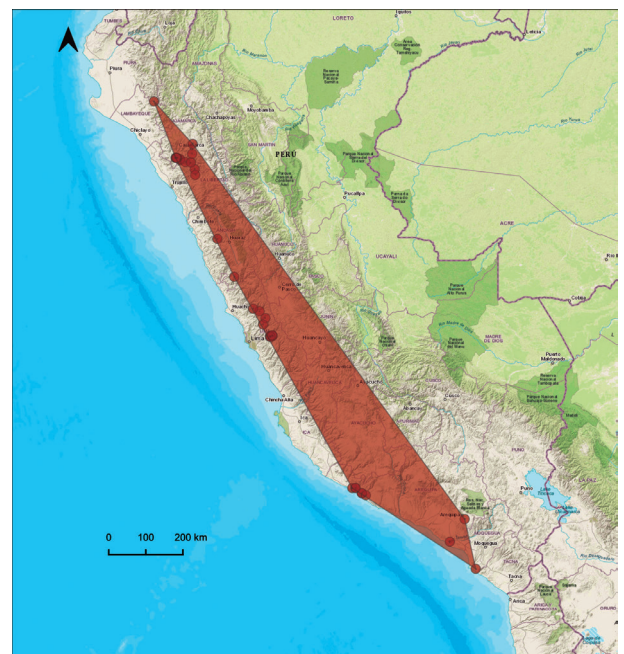
— *Cheilanthes lonchophylla* maintains the category of Endangered (EN) B1ab(iii) proposed by León (2006). Most records were made between the years 1960–1980, while a single collection was made in 2020. It is known from both sides of the

Andes, has disjunct localities on the Pacific slopes and seasonally dry valleys of the Marañón basin (Fig. 18). Specific threats are unknown.



**Figure 18.** Extent of occurrence (EOO) of *C. lonchophylla* represented by an orange polygon.

— *Cheilanthes peruviana* was categorized as of Least Concern (LC), a category also proposed by León (2006). It is known from several populations distributed in the western slopes of the Andes, and some interandean valleys in northern Peru, having a wide altitudinal range. It grows in “lomas” ecosystems, such as Atiquipa, Capac, Cachendo and Tacahuay (Fig. 19), also in western Andean forests, and dry scrubs. Despite occupying different habitats, the status of each population has not been evaluated.



**Figure 19.** Extent of occurrence (EOO) of *C. peruviana* represented by an orange polygon.



All four endemic species require further work to clarify conditions and population trends (i.e., size, biology, location, and threats), as it is also of their habitats. Only one species is represented within a protected area. The uses for these four species remain unknown.

For species not restricted to Peru, three of them (*C. incarum*, *C. scariosa* and *C. pruinata*) require attention on their conservation status, given that they are being extracted from natural populations and traded as medicinal in most cases. Some of these species are considered a substitute for *Erythroxylum coca* "coca" in Peru (Tryon 1959; Navarrete et al. 2006). *Cheilanthes incarum* and *C. scariosa* are morphologically similar and could be confused by their users. Both are known from Peru and Bolivia and possible impacts on the state of their populations are unknown. *Cheilanthes pruinata* "cuti cuti" is used in folk-medicine (Navarrete et al. 2006) and is extracted from wild populations and traded locally.

Recently, a photograph of an unconfirmed species of *Cheilanthes*, from Peru, is advertised as the "Amazon diabetic tea", a product sold online (<https://amazonriverte.com/the-tea/>), however, its attributes are those linked to *Argyroschisma nivea*. This case demonstrates the importance of accurate surveys, sound identifications, and evaluations on potential impacts on wild populations.

## Conclusions

The Peruvian species of *Cheilanthes* are important components of Andean ecosystems (Tryon 1964, Tryon and Stolze 1989, León and Valencia 1998, León et al. 1996, 2022), some extending to the flanks of the Amazon basin.

The fifteen species of *Cheilanthes* recognized here represent 31% of all species in the subfamily *Cheilanthesoidae* in Peru's flora. They are morphologically distinguishable; however, species limits are still a work in progress, especially when using only morphological characters in the frond, as lamina-petiole ratio, frond division, and indument density, as it has been discussed in other Andean fern floras (Ponce 2016, Kessler et al. 2017).

The type of indument shared by Peruvian *Cheilanthes* allow the distinction of three main groups that are not completely congruent with phylogenetic clades proposed by Ponce and Scataglini (2022). The first group includes simple or branched hairs or glabrous species, i.e., *C. mollis*, *C. fractifera*, *C. fraseri*, *C. rufopunctata*, *C. poeppigiana*, *C. pruinata*, *C. pilosa* and *C. andina*, all these species representing the South American clade; the second group have acaroid-like hairs or a combination of simple hairs plus scales in the frond, i.e., *C. obducta* and *C. cantangensis*; in the third group, there is a dominance of scales in one or both surfaces of the frond and linear-acicular rhizome scales, i.e., *C. scariosa*, *C. incarum*, *C. lonchophylla*, *C. arequipensis* and *C. peruviana*. These last two groups are members of the Australasian-South American clade in the new concept of *Cheilanthes*.

The genus *Cheilanthes* still requires additional observations for several morphological characters, such

reproductive expression (examined for two species of the Peruvian flora by Martínez et al. 2017), spore surface macro-ornamentation (not examined here) and venation patterns. The genus is known to present variable positions of the meristematic tissue in the gametophyte, that may inform phylogenetic affinities (as shown by George et al. 2019), a life stage rarely explored for Peruvian taxa.

This study documents that sampling of *Cheilanthes* species in Peru is still in deficit, as is poorly represented in Peruvian herbaria. For example, *C. pruinata*, a common species along the Andes has still not been recorded from Piura and Pasco, despite its presence in neighboring departments. For rare species, this shortfall of collections is accompanied by highly spaced collections in years, and highly dispersed known populations in climatic seasonal environments. A detailed survey of the pteridoflora, and particularly *Cheilanthes*, will be important for future assessment of threats and reevaluation of their conservation status.

For traded species, exploited from wild populations (Navarrete et al. 2006), detailed field evaluation of population size and locations are needed, as it was demonstrated for *Dicksonia* in Santa Catarina, Brazil (Gasper et al. 2011).

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The authors declare no conflict of interest.

**Rol de los autores / Authors Roles:**

SR: Conceptualización; Investigación; Administración de proyecto; Escritura-Preparación del borrador original.

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**Appendix 1.** Conservation assessment of Peruvian endemic *Cheilanthes*

PLANTAE - TRACHEOPHYTA - POLYPODIOPSIDA - POLYPODIALES – PTERIDACEAE

***Cheilanthes cantangensis* (R.M. Tryon) R.M. Tryon**

Red List Status
EN – Endangered, B1ab(iii) (IUCN version 3.1)

**Assessment Rationale**

*Cheilanthes cantangensis* is categorized as Endangered (EN) B1ab(iii). This terrestrial species is known from dispersed localities of the Marañón basin in north-eastern Peru. It is expected to occur in other sites within its range. This species occupies seasonally dry forests and scrubs, scarcely surveyed for ferns. It is not known from any protected area. The status of its populations requires further research.

**Distribution****Geographic Range**

Fern known from the departments of Cajamarca and Amazonas, in the Marañón basin, in the lower Utcubamba. The current area of occupancy (AOO) as measured with a 2x2 grid is 16 km<sup>2</sup>. The extent of occurrence (EOO) is 2,794 km<sup>2</sup> (Fig. 16).

**Elevation / Depth / Depth Zones**

Elevation Lower Limit (in meters above sea level): 500

Elevation Upper Limit (in meters above sea level): 1900

**Locations Information**

Number of Locations	Justification
4	These four sites include the type locality, plants collected 60 years ago. There are more recent collections from other three scattered localities in the Marañón basin, and its tributaries.

**Area of Occupancy (AOO)**

Estimated area of occupancy (AOO) in km <sup>2</sup>	Justification
16	-

**Extent of Occurrence (EOO)**

Estimated extent of occurrence (EOO) in km <sup>2</sup>	EOO estimate calculated from Minimum Convex Polygon	Justification
2,794.374	True	-

**Biogeographic Realms: Neotropical****Occurrence****Countries of Occurrence**

Country	Presence	Origin	Formerly Bred	Seasonality
Peru	Extant	Native	-	Resident

**Population**

This species occupies seasonally dry forests and scrubs, scarcely surveyed for ferns, thus contributing to the scarce information on its biology, features and size of its populations.

**Population Information**

Current Population Trend: Unknown.

**Habitats and Ecology**

Terrestrial fern that occupies rocky sites in dry forests and scrub vegetation in Marañón and Utcubamba basins.

**Continuing Decline in Habitat**

¿Continuing decline in area, extent and/or quality of habitat?	Qualifier	Justification
Yes	-	Although there is no detail evaluation, no additional plant records exist from known localities

**Systems: Terrestrial****Plant Specific**

Plant Growth Forms
Herb, 13–44.2 cm height

**Use and Trade****General Use and Trade Information**

Species not utilized: True

There is no known use or trade for this species.

**Threats**

It is suggested that among the threats to its populations are the extensions of land for agricultural or mining activities.

**Conservation**

This species is not found in any *ex-situ* collection. The species is not known to occur inside Peru's protected areas network.

**Conservation Actions In- Place**

Occur in at least one PA	Note
False	-
Percentage of population protected by Pas (0-100)	Note
-	-
Subject to ex-situ conservation	Note
False	-



## Important Conservation Actions Needed

Conservation Actions	Note
1.2. Land/water protection -> Resource & habitat protection	-

## Research Needed

Research	Note
1.1. Taxonomy	Evaluation of the gametophyte and spore morphology
1.2. Population size, distribution & trends	-
1.3. Life history & ecology	Study of apomictic and sexual populations
1.5. Threats	The status of populations is unknown
Monitoring	Note
3.1. Population trend	Unknown

PLANTAE - TRACHEOPHYTA - POLYPODIOPSIDA - POLYPODIALES – PTERIDACEAE

### *-Cheilanthes fractifera* R.M. Tryon

Red List Status
LC (IUCN version 3.1)

## Assessment Rationale

*Cheilanthes fractifera* is categorized as of Least Concern (LC). This terrestrial species is known from dispersed and fragmented populations from the departments of La Libertad, Lima, Ayacucho and Arequipa, all in the Pacific basin. The type locality, along the road Nasca-Puquio, Ayacucho was surveyed in 1958, but no additional records exist for this site. Possibly, the species occupy other areas of the Pacific slope. Habitats are being used for urban expansion and road projects. The species has been recorded in the Buffer Zone of the Salinas and Aguada Blanca National Reserve.

## Distribution

### Geographic Range

Herb found in the departments of La Libertad, Lima, Ayacucho and Arequipa on the Pacific basin. The current area of occupancy (AOO) as measured with a 2x2 grid is 40 km<sup>2</sup>. The extent of occurrence (EOO) is 115,082 km<sup>2</sup> (Fig. 17).

### Elevation / Depth / Depth Zones

Elevation Lower Limit (in meters above sea level): 1800

Elevation Upper Limit (in meters above sea level): 2600

### Locations Information

Number of Locations	Justification
10	All sites were counted including historical records over 60 years ago, except two records without detailed geographical data.

### Area of Occupancy (AOO)

Estimated area of occupancy (AOO) in km <sup>2</sup>	Justification
40	-

**Extent of Occurrence (EOO)**

Estimated extent of occurrence (EOO) in km <sup>2</sup>	EOO estimate calculated from Minimum Convex Polygon	Justification
115,082.3766	True	-

**Biogeographic Realms: Neotropical****Occurrence****Countries of Occurrence**

Country	Presence	Origin	Formerly Bred	Seasonality
Peru	Extant	Native	-	Resident

**Population**

There is a lack of detailed information on population size. Five of the ten locations correspond to records made in the 1950's and 1960's.

**Population Information**

Current Population Trend: Unknown

**Habitats and Ecology**

The species occupy scrub, on exposed and rocky slopes.

**Continuing Decline in Habitat**

¿Continuing decline in area, extent and/or quality of habitat?	Qualifier	Justification
Yes	-	Extensions of the human population towards the habitat of the species, installation of investment projects, and impact of agricultural activity

**Systems: Terrestrial****Plant Specific**

Plant Growth Forms
Herb, 7.5–15 cm height

**Use and Trade****General Use and Trade Information**

Species not utilized: True

There is no known use or trade for this species.

**Threats**

Habitat destruction, and land use changes.

**Conservation**

*Cheilanthes fractifera* occurs in the Buffer Zone of the Salinas and Aguada Blanca National Reserve. This species is not found in any *ex-situ* collection.

**Conservation Actions In- Place**

Occur in at least one PA	Note
False	-
Percentage of population protected by Pas (0-100)	Note
< 1%	Inside Buffer Zone of PA



Subject to ex-situ conservation	Note
False	-

### Important Conservation Actions Needed

Conservation Actions	Note
1.2. Land/water protection -> Resource & habitat protection	-

### Research Needed

Research	Note
1.1. Taxonomy	Evaluation of the gametophyte and spore morphology
1.2. Population size, distribution & trends	-
1.3. Life history & ecology	Study of apomictic and sexual populations
1.5. Threats	The status of populations is unknown
Monitoring	Note
3.1. Population trend	Unknown

PLANTAE - TRACHEOPHYTA - POLYPODIOPSIDA - POLYPODIALES – PTERIDACEAE

*-Cheilanthes lonchophylla* (Weath. ex R.M. Tryon) R.M. Tryon & A.F. Tryon

Red List Status
EN – Endangered, B1ab (IUCN version 3.1)

### Assessment Rationale

*Cheilanthes lonchophylla* is categorized as Endangered (EN) B1ab (iii). This terrestrial species is known from disjunct populations on the Pacific slopes and in the Marañón basin in a very narrow altitudinal range. Most of the records made for this species correspond to the 1960's and 1980's, only a single plant specimen was made in 2020. The status of its populations and ecology are still unknown, studies are needed to understand and assess threats. The species occurs in the western side of the Buffer Zone of Rio Abiseo National Park.

### Distribution

#### Geographic Range

Fern known from two departments, La Libertad and Cajamarca. It has disjunct populations, one in the Pacific slopes and the other in the Marañón basin. The current area of occupancy (AOO) as measured with a 2x2 grid is 16 km<sup>2</sup>. The extent of occurrence (EOO) is 5,787 km<sup>2</sup> (Fig. 18).

#### Elevation / Depth / Depth Zones

Elevation Lower Limit (in meters above sea level): 2200

Elevation Upper Limit (in meters above sea level): 2950

#### Locations Information

Number of Locations	Justification
4	This species is known from six plant records, two are of historical importance but without detailed geographical data

#### Area of Occupancy (AOO)

Estimated area of occupancy (AOO) in km <sup>2</sup>	Justification
16	-

**Extent of Occurrence (EOO)**

Estimated extent of occurrence (EOO) in km <sup>2</sup>	EOO estimate calculated from Minimum Convex Polygon	Justification
5,787.526	True	-

**Biogeographic Realms: Neotropical****Occurrence****Countries of Occurrence**

Country	Presence	Origin	Formerly Bred	Seasonality
Peru	Extant	Native	-	Resident

**Population**

The populations of this species are poorly known.

**Population Information**

Current Population Trend: Unknown

**Habitats and Ecology**

Terrestrial fern inhabiting rocky sites associated to seasonally dry tropical forest.

**Continuing Decline in Habitat**

¿Continuing decline in area, extent and/or quality of habitat?	Qualifier	Justification
Yes	-	Areas of uses for agricultural or mining activities

**Systems:** Terrestrial

**Plant Specific**

Plant Growth Forms
Herb, 19.4–27 cm height

**Use and Trade****General Use and Trade Information**

Species not utilized: True

There is no known use or trade for this species.

**Threats**

We infer that among threats to this species are the multiple uses of its habitats for agricultural and mining activities.

**Conservation**

This species is not found in any *ex-situ* collection. The species occurs in the Buffer Zone of Rio Abiseo National Park.

**Conservation Actions In- Place**

Occur in at least one PA	Note
False	-
Percentage of population protected by Pas (0-100)	Note
< 1%	Inside Buffer Zone of PA
Subject to ex-situ conservation	Note
False	-



## Important Conservation Actions Needed

Conservation Actions	Note
1.2. Land/water protection -> Resource & habitat protection	-

## Research Needed

Research	Note
1.1. Taxonomy	Evaluation of the gametophyte and spore morphology
1.2. Population size, distribution & trends	-
1.3. Life history & ecology	Study of apomictic and sexual populations
1.5. Threats	The status of populations is unknown
Monitoring	Note
3.1. Population trend	Unknown

PLANTAE - TRACHEOPHYTA - POLYPODIOPSIDA - POLYPODIALES – PTERIDACEAE

-*Cheilanthes peruviana* (Desv.) T. Moore

Red List Status
LC (IUCN version 3.1)

## Assessment Rationale

*Cheilanthes peruviana* is categorized as of Least Concern (LC). It is a terrestrial fern known from several localities along the Pacific basin in a wide altitudinal range. However, knowledge of the features and current state of its populations is still lacking. *Cheilanthes peruviana* occurs in a single protected site, the Protected Natural Area Coto de Caza Suchubamba.

## Distribution

### Geographic Range

Terrestrial fern found in the departments of Lambayeque, La Libertad, Cajamarca, Ancash, Lima, Arequipa, and Moquegua. All known localities are in the western slopes of the Pacific basin, from the fragile ecosystems of “Lomas” in southern Peru, extending to Andean ecosystems. The current area of occupancy (AOO) as measured with a 2x2 grid is 92 km<sup>2</sup>. The extent of occurrence (EOO) is 193,225 km<sup>2</sup> (Fig. 19).

### Elevation / Depth / Depth Zones

Elevation Lower Limit (in meters above sea level): 400

Elevation Upper Limit (in meters above sea level): 3900

### Locations Information

Number of Locations	Justification
23	Widely distributed and recorded.

### Area of Occupancy (AOO)

Estimated area of occupancy (AOO) in km <sup>2</sup>	Justification
92	-

### Extent of Occurrence (EOO)

Estimated extent of occurrence (EOO) in km <sup>2</sup>	EOO estimate calculated from Minimum Convex Polygon	Justification
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193,225.585

True

-

**Biogeographic Realms: Neotropical****Occurrence****Countries of Occurrence**

Country	Presence	Origin	Formerly Bred	Seasonality
Peru	Extant	Native	-	Resident

**Population**

The status of populations are unknown.

**Population Information**

Current Population Trend: Unknown

**Habitats and Ecology**

Grows in rocky slopes, in ravines, and shrublands associated to “lomas” and relict Andean forests ecosystems.

**Continuing Decline in Habitat**

¿Continuing decline in area, extent and/or quality of habitat?	Qualifier	Justification
Yes	-	Expansion of human population towards the habitat of the species, installation of investment projects, and impact of agricultural activity

**Systems: Terrestrial****Plant Specific**

Plant Growth Forms
Herb, 7.8–29.9(–31.3) cm height

**Use and Trade****General Use and Trade Information**

Species not utilized: True

There is no known use or trade for this species.

**Threats**

Habitat destruction, and land use changes.

**Conservation**

Some populations have been recorded in two protected sites, the Protected Natural Area Coto de Caza Suchubamba between Cajamarca and La Libertad, and the Private Conservation Area of Lomas de Atiquipa in Arequipa. Also, in fragile ecosystems of Lomas of Capac, Cachendo and Tacahuay in the south of Peru. This species is not found in any *ex-situ* collection.

**Conservation Actions In- Place**

Occur in at least one PA	Note
True	-
Percentage of population protected by Pas (0-100)	Note
< 1%	Protected Area Coto de Caza Suchubamba

Subject to ex-situ conservation	Note
False	-

### Important Conservation Actions Needed

Conservation Actions	Note
1.2. Land/water protection -> Resource & habitat protection	-

### Research Needed

Research	Note
1.1. Taxonomy	Evaluation of the gametophyte and spore morphology
1.2. Population size, distribution & trends	-
1.3. Life history & ecology	Study of apomictic and sexual populations
1.5. Threats	The status of populations is unknown
Monitoring	Note
3.1. Population trend	Unknown