THE ARGENTINE SPECIES OF « NOTHOLAENA »

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RESUMEN

Las especies argentinas de « Notholaena ». — El autor realiza un estudio taxonómico dando una clave y descripciones de las seis especies del género *Notholaena* que habitan Argentina : *N. sinuata* (Lag.) Kaulf., *N. aurea* (Poir.) Desv., *N. Buchtienii* Rosenst., *N. obducta* (Mett. ex Kuhn) Baker, *N. squamosa* (Gill. ex Hook. et Grev.) Lowe, y *N. arequipensis* (Maxon) y describe una especie nueva del Paraguay : *N. Hassleri.*

Through the courtesy of the officers in charge, I have had the privilege of examining the specimens of *Notholaena* in several of the great herbaria in Europe as well as in the United States. In the course of this study I have seen the types, or authentic material, of most of the American species. The data thus gathered are here presented, in so far as they apply to the Argentine species, in the hope that they may help to clarify the taxonomy and nomenclature of the groups concerned.

Although Robert Brown [1] distinguished *Notholaena* primarily by the absence of an indusium and remarked that the species he referred to it were related, respectively, to *Acrostichum, Pteris* and *Cheilanthes,* with a single exception they actually formed a related group, alike in their more or less elongate sori and differing from *Cheilanthes* in this feature, from the gymnogrammoid ferns in various characters of habit and in the more

[1] *Prodromus Fl. Novae Hollandiae,* 145 (1810). « Sori marginales continui vel interrupti. *Involucrum* nullum (nisi setae interstinctae v. squamulae lanave frondis). »

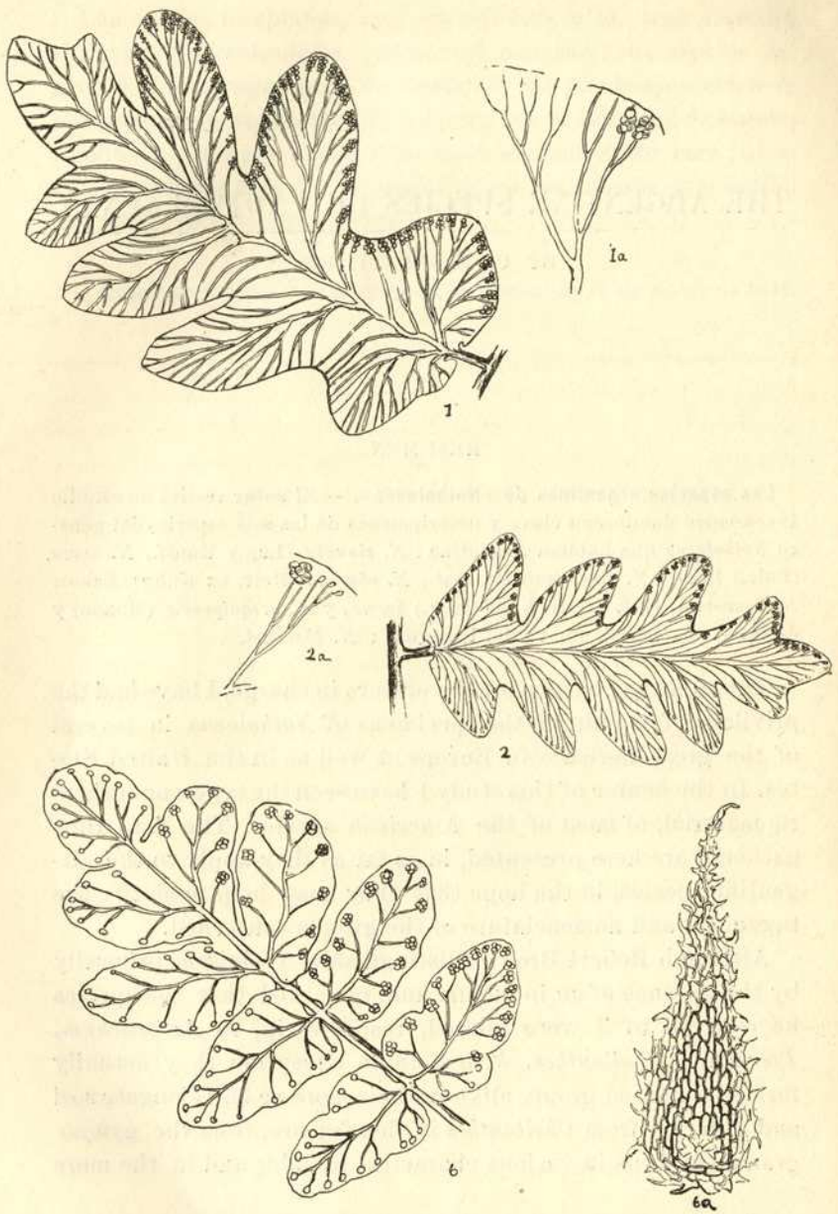


Fig. 1. — 1, pinna of *Notholaena sinuata*, × 2,5 ; 1ª, vein-ends and sori, × 5 ; drawn from Hartman 130, from Sonora, México ; 2, pinna of *N. aurea*, × 2,5 ; 2ª, vein-ends and sori, × 5 ; from Mexia 8055 *b*, Cuzco, Perú ; 6, pinna of *N. arequipensis*, × 2,5 ; 6ª, scale, × 10 ; from Pennell 13198, Arequipa, Perú. (All drawings of venation and sori were made from specimens cleared with potassium hydroxide or xylol, from which scales or hairs and some of the sporangia had been removed.)

nearly apical position of the sori on the veins, and from *Pellaea* in habit and in their vestiture of scales or hairs. To this homogeneous assembly Brown himself added the quite unrelated *N. trichomanoides* (L.) Desv.[1] and accretions by later authors have been so various that *Notholaena,* as at present usually delimited, is a wholly unnatural agglomeration, held together, as Baker long ago remarked[2], only by the absence, or slight development, of a modified, hyaline leaf-margin serving as an indusium.

Various authors, at least as far back as Colla[3], have called attention to the unnatural character of the aggregate. Mettenius[4] reduced the genus altogether, placing the species with elongate sori in *Gymnogramma* (as then treated, a widely inclusive group) and those with round sori in *Cheilanthes.* Domin[5], less critical, referred the species indiscriminately to *Cheilanthes,* even those like *N. marantae* and *N. sinuata* which have very definitely noncheilanthoid sori.

Neither of these dispositions is satisfactory, though that of Mettenius may well indicate at least possible relationships. A really natural arrangement of the species cannot be achieved without detailed comparative study of related groups among the cheilanthoid, and very likely also certain gymnogrammoid, genera. Such a study I had begun in Europe in 1939, only to be interrupted by the war. Until it can be completed, the best course seems to be to leave the species concerned in their conventional position under *Notholaena,* rather than to attempt a rearrangement which is likely to be premature and of no permanent value.

[1] This combination has usually been credited to Robert Brown. He, however, merely stated, under *Notholaena*, « huc... pertinent *Acrostichum Marantae, Pteris trichomanoides L.* » and did not actually make the transfer. The combination seems to have been first definitely made by Desvaux, *Journ. Bot. Appliquée,* I, 92 (1813).

[2] *Synopsis Filicum,* 370 (1868).

[3] « Plantae rariores in regionibus chilensibus a... Bertero... detectae » in *Mem. Accad. Sci. Torino,* XXXIX, 46 (1836).

[4] *Einige Farngattungen.* V. *Cheilanthes,* pp. 5 ff. (1859).

[5] In *Bibliotheca Botanica,* XX, 133 (1915).

The six Argentine species fall, however, into three more or less clearly recognizable groups. *N. sinuata* represents the first group. In it, the lamina is pinnate-pinnatifid, the indument is paleaceous, the costules leave the costae at an acute angle and bend outward rather gradually, the sori are elongate and borne on the outer portions of unthickened veinlets, and the spores are strongly rugose. This is section *Eunotholaena,* sensu stricto. The second group comprises *N. aurea* and *N. Buchtienii.* In it, the lamina is chiefly pinnate-pinnatifid and the venation is similar to that of the first group, but the indument is of simple hairs, the sori are short (nearly or quite round) and borne on the clavate or flabellate-thickened vein-ends, and the spores are only minutely roughened. The third group includes *N. squamosa, N. arequipensis* and I think *N. obducta.* In it, the lamina is definitely bipinnate, the indument is of scales, or in *N. obducta,* of peculiar compound trichomes, the veins are fewer and the costules leave the costae at a wide angle or are abruptly bent outward, the sori are short and apical on the veins as in group 2, but the soriferous vein-ends are abruptly dilated laterally (like the head of a pin), in *N. arequipensis* sometimes so extended as to connect adjacent vein-ends with a band of sporangiferous vascular tissue, and the spores are slightly roughened.

The above definitions are drawn up wholly from Argentine material; some of the characters used would undoubtedly break down if more species were included. The Paraguayan *N. Hassleri,* for instance, proposed in this paper, agrees with *N. sinuata* in elongate, unthickened veins, paleaceous indument and rugose spores, but is bipinnate-pinnatifid. But the characters of soral structure, venation, spores and, in a lesser degree, indument appear to be genuinely significant.

It should be emphasized that the sori of *Cheilanthes* and *Notholaena* are, except for occasional aberrant instances like those in *N. arequipensis* mentioned above, discrete, not continuous along the margin, as they have been sometimes described. They are merely contiguous, the sporangia of adjacent sori touching one another at maturity.

Geographically, the Argentine species also fall into three groups. *N. sinuata* and *N. aurea* range from the southwestern

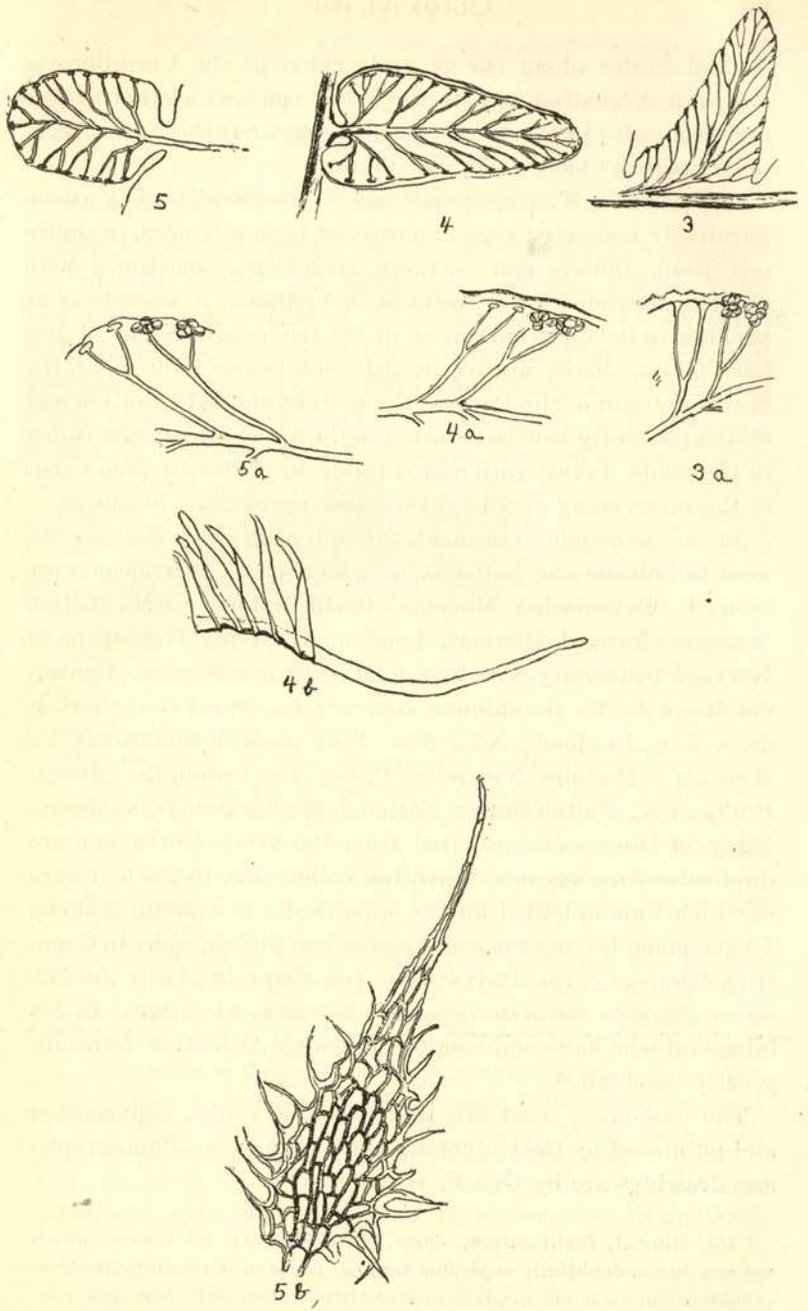


Fig. 2. — 3, ultimate segment of *N. Buchtienii,* × 3; 3ª, vein-ends and sori, × 6; from A. G. Schulz 970, Salta, Argentina; 4, pinnule of *N. obducta,* × 3; 4ª, vein-ends and sori, × 6; 4*b*, trichome, × 40; from Venturi 1871, Tucumán, Argentina; 5, terminal pinnule of *N. squamosa,* × 3; 5*a*, vein-ends and sori, × 6; 5*b*, scale. × 12; from Fiebrig 3122, Tarija, Bolivia.

United States along the general region of the Cordillera to northern Argentina and (in the latter species) northern Chile and occur also in the West Indies. *Pellaea ternifolia* and *Asplenium resiliens* [1] have a like distribution.

N. squamosa, N. arequipensis and *N. Buchtienii* occupy a comparatively restricted region, mostly at high altitudes, in southern Perú, Bolivia and northern Argentina, sometimes with outlying stations in the Sierra de la Ventana. *N. obducta* is as peculiar in its distribution as in its trichomes. So far, it has been found, almost always at altitudes below 1000 m, in the drainage-basin of the Paraná, the eastern slopes of Bolivia and at an apparently isolated station in the upper Magdalena valley in Colombia. Investigation at suitable localities (if such exist) in the intervening area might disclose connecting localities.

In the taxonomic treatment, the following abbreviations are used to indicate the herbaria in which cited specimens were seen: B., Botanisches Museum, Berlin-Dahlem; BM., British Muséum (Natural History), London; G., Gray Herbarium of Harvard University, Cambridge, Massachusetts; Gen., Conservatoire et Jardin Botaniques, Genève; K., Royal Botanic Gardens, Kew, England; NY., New York Botanical Garden; P., Muséum d'Histoire Naturelle, Paris; Pr. Národního Musea, Praha; US., United States National Herbarium, Washington. Many of the specimens cited from the Gray Herbarium are duplicates from various Argentine collections, to the curators of which I am indebted for the opportunity of examining them. I have made frequent use of the excellent bibliography in Capurro's *Catalogo de las Pteridofitas Argentinas* in *Anais da Primeira Reunião Sul-Americana de Botanica,* II (1940). To his labors all who have occasion to work with Argentine ferns are greatly indebted.

The base-maps used are from Goode's series, copyrighted and published by the University of Chicago Press. Photographs and drawings are by Una F. Weatherby.

[1] Including *A. Lealii* Alston, *Journ. Bot.* LXXVII, 20 (1940), which appears to me doubtfully separable from *A. resiliens.* Certainly, its geographic isolation is not so great as Mr. Alston supposed; there are connecting stations, in Ecuador and Perú, between Guatemala and Argentina.

NOTHOLAENA R. Br.

Brown, R., *Prodromus Fl. Novae-Hollandiae,* 145 (1810).

Stipes with castaneous, sclerotic cortical layer. Blade without, or with narrow and rudimentary, hyaline margin. Veins free. Sori linear or oblong and borne on the outer portion of unthickened veins, or round and borne on dilated vein-ends, discrete (though often appearing to form a continuous marginal band). Sporangia short-stalked. Mostly small, rock-inhabiting ferns with short, horizontal rhizomes, the fronds rarely more than a few decimeters in heigt. *Cincinalis* « Gled. » sensu Desv. *Berlin Magazin,* v. 311 (1811), verisimiliter non Gleditsch (1764). *Cosentinia* Todaro, *Syn. Pl. Acot. Vasc. Sicilia,* 14 (1866). Spp. *Cheilanthis* et *Pellaeae* auctt.

ARTIFICIAL KEY TO THE ARGENTINE SPECIES

a. Indument principally of scales.

b. Blade linear or linear-oblong, much longer than stipe, pinnate, with numerous (12 or more pairs) of merely lobed pinnae; sori oblong, on the outer third of unthickened veins; spores rugose. 1. *N. sinuata*

b'. Blade broadly ovate to elliptic, bipinnate, with few pinnae (5-8 pairs), about equalling stipe; sori round, borne on the abrutly dilated vein-ends; spores with low, broad, rounded tubercles.

c. Scales of the upper surface of the blade lance-subulate, flat, soon deciduous, those of the lower surface erose-serrulate with relatively short, mostly deltoid teeth; scales of the rhizome minutely serrulate. 6. *N. arequipensis*

c'. Scales of the upper surface of the blade piliform, usually persistent, those of the lower surface pectinate-serrulate with relatively long, often piliform (though broad-based) teeth; scales of the rhizome remotely antrorse-serrulate. 5. *N. squamosa*

a'. Indument principally of hairs; sori round, borne on thickened vein-ends; spores minutely granular — or tuberculate — roughened.

d. Blade fully bipinnate; indument of lower surface of coarse, nearly straight, subappressed, compound trichomes; vein-ends abruptly dilated. 4. *N. obducta*

d'. Blade pinnate-pinnatifid, bipinnate, if at all, only near base; indu-

ment of lower surface of fine, matted, crisped, simple hairs; vein-ends clavate or flabellate.

e. Blade not, or scarcely narrowed at base ; upper surface thinly tomentose with fine, dull, matted or arachnoid hairs or glabrate ; rhizome slender, horizontal. 3. *N. Buchtienii*

e'. Blade narrowed at base ; upper surface persistently covered with relatively coarse, lustrous, white or golden hairs not strongly matted or arachnoid ; rhizome short, ascending, knotted. 2. *N. aurea*

1. **Notholaena sinuata** (Lag.) Kaulf.

Kaulf., *Enum. Fil.* 135 (1824) ; C. Chr. *Index Filicum,* 462 (1906) ; Hicken, *Cat.* 255 (1908).

Acrostichum sinuatum Lag. ex Sw. *Syn. Fil.* 14 (1806).

Diagnosis originalis : « frondibus pinnatis ensiformibus pinnis ovatis semipinnatifidis coriaceis, subtus imbricato-squamosis... Peruvia ». Type presumably in Naturhistorika Riksmuseet, Stockholm ; not seen, but identity not doubtful.

N. Tectaria Desv. in *Mém. Soc. Linéenne Paris,* VI, 219 (1827). Peru. Type at Paris ; seen.

Gymnogramma sinuata (Lag.) Presl, *Tent. Pterid.* 219 (1836) ; Mett. *Cheilanthes,* 6 (1859).

N. laevis Mart. et Gal. in *Mém. Acad. Bruxelles,* XV, 46 (1842). Type, *Galeotti* 6350, in herb. Jardin Bot. de l'Etat, Brussels ; seen. Presumably because of the statement that the pinnae were only slightly lobed, Martens and Galeotti's name was interpreted by Liebmann and Hooker as applying to the Mexican form of *N. sinuata* with entire pinnae. The type, however, consists of three small, old fronds, with the scales weathered off the upper surface and the pinnae quite as deeply lobed as is usual in dwarfed individuals.

N. sinuata, var. *integra* Liebmann in *Vid. Selsk. Skr.* (Mexicos Bregner), V, 213 (seors. 61) (1849). Based on *N. laevis* Mart. et Gal.

N. sinuata var. *laevis* (Mart. et Gal.) Hook. in *Bot. Mag.* LXXIX sub t. 4599 (1853), as to name, not as to plant illustrated.

N. deltoidea Baker, *Syn. Fil.* ed. 2, 514 (1874). Mexico, Leybold. Type at Kew ; seen. The specimen is a juvenile state of *N. sinuata.*

Cheilanthes sinuata (Lag.) Domin in *Bibl. Bot. (Beiträge zur Flora Australiens),* LXXXV, 133 (1915).

Rhizome short, horizontal, 3-5 mm thick, densely clothed with castaneous, linear or linear-subulate, soft, more or less

serrulate scales, composed of elongate cells with very narrow lumina ; fronds closely approximate but not truly cespitose, up

Map. 1. — Range of *Notholaena sinuata* (Lag.) Kaulf

to 4,5 dm tall ; stipe stout, terete, at maturity usually less than 1/4 lengt of blade, with two flattened vascular budles, castaneous, densely and usually persistently cloted with linear, whitish, strongly pectinate scales ; blade linear, pinnate-pinnatifid ; pinnae numerous, 12 or more pairs, short-petiolulate, broadly

oblong to deltoid-ovate, obtuse, up to 2 cm long and 1 cm broad, cut about halfway to the costa into 3-5 pairs of deltoid to oblong, obtuse, entire lobes; the upper surface sparsely beset with narrow, whitish, very strongly pectinate scales like those of the stipe (sometimes reduced to stellate processes), or glabrate; lower surface thickly covered with castaneous or pale brown, imbricate, deltoid to lanceolate, acuminate, short-fimbriate scales composed of elongate cells, overlying a dense tomentum of smaller scales dissected into long, capillary segments; rachis similarly scaly; veins 1-2-forked, leaving costa and forking at acute angles; spores triplanate, about 75μ in diameter, coarsely and irregularly rugose with dark, tortuous, scarcely reticulate ridges.

Illustration : Kunze, *Farnkräuter,* I. t. 45 : my figs. 1, a.

Crevices of cliffs, rocky banks and hillsides, apparently preferring limestone, but recorded also from sandstone, lava and granite, Oklahoma to Arizona in the southwestern United States, south along the Cordillera to northern Argentina; Haití, Venezuela. Map. 1.

Argentine specimens seen. — Jujuy : Maimará, Hualchin, 3000 m, 20-I-1912, Budin, (G., 1703 LIL.). Salta: Salta, Hieronymus et Lorentz 195 (B.). Tucumán : Tucumán, Lorentz 217 (B.), 218 (B., US.); Barranca Colorada, Capital, 550 m, 4-VII-1920, Venturi 838 (G., 16999 LIL.); Vipos, Trancas, 25-III-1908, Lillo, 7940 (G., 16997 LIL.). Catamarca : El Potrero, Ambato, El Potrero, 1200 m, Castillon (G., P., 16998 LIL.).

A well-known species which is rather variable, especially in scale-characters, but, except at the northern extremity of its range, has not produced any clearly distinguishable segregates.

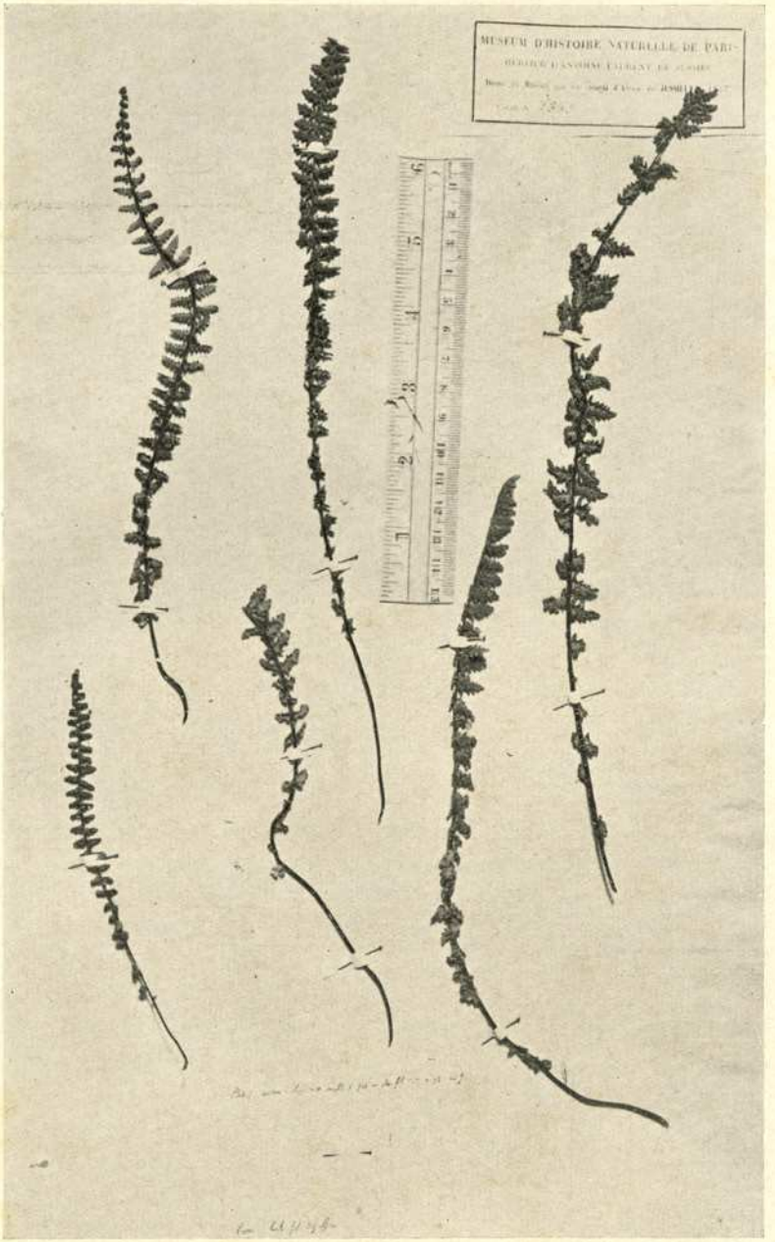
2. **Notholaena aurea** (Poir.) Desv.

Desv., in *Mém. Soc. Linn. Paris,* VI. 219 (1827); Weatherby in *Contrib. Gray Herb.* CXXIV. 21 (1939).

Pteris aurea Poir. *Encycl. Méth.* V. 710.

Diagn. orig. : Pteris fronde pinnata; pinnis brevibus, ovatis, crenatis, subtus tomentosis, cinereis, supra pubescenti-luteis. (N).

Cette plante a des pétioles grêles, anguleux, pubescens, particulièrement sur leurs angles, d'un brun noir, longs de huit à dix



Type of *Pteris aurea* Poir., sheet nº 1333 in herb. Jussieu, Mus. Paris

pouces, supportant une feuille lancéolée, retrécie à ses deux extremités, une fois ailée, composée de pinnules très rapprochées, presqu'opposées, ovales, obtuses, longues de deux à quatre lignes, chargées en dessous de poils tomenteux, grisatres, cendrés, et à leur face supérieure d'un duvet pubescent, jaune, presque doré ; crénelées plus ou moins profondement à leurs bords ; les crénulures arrondies, un peu roulées en dedans ; les deux inférieures un peu plus alongées, et en forme d'oreilletes. Je n'ai pu y découvrir de fructification ; ce qui rend douteux le genre de cette plante. Elle a été reccueillie au Pérou par Joseph de Jussieu *(V. s. in herb.* Jussieu). Type, sheet n° 1333 in herb. Jussieu at Paris ; seen Plate I.

Acrostichum bonariense Willd. *Sp. Pl.*V. 114 (1810). « Habitat in Bonaria ». Type at Berlin ; seen.

Cheilantes ferruginea Willd. ex Link, *Enum. Pl. Berol.* II. 463 (1822). « Habitat in America meridionali ». Type at Berlin ; seen. Not *Notholaena ferruginea* Desv., which is *N. trichomanoides* (L.) Desv.

Notholaena rufa Presl, *Rel. Haenk.* I. 19 (1825), nomen illegitimum. México. Type at Praha ; seen.

Notholaena ferruginea (Willd.) Hook., *Second Century Ferns* sub t. 52 (1861) ; not Desv. (1827).

N. bonariensis (Willd.) C. Chr., *Ind. Fil.* 6 (1905), 459 (1906) ; Hicken, *Cat.* 255.

N. chiapensis Rovirosa, *Pteridographia Mex.* 229, t. 48, fig. 1-6 (1909). Type from Chiapas, México, Rovirosa 1077, location unknown ; isotype, G. The specimen is a much stunted individual of *N. aurea.*

Illustrations : Hooker, *Second Century Ferns,* t. 52 ; D. C. Eaton, *Ferns North America,* I. t. 39 ; my figs. 2, 2*a.*

Rhizome short-repent, its scales lance-linear, with shining, castaneous, sclerotic central band and narrow or relatively broad, pale brown, entire, hyaline margin ; stipe 1/3 as long as blade or less, terete, castaneous or blackish, with a single, V-shaped vascular bundle, clothed, as is the rachis, with coarse, straightish, subappressed, whitish, septate hairs ; blade linear-elliptic, long-attenuate at base, pinnate-pinnatifid almost to the gradually or abruptly narrowed obtusish apex ; pinnae numerous (up to 40 pairs), oblong or deltoid-oblong, obtuse or acutish, cut 1/2-3/4 to the costa into oblong or linear-oblong, entire, obtuse lobes ; upper surface rather sparsely clothed with straightish, rather coarse, whitish or golden-tinged pluri-

cellular hairs; lower surface covered with dense tawny tomentum (white when young) of fine, matted hairs; veins oblique, 1-2-forked; leaf-tissue produced beyond the marginal sori into a very narrow, subhyaline, entire band, 3-4 cells wide; spores spherical, yellowish brown, minutely granular-roughened, about 70 μ in diameter.

Ledges and rocky slopes, in both moist and dry places, southwestern United States, West Indies, and through the Andean region to northern Chile and northern Argentina.

Argentine specimens seen. Jujuy: 1892, Kuntze (B., P.); Estancia San Teodoro, Río Primero, 1901, Stuckert (P.); Jujuy, barrancas pedregosas, 19-II-1931, Parodi 9794 (G.); entre las peñas, Tilcara, 3000 m, 18-II-1927, Venturi 7397 (US.); Cerro de Soledad, 3000 m, 24-I-1928, Venturi 9006 (US.). Salta: los potreros al pie del Nevado del Castillo, 18-III-1873, Lorentz et Hieronymus 160 (B., P.), 849 (B.), Salta, III-1873, 158 (B., US.); bajo una peña, Cerro de Cachi, San Carlos, 3500 m, 11-IV-1927, Venturi 6838 (US.); en una barranca, Alemanía, Guachipas, 20-XII-1929, Venturi 9984 (G.); Peñas Blancas, Sierra del Cajón, 4040 m, 26-III-1914, Rodríguez 1433 (G.). Tucumán: prairie alpine, 1080 m, Villa Nougués, 16-VII-1911, Castillon (P.); Cumbre de Taficillo, 2000 m, 19-IV-1930, Venturi, 10422 (G.); Tafí, Valle de Tafí, El Pelado, 2080 m, 5-XII-1912, Castillon 33 (16922 LIL.); La Cueva, IV, 1912, Rodríguez 547 (G., 1955 LIL.); Tafí, el Molle, 2740 m, 20-XII-1912, Castillon 38, 20-XII-1912 (16921 LIL.); entre las peñas, 2400 m, II *a* Cuesta, Tucumán, 21-IV-1926, Venturi 4190 (G., US. 16928 LIL.); en los murallones, Pueblo Viejo, 4000 m (Chicligasta), 12-II-1925, Venturi 6456 (US); cumbre de un cerro entre piedras, Villa Nougués, Tafí, 1200 m, 12-I-1922, Venturi 1719 (US., 16927 LIL.); Tafí, Siambón 1200 m, 26-XI-1888, Lillo 1043 (G., 16929 LIL.); Tafí: Bajo de Anfama, 1600 m, 8-VI-1906, Lillo 5061 (G., 16925 LIL.); Tafí, verano 1912, Castillon (16926 LIL.); Tafí, Amaicha, El Molle, 2740 m, 20-XII-1912, Castillon 2273 (16924 LIL.); Río Chico, Escava, 2500 m, Monetti 1851 (16923 LIL.). Catamarca: ravines, Ambato, Potrero, 1200 m, 10-V-1910, Castillon (P.). Mendoza: Sierra Lucas, 1-VII-1879, Lorentz (B.).

Hicken reports the species also from Córdoba, La Rioja and Buenos Aires.

Although it has been repeatedly named and has had a rather unfortunate nomenclatural history, *N. aurea* is a remarkably uniform species, showing practically no variation, except in size and relative luxuriance, throughout its extensive range.

3. **Notholaena Buchtienii** Rosenst.

Rosenst., Fedde, *Repert. Sp. Nov.* V. 238 (1908). Type from Sirupaya, Suryungas, Bolivia, Buchtien 472, presumably at Stockholm, not seen; isotypes B., BM., G., P., US., all seen. Plate 2. *N. Fraseri* (Mett.) Baker, var. *robusta* Hieron. in Engler, *Bot. Jahrb.* XXII. 400 (1896). Argentina (Córdoba), Galander. Type at Berlin; seen.

Rhizome repent, about 3 mm. in diameter, short or up to 10 cm long, its scales narrowly linear, about 3 mm long, with relatively broad, castaneous, shining, sclerotic central portion and narrow, pale, hyaline, subentire or serrulate margin, tipped with a long, weak, hair; fronds approximate, up to 40 cm long; stipe about equalling or shorter than blade, castaneous, deciduously tomentose, usually with a few small scales mingled with the tomentum on its upper part, with a single V-shaped vascular bundle; blade linear-lanceolate, not or only a little narrowed at base, obtuse or acutish at the short pinnatifid apex, below this pinnate-pinnatifid; pinnae 8-20 pairs, lanceolate or deltoid-lanceolate, tapering from near the base to the obtuse apex, deeply pinnatifid or the lower pinnate at base; segments oblong or oblong-lanceolate, obtuse, entire or cut not more than 1/2 to costule into 2-4 pairs of broad, obtuse lobes; upper surface more or less arachnoid-tomentose with fine white hairs or glabrate; lower surface densely rufescent-tomentose; texture comparatively thin, the veins somewhat impressed and usually visible on the upper surface (except as hidden by tomentum); sori round, borne on the flabellate-dilated tips of 1-2-forked, oblique veins at the margin of the leaf-tissue, which is produced beyond them into a very narrow, entire usually reflexed hyaline band 3-4 cells wide (sometimes interrupted)

Map. 2. — Range of *Notholaena Buchtienii* Rosenst

Isotype of *Notholaena Buchtienii* Rosenst. *Buchtien* 472 in herb. Mus. Paris

figs. 3, 3 *a*); spores spherical, brownish, minutely tuberculate-roughened, apparently also with a few low ridges, about 50-60 μ in diameter. A critical species, perhaps better treated as a geographic variety of *N. Fraseri*.

Rocks and walls, Bolivia and northern Argentina. Map 2.

Argentine specimens seen. — Jujuy : outlet of Laguna de Yala, 27 km. northwest of Jujuy, on dry, protected banks, 26-IX-1938, Eyerdam and Beetle 22229 (G.). Salta : entre matorrales, ladera de los cerros, San Bernardo, II-1936, A. G. Schulz 970 (G.); Alemania, 1600 m, en una barranca, 20-XII-1929, Venturi 9984 (G.); Tartagal, 6-XII-1934, T. Meyer 956 (G.); Rosario de la Frontera, 8-I-1905, Lillo 3860 (G., 16935 LIL.). Tucumán : earthern walls, town of Tucumán, Tweedie (K.); Tafí, Valle de Tafí, verano 1911-12, Castillon 32 (16930 LIL.); Tafí, 2-I-1908, Castillón 655 (16931 LIL.); en las peñas, Cerro del Campo, 3-IV-1930, Venturi 10439 (G.); Yerba Buena, Tafí, 600 m, I-1920, Venturi 750 (G., US., 16938 LIL.); Trancas, Pie de la Cuesta, 1700 m, 21-IV-1926, Venturi 4194 (G., 16937 LIL.); Cumbre de Taficillo, Tafí, 3-V-1928, Venturi 5981 (US.); Tafí, Cerro del Medio, 2050 m, 12-XII-1908, Lillo 8738 (16932 LIL.), Cerro el Nogalito, Burruyacu, 1500 m, 14-IV-1929, Venturi 8829 (US.); Sierra Chica, II-1898, Stuckert (Gen.); Escava, Río Chico, 6-XII-1913, Monetti 1661 (G., 16936 LIL.). Catamarca : El Candado, Andalgalá, 2-VI-1917, Jörgensen 1235 (G.); Ambato : El Crestón, Castillon 715 (17012 LIL.) Ambato Potrero, coteaux arides, 14-VI 1910, Castillon (P., 16934 LIL.); Quebrada del Nacimiento, V-1910, Castillon 1491 (G., 16939 LIL.); Córdoba: Sierra Achala, 15-II-1880, Galander (B.); Quebrada del Chorro al este de los Gigantes, Sierra Achala, XII-1878, Hieronymus (B.); entre Tanti y el Río Juspe, Sierra Achala, 12-II-1876, Hieronymus (B.); entre Cañada del Molino y Sta. María, 30-III 1888, Galander, (B., NY.); boca del Río de San José, Sierra Achala, 26-III-1881, Galander (B; type of *N. Fraseri* var. *robusta* Hieron.); Felsspalten des Thales von Las Peñas, II-1871; Lorentz 15 (B.), 14*a* (B.); Puesto San José in der Sierra oberhalb der Caleras bei Córdoba, 26/27-I-1876, Hieronymus 269 (B.); El Durazno, Sierra de Córdoba, 29-I-1880, Galander (B.); Sierra Curumalán, 30-IV-1879, Lorentz et Niederlein,

(B.); near Cassafousth, 9-IX-1915, Rose and Russell 23417 (US.); crevices of roks, southern extremity of Cordoba Range, Gillies (K.); Caminos de las Cumbres, 17-II-1926, Castella 26/208 (G.); Yacanto, VII-1922, Hauman (G.); San Luis: Cabrada del Salado, 9-III-1882, Galander (B.). Buenos Aires: Sierra de la Ventana, Feb.-April, 1881, Lorentz 60 (B, G, P, Pr, US.), I-1892, Hauthal (B., NY.).

Hosseus, *Bol. Acad. Nac. de Córdoba,* XXVI. 18 (192[illegible]) records the species also from La Rioja (as *N. Fraseri).*

4. **Notholaena obducta** (Mett. ex Kuhn) Baker

Baker, *Syn. Fil.* ed. 2, 515 (1874); C. Chr., *Ind. Fil.* 462; Hicken, *Cat.* 256.

Cheilanthes obducta Mett. ex Kuhn in *Linnaea,* XXXVI. 83 (1869). Type from Bolivia, d'Orbigny 386, at Berlin; seen. The specimen is a portion of a frond only, with 8 pairs of pinnae, but shows clearly the characteristic habit and indument of the species. Isotype, P., a better specimen. Plate 3.

N. Balansae Baker in *Journ. Bot.* XVI. 301 (1878); C. Chr. *Ind. Fil.* 459; Hicken, *Cat.* 255. Type from Paraguay, Balansa 330, at Kew; seen.

N. Herzogii Rosenst. in Fedde, *Repert. Sp. Nov.* VI. 175 (1905); C. Chr. *Ind. Fil. Suppl.* I, 52. Type from Bolivia, Th. Herzog 117, probably at Stockholm; not seen. Isotype B; seen.

Illustrations: Hooker, *Icon. Pl.* XVII. t. 1677 (1887), as *N. Balansae;* figs. 4, 4a, 4b.

Rhizome short-repent, about 8 mm in diameter, producing several approximate fronds up to 5,5 dm tall; rhizome-scales narrowly linear, soft, pale brown with rather large oblong cells or with shining, sclerotic, castaneous central band and narrow, pale brown margin; stipe terete, stoutish, castaneous, sublucent, covered with subappressed deciduous trichomes similar to those of blade, with a single, V-shaped vascular bundle; rachis similar; blade lanceolate, bipinnate, with numerous (15-25) pairs of oblong-lanceolate pinnae, these simply pinnate, with 8-10 pairs of oblong, broadly obtuse, entire pinnules, which are sessile or nearly so, subcordate and nearly equilateral at the broad base; terminal segment of the lamina deltoid,

Map. 3. — Range of *Notholaena obducta* (Mett. ex Huhn) Baker

3-5-lobate; rachillae dark-castaneous; upper surface glabrous or nearly so, lower surface densely clothed with, long, straightish, subappressed, relatively thick, brownish, pluricellular, compound trichomes, with 3-6 elongate lower cells attached at their bases only, the remainder of each cell free, more or less reflexed and imbricate; venation of pinnules pinnate, catadromous, the veinlets alternate, 1- or the basal 2-forked; sori borne on the abruptly dilated vein-ends a little within the unmodified margin which is narrowly revolute over them; sporangia with stalk about half as long as the body; spores obtusely triangular in outline, minutely roughened, about 60μ in diameter. In its evenly bipinnate habit and peculiar trichomes an exceptionally well-marked species, in venation and structure of sorus similar to the two following.

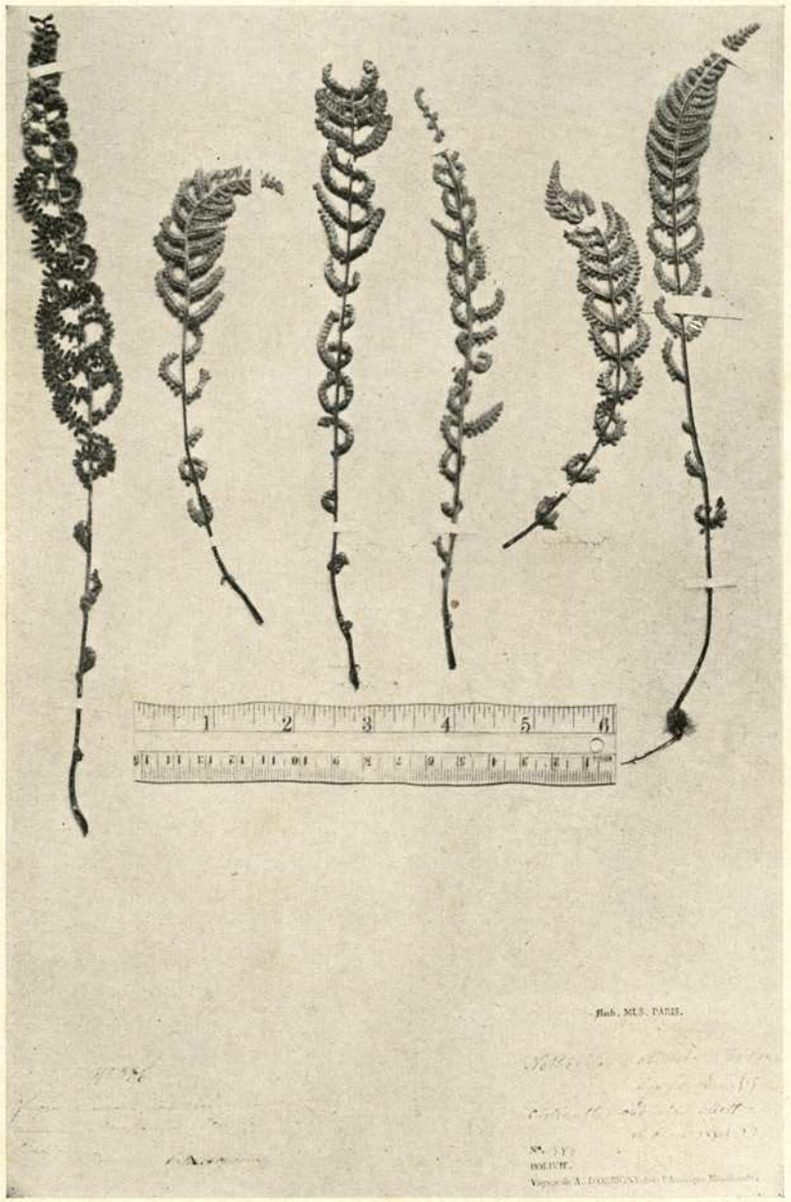
Colombia (upper Magdalena walley between Yaguará and Neiva, alt. 300-800 m, Lehmann 6056, B., G., P., US.): Bolivia, Paraguay and northern Argentina, mostly at altitudes of 1000 m or less. Map 3.

Argentine specimens seen. — Jujuy: Cerro de Zapla, 1350 m, 14-XI-1925, Schreiter 5129 (G., 17004 LIL.); same locality, 14-XI-1926, Venturi 5111 (G., US.). Salta: pasaje del Río Juramento, II-1873, Hieronymus and Lorentz 269 (B.); near forest trail, open woods, sandy soil, 800 m, Embarcación, Orán, 9-XI-1938, Eyerdam and Beetle 22899 (G.). Tucumán: Burruyacu, 12-VI-1922, Venturi 1871 (US., 17005 LIL.); Barranca Colorada, VI-1920, Venturi 846 (G., US., 17006 LIL.); Vipos, Trancas, 786 m 9-XI-1921, Schreiter 1828 (G., 17002 LIL.); Las Cejas, Cruz Alta, 400 m, VI-1922, Venturi 1871 (G). Catamarca: coteaux arides, Choya, Capital, 550 m, 15-V-1910, Castillon (P.); Río del Valle, 1-III-1909, Castillon 714 (G., 17000 LIL.); Quebrada del Nacimiento, V-1910, Castillon, (G., 17007 LIL.). Entre Ríos: Crespo, 28-II-1899, Stuckert 6582 (Gen.). Hicken records the species (as *N. Balansae)* also from Misiones.

5. **Notholaena squamosa** (Gill. ex Hook. et Grev.) Lowe

Lowe, *Ferns British and Exotic*, 1. 49 (1856), quoad basinymon, nec quoad plantam illustratam.

Cheilanthes squamosa Gill. ex Hook. et Grev. *Icon. Fil.* t. 151



Isotype of *Cheilanthes obducta* Mett. ex Kuhn in herb. Paris.

(1829). Type presumably in herb. Royal Botanic Garden, Edinburgh ; not seen. Isotype K ; seen.

N. Gilliesii Fée, *Gen. Fil.* 159 (1850-52). Based on *Ch. squamosa* Gill.

Pellaea Lilloi Hicken in *Trab. Mus. Farm. Buenos Aires,* n° 15, 210, cum tab. (1907). Type from Tucumán, Lillo 5021 in herb. Mus. Darwinion ; seen. In all technical characters, this agrees with *N. squamosa ;* it appears to be only a dwarfed and aberrant state of that species.

N. Lilloi Hicken in *Apuntes Hist. Nat.* I. 117 (1909). Based on *P. Lilloi* Hicken.

Rhizome short, erect or oblique, its scales thick, subsclerotic, linear, tapering to a long, capillary point, chestnut-brown, pectinate-serrulate, the teeth often antrorse, composed of very narrow, dark-walled cells; fronds numerous, densely cespitose, up to 3 dm tall ; stipe from half as long to somewhat longer than blade, terete, brown, lustrous, when young covered with pale, erose-serrulate scales in size and texture similar to those of blade, in age glabrate, with a single, deppressed-trigonous or flattened vascular bundle ; blade coriaceous, oblong-lanceolate to broadly ovate, subabruptly narrowed to an obtuse apex, bipinnate except near apex with 5-8 pairs of oblong or ovate-lanceolate, obtusish pinnae ; upper surface with sparse, piliform scales or rarely glabrate ; lower surface densely covered with soft, imbricate, brown, lance-ovate to ovate, pectinate-fimbriate, caudate-tipped scales composed of narrowly to broadly oblong cells with large, pellucid lumina (fig. 5b) ; no small, dissected scales beneath the larger ones ; pinnules oblong, broadly obtuse, truncate or subcordate at base, entire or the larger with a pair of lobes at base ; lower pinnae slightly or not at all reduced; sori on transversely more or less dilated vein-ends somewhat within the thickened and slightly revolute unmodified margin (figs. 5, 5a) ; spores triplanate, pale brown, about 50μ in diameter, with large, low, rounded tubercles.

Crevices of rocks, eastern slope of the Andes, Perú (?), Bolivia and Argentina, aparently at relatively high altitudes. Map. 4.

To this species are to be referred all Argentine reports of *Notholaena scariosa.* As I have elsewhere *(Contrib. Gray Herb.* CXXIV. 19) pointed out, true *Acrostichum scariosum* is the same

Map. 4. — Range of *Notholaena squamosa* (Gill. ex Hook et Grev.) Lowe

as *Cheilanthes ornatissima* Maxon and the epithet *scariosa* should be applied to that species, which is not known from Argentine.

Argentine specimens seen. — Jujuy: Hualchin, Maimara, 3000 m 17-I-1912, Budin, (G., 16990 LIL.); Estación Volcán, 2100 m, 2-XII-1918, Castillon 24 (G., 16994 LIL.); Salta: Los Potreros al pie del Nevado del Castillo, 24-III-1873, Lorentz et Hieronymus 140 (B., BM.); Cerro de Cachí, San Carlos, 3600 m, 10-III-1927, Venturi 6829 (US.). Tucumán: « comm. Grisebach, 1878 » (K.); La Queñoa, 2600 m, III-1912, Rodríguez 414 (G., 16988 LIL.); Hochalpenregion bei der Cienaga, Sierra de Tucumán, and Felsen, 30-III-1872, Lorentz 299, 782 (B); en rajaduras de las peñas, Cerro Bayo, Chicligasta, 3400 m, 12-III-1924, Venturi 3120 (G., US.); Estancia Santa Rosa, Chicligasta, 3600 m, II-1925, Venturi 6452 (US.); Valle de Tafí, II-1912 Castillon 28 (16993 LIL.); Valle de Tafí, El Pelado, 2080 m, 5-XII-1912. Castillon 29 (G., 16996 LIL.); Cerro Muñoz, Tafí, 17-XII-1907, Castillon 653 (G., 16989 LIL.); Tafí, 2000 m, I-1907, Lillo, 3932 (G., 1923 LIL.); Valle de Tafí, verano 1106-7, Castillon 25 (16992 LIL.). Catamarca: La Tranca, 4-II-1930, Castellanos 30/312 (G.); Quebrada de Choya, 1877-8, Schickendantz 362 (B.); Quebrada de El Tala, Ambato, 600 m, 8-IV-1910, Castillon (P.); in cacumine montis, Sierra Chaco, II-IV-1881, Lorentz 178 (B.); Ambato, El Potrero, 15-III-1909, Castillon 26 (16995 LIL.); Capillitas, II-1873, Schickendantz 175, 361 (B.); Quebrada del Nacimiento, Potrero, Ambato, 14-IV-1910, Castillon (G., 16991 LIL.). La Rioja: en las cercanías de la mina El Oro, Sierra Famatina, 23-25-I-1879, Hieronymus et Lorentz 440 (B.). San Luis: Cerro del Morro, III-1828, Gillies (K.).

Reported also by Hicken (as *N. scariosa)* from Buenos Aires (Sierra de la Ventana) and Patagonia. What the basis of latter report may be, I do not know; I should doubt its correctness.

6. **Notholaena arequipensis** Maxon

Maxon, *Smithsonian Miscellaneous Collections,* L XV. nº 8, 9 (1915). Type from near Arequipa, Peru, Aug. 15, 1914, Rose and Rose 18797, in U. S. National Herbarium ; seen.

Illustration : fig. 6, 6 *a*.

Rhizome erect or ascending, 1 cm or less in diameter, its scales yellowish brown to bright castaneous, linear, long-attenuate, distantly denticulate, the teeth minute, low, acutish, cells oblong to linear, thin-walled; fronds numerous, up to 8 cm tall; stipes somewhat longer than blade, terete, castaneous, subappressed-paleaceous with a single subcircular or bluntly trigonous vascular bundle; blade deltoid-oblong, obtuse or acutish, bipinnate; pinnae about 4 pairs, petiolate, the basal pair the largest, rounded-deltoid, with 2-3 pairs of segments below the trilobate or tripartite obtuse apex, the basal segments sessile, triangular, pinnately lobed or parted, the other simpler, subsessile; upper surface with a few pale, lax, tortuous, flattish, linear, mostly deciduous scales; lower surface densely covered with large, widely imbricate, appressed, ovate-oblong, long-acuminate, light reddish-brown, erose-denticulate scales, their cells large, elongate-polygonal, the central ones of the lower portion with colored, sclerotic partition-walls; veins once-forked or simple; sori borne on vein-ends abruptly and laterally dilated sometimes so much as to unite adjacent veins, close to the somewhat revolute, unmodified margin; spores triplanate, about 60μ in diameter, with low, broad, rounded tubercles.

Argentine specimens seen. — Jujuy : in fissuris rupium, loco subumbroso, Moreno, 3500 m, 24-X-1901, R. E. Fries 698 (US.) (distributed as *N. peruviana).*

Fries cites another collection « Rinconada, circa 3800 m. s. m. (3 Jan. 1901 ; Kurtz 11341) which I have not seen.

Known only from the type region, Dept. Arequipa, Perú and from Jujuy.

A critical species, apparently of high altitudes, closely related to *N. squamosa,* from which it is most readily separated by the absence of piliform scales on the upper surface of the lamina. Also near *N. peruviana* Desv.

Excluded species

Notholaena Fraseri (Mett.) Baker. Perú and Bolivia. All reports from Argentina are to be referred to *N. Buchtiennii.* The two may be distinguished as follows :

Rhizome bearing numerous pale scales with conspicuous tortuous capillary tips, giving a tomentose appearance ; no scales on rachis or upper part of stipe ; median pinnae mostly deltoid, the veins not visible on the upper surface. *N. Fraseri.*

Rhizome usually with few and inconspicuous pale, capillary-tipped scales, not appearing tomentose ; a few deciduous scales among the tomentum on upper part of stipe and lower part of rachis ; median pinnae mostly lanceolate or deltoid-lanceolate, the veins usually subimpressed and visible on the upper surface. *N. Buchtienii.*

N. mollis Kze. Chile and extreme southern Perú (Mollendo). Not known to me from Argentina. Hicken's record *(Cat. Polyp. Arg.* in *Rev. Mus. La Plata,* XV, 256) is obviously based on a taxonomic misconception, since he includes Central America (following Baker, *Syn. Fil.* 372. as Christensen also did, *Ind. Fil.* 461) and Ecuador in the range of the species. What his plant may have been, I cannot guess. The record from Tierra del Fuego, attributed to Alboff by Capurro *(Anais Prim. Reun. Sul-Amer. Bot.* III, 138) is an error. Alboff's list, in which the name *N. mollis* appears, is not an enumeration of species occurring in Tierra del Fuego, but of species found in southern Chile, but not beyond. In another table on the same page he definitely lists *Notholaena* among genera not represented in Tierra del Fuego. This statement applies also to *Cheilanthes chilensis (Ch. glauca),* included in the same list and likewise cited by Capurro.

N. mollis is at once distinguished from all Argentine species of *Notholaena* by its stellate pubescense.

N. peruviana Desv. Fries' collection, on which the sole report of this species from Argentina is based, is, as noted above, *N. arequipensis.* From the latter, *N. peruviana* differs in its lanceolate blade, 12-18 cm long (2-4,5 in *N. arequipensis),* the dark brown scales of the lower surface, and the presence of small, hyaline marginal lobes outside the sori.

N. scariosa (Sw.) Baker = *Cheilanthes scariosa* (Sw.) Presl. Known to me only from Perú. As noted above, all Argentine records should be referred to *N. squamosa*. From the latter, *Ch. scariosa* differs in its very short-stiped fronds and its tripinnate blade, gradually narrowed to the base and with minute ultimate segments.

N. tomentosa Desv. *N. hypoleuca* Kze. Apparently endemic in Chile. No specimens from Argentina have been seen; most reports are to be referred to *N. Buchtienii*. From that species and its immediate relatives *N. tomentosa* may be distinguished by its glabrous, sulcate stipe, the glabrous upper surface of the blade and the elongate sori extending along the veins to some distance back from the margin.

The group of *Notholaena* (or *Pellaea) nivea* has been recently treated by Dr. Maxon and the writer in *Contrib. Gray Herb.* CXXVII. 3-16 (1939).

Another species, hitherto undescribed, occurs in Paraguay. Since it is likely to be found also in Argentina, its description may appropriately be published here.

Notholaena Hassleri, n. sp.

Rhizoma breve horizontale vel adscendens frondes irregulariter aggregatas ad 2 dm altas emittens, paleis lineari-subulatis circa 2,5 mm longis minute crebreque serrulatis vetustioribus medio saturate brunneis vel nigrescentibus scleroticis marginem versus pallide brunneis hyalinis onustum. Stipes teres atro-castaneus laminam aequans vel ea paullo brevior, paleis lanceolato-ovatis acuminatis pectinato-serrulatis basi cordatis tenuibus brunnescentibus vel albescentibus e cellulis oblongis magnis translucentibus parietibus tenuibus compositis dense tectus. Lamina lanceolata vel oblongo-lanceolata basi nec attenuata, superne in apicem pinnatifidum acutum subabrupte angustata, bipinnato-pinnatifida vel basem versus subtripinnata. Pinnae 8-10-jugae oblongae vel linearioblongae, imae propter pinnulas basales lateris inferioris elongatas deltoideae, obtusae vel acutae inferiores subdistantes. Pinnulae deltoideo-ovatae obtussae apicem pinarum versus late adnatae integraeque basem earum versus sessiles vel brevissime petiolulatae

Type of *Notholaena Hassleri* Weath. in herb. Kew.

cordatae lobatae vel pinnarum imarum longissimae pinnatae. Rachis supra et infra, costae, costulaeque infra paleis eis stipitis similibus dense onustae, laminae pagina inferior alibi glabra, superior trichomatibus brevibus crassis moniliformibus albescentibus e cellulis brevissimis compositis subsparse onusta. Venae liberae, parte tertia superiore vix incrassata soros subelongatos gerentes, marginem subhyalinum modice revolutum vix attingentes. Spori triplanati diametro circa 40μ. brunnescentes vel nigrescentes jugis prominentibus tenuibus plus minusve irregularibus rugosae.

PARAGUAY: *in regione calcarea cursus superioris fluminis Apa, Feb. 1913, Hassler 10996 (K., typus; B., BM., Gen.), sub nomine* N. scariosae *emissa; ad ripas fluminis Paraguay, Nov. 1913, Hassler 12980 (P.). Plate 4.*

In characters of sori and spores this species is related to *N. sinuata* from which it is at once distinguished by its very different habit and the simple, moniliform hairs of the upper surface of the lamina. These same hairs, the elongate sori and rugose spores, separate it from all Argentine species.

Index of names applied to Argentine species of Notholaena

Notholaena Balansae Baker = *N. obducta*.
» bonariensis (Willd.) C. Chr. = *N. aurea*.
» ferruginea auctt. = *N. aurea*.
» Fraseri sensu Hicken at auctt. = *N. Buchtienii*.
» » var. robusta Hieron. = *N. Buchtienii*.
» hypoleuca sensu Hicken = *N. Buchtienii*.
» Lilloi Hicken = *N. squamosa*.
» mollis sensu Hicken ?
» *obducta* (Mett. ex Kuhn) Baker.
» peruviana sensu Fries = *N. arequipensis*.
» rufa Presl = *N. aurea*.
» scariosa sensu Hicken = *N. squamosa*.
» *sinuata* (Lag.) Kaulf.
» *squamosa* (Gill. ex Hook. et Grev.) Lowe.