

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF
HARVARD UNIVERSITY,—CXXVII.

1. SOME SPECIES OF NOTHOLAENA, NEW AND OLD.

BY W. R. MAXON AND C. A. WEATHERBY.

I. THE GROUP OF NOTHOLAENA NIVEA.

THIS group is characterized by the bi- to tri- or subquadripinnate lamina, which is either glabrous or with ceraceous indument; petiolate pinnae and pinnules and small, usually entire or trilobate, often distant ultimate segments, which are articulate on their pedicels; elongate more or less gymnogrammoid sori, which commonly occupy at least the outer third of the veins; usually rugose spores (*N. incana* excepted); and brown, concolorous, linear or linear-subulate, rather thin rhizome-scales with elongate, slender-walled cells. From the related group of *N. dealbata*, *N. limitanea* and *N. Fendleri*, it is most readily distinguished by its articulate ultimate pinnules. The articulation is rather obscure but is evidenced by the abrupt stopping of the dark color of the pedicel at the base of the pinnule, the costule being green for its whole length, and by the clean and even transverse fracture left when, in age, the pinnule falls off. In *N. dealbata* and its immediate relatives the dark color passes without interruption part way up the costule and the fallen pinnules leave a comparatively irregular and ragged fracture.

The placing of the group to which *N. nivea* belongs (*Cincinalis* of Desvaux) in *Notholaena* has been repeatedly questioned. In general habit and in type of sorus and spore it agrees well with species of *Pellaea*, sect. *Eupellaea*. But, although very different in habit and vestiture, it also agrees in type of sorus, spores, and thin, concolorous rhizome-scales with species of *Eunotholaena*,¹ such as *N. marantae* and *N. sinuata*. Nevertheless, its sori are, in their extreme condition in *N. incana*, much more gymnogrammoid than in either *Eupellaea* or *Eunotholaena*.

Mettenius was well aware of the resemblance of *Cincinalis* and *Eunotholaena* in soral characters, and on the strength of it trans-

¹ Accepting Christensen's designation of *N. marantae* as type.

ferred both together to *Gymnogramma*.¹ Prantl, in placing, with much reasonableness, our group in *Pellaea*, suggested that Mettenius may have been right in treating *Eunotholaena* and *Cincinalis* as a unit and that the former as well as the latter ought to be transferred to *Pellaea*.² Our own feeling is that the final disposition of *N. nivea* and its allies—whether as a subgenus of *Notholaena* or of *Pellaea*, or as an independent genus, or as something we do not now foresee—must await a comprehensive and detailed study of all the *Cheilanthes*. For the present, we leave them in their old conventional position under *Notholaena*.

In any case, Prantl was doubtless right in associating with our group the species usually known as *Pellaea formosa* (*P. pulchella*). It agrees in general habit, numerous, tiny pinnules, type of rhizome-scales, sori and spores. With it would go, of course, its close relative, *P. microphylla* Mett. But until generic affinities in the *Cheilanthes* are better understood than at present, we are making no transfers.

Of the species and varieties here treated, those with white ceraceous indument have usually been referred to *N. nivea*. *N. tenera* and *N. flavens* have by most authors been regarded as distinct.

The characters in the synoptic, but somewhat artificial, key which follows are mostly comparative, and none of them, not even the difference in spores, are wholly constant. Plainly, the group is still plastic, its variants not completely separated. But, as here defined, they appear natural, and distinct enough to make their recognition desirable. Geographically, *N. nivea* and its varieties occupy the higher portions of the Andean region of South America from Ecuador southward to extreme northern Chile, passing into lower altitudes on the eastern slope of the Cordillera in northern Argentina, and with a few outlying stations in the highlands of eastern Brazil. If the data on Mutis's labels may be depended upon, var. *flava* has also an outlying station to the north, in Colombia. *N. incana* inhabits the highlands of central Mexico, extending southward into Guatemala, with a quite unexpected outpost in Santo Domingo. From the few collections at hand, *N. delicatula* appears to be confined to the eastern and western ranges of north-central Mexico.

We are indebted to the officials of the various herbaria listed below for loans and for the privilege of examining specimens under their care. Determinations of specimens in European herbaria

¹ See Mett. Cheil. 5-7 (1859).

² Prantl in Engl. Bot. Jahrb. iii. 417 (1882).

were made by the junior author; others are mostly joint. In citation, the following more or less standard abbreviations for names of herbaria are used: Berlin, (B); British Museum, (BM); Gray Herbarium, (G); Kew, (K); New York, (NY); Paris, (P); Philadelphia Academy, (Pa); Praha, (Pr); United States National Herbarium, (US); Yale University, (Y).

- a. Indument white, ochroleucous, or none. . . . b.
- b. Indument present, white or ochroleucous. . . . c.
- c. Pinnules herbaceous, often cuneate at base, usually glandular on upper surface; lamina broadly deltoid, nearly or quite as broad as long, tri- to subquadripinnate; veins sporangiferous for nearly their whole length; spores rugose *N. delicatula*
- c. Pinnules commonly coriaceous (if thinner, lamina distinctly longer than broad and bipinnate except near base), commonly truncate to subcordate at base, glabrous on upper surface; lamina longer than broad d.
- d. Stipe blackish; veins usually bearing sporangia for nearly their whole length; spores minutely and inconspicuously roughened *N. incana*.
- d. Stipe castaneous; veins usually bearing sporangia in the outer third or half only; spores strongly rugose e.
- e. Lamina more or less completely tripinnate; ultimate pinnules suborbicular to broadly oblong, the simple lateral ones mostly less than 4 mm. long, the terminal often lobed; scales often strongly crisped in drying *N. nivea*.
- e. Lamina bipinnate above, only imperfectly tripinnate as to lower pinnae; ultimate pinnules oblong, the lateral 4 mm. long or more, the terminal commonly simple; scales never strongly crisped. *N. nivea* var. *oblongata*.
- b. Indument none; lamina usually only bipinnate except toward base; scales not strongly crisped. *N. nivea* var. *tenera*.
- a. Indument bright yellow; stipe dark-castaneous; scales not crisped. *N. nivea* var. *flava*.

NOTHOLAENA INCANA Presl, Rel. Haenk. i. 19, t. 1, fig. 2 (1825) excl. spec. Amer. merid. TYPE, Mexico, Haenke (Pr, seen; photo, G).

Gymnogramma candida Mett. Cheil. 6 (1859), non *Notholaena candida* (Mart. & Gal.) Hook. (1865). TYPE, Schmitz 231 from Valle de Mexico, at Berlin (seen; photo, G, US, BM).

Pellaea candida (Mett.) Prantl in Engl. Bot. Jahrb. iii. 417 (1882).

MEXICO.—CHIHUAHUA: *E. Palmer* 215 (BM, K, US); 115 (G, Y). SAN LUIS POTOSI: in montibus San Rafael, 1876, *Schaffner* 961 (G, K); 1851, *Virlet d'Aoust* 21 (P). DURANGO: *García* 790 (US). ZACATECAS: Plateado, Sept. 4, 1897, *Rose* 3740 (US).

GUANAJUATO: 1902, *Dugès* 12 (G). HIDALGO: Sierra de Pachuca, Sept. 1, 1903, *Rose & Painter* 6747 (US). MEXICO: montes circa urbem Mexico, *Schmitz* (K); Valle de Mexico, *Schaffner* 234 (B, K, P), 262 (K); shaded banks near Ozumba, 8500 ft., Nov. 3, 1902 *Pringle* 11267 (B, G, K, US); barranca près Mixcoal, and Santa Fé, Sept. and Oct. 1865, *Bourgeau* 754 (G, K, P); dans les ravins entre San Angel et Miquac, *Schnee* (P); cliffs, Sierra de las Cruces, Oct. 23, 1892, *Pringle* 5248 (P); San Angel, Aug. 1875, *Schaffner* 28 (B); near Salazar, Sept. 14, 1903, *Rose & Painter* 7042 (US); Popo Park, Aug. 4-8, 1910, *Hitchcock* (US); Amecameca, July 29, 1924, *Fisher* 35 (US); Sierra de Ajusco, 8500 ft., Nov. 10, 1907, *Pringle* 15021 (G, US); near Santa Fé, along rocky banks of stream, Oct. 18, 1903, *Rose & Painter* 8001 (US); Cima de Toluca, 3000 m., Sept. 1925, *Lyonnet* 35 (G, US). MORELOS: cool banks, Parque Station, 7500 ft., Oct. 16, 1909, *Pringle* 15698 (US); near Cuernavaca, Sept. 8, 1903, *Rose & Painter* 6872 (US). TLAXCALA: Sta. Ana Chiantempan, *Arsène* 1739, 1848 (P), s.n. (NY). MICH-OACAN: Panguato près Morelia, 2000 m., Sept. 25, 1910, *Arsène* 5756 (US), 5341 (P). PUEBLA: Manzanillo, *Nicolas* (P); Hueyotlipam, June 15, 1908, *Arsène* 2145 (P); barrancas de l'Alseseca, Hacienda Batan, près Totimehuacan, 2120 m., Dec. 3, 1907, *Arsène* 1993 (P). OAXACA: Monte Alban near Oaxaca City, 5500-6000 ft., *C. L. Smith* 2041 (US); sur les rochers en terre temporaire, Sept. 1842, *Ghiesbreght* 415 (P); Cerro de San Felipe, 2000 m., Aug. 22, 1897, *Conzatti & Gonzalez* 463 (G). CHIAPAS: entre les rochers, 6500 pieds, *Ghiesbreght* 226 (G, K, Y).

GUATEMALA: without locality, *Salvin & Godman* (K); *Salvin* 238 (G); Quezaltenango, Aug. 1871, *Bernouilli & Cario* 251 (B, K, P).

SANTO DOMINGO: face of cliffs, 2600 m., Pico del Valle Nuevo, prov. de la Vega, Cordillera Central, Oct. 15, 1929, *Ekman* 13770 (US).

The type sheet of *N. incana* (no. 78538 in the herbarium of the National Museum at Praha) contains a clump of typical *N. nivea* (three plants much matted together and rather badly battered) and three detached fronds of the Mexican species, two of them young and poorly developed and one in good fruiting condition. Presl's conventionalized drawing seems not to have been made directly from any of the specimens. His diagnosis is: "fronde ovato-triangulari triplicato-pinnata, apice bipinnata, pinnulis ellipticis rotundatisve subtus albo-farinosis, terminalibus et infimis subtrilobis, stipite rachibusque nitidis."

Except that the shape of the lamina could hardly have been made out from the matted mass of *N. nivea*, this is broad enough to cover both elements. His description is somewhat more specific. "Stipes brevis" does not apply to the specimens of *N. nivea*, but could have been drawn from the broken-off petioles of the Mexican material. "Stipes . . . fusco-nigricans" must have been taken from the latter. "Capsulae submarginales . . . dein confluentes et totam paginam inferiorem, costa excepta, obtegentes" presumably came from both elements, the first phrase from the South American, the latter from the fertile Mexican frond, which Presl evidently supposed represented the fully mature condition of his species.

N. incana, then, is validly published, and is attested by adequate type specimens. The South American element in it has a tenable name; the Mexican, which played a considerable though by no means exclusive part in shaping the diagnosis, has no available one. Under these circumstances it seems best to retain *N. incana* for the Mexican element, typifying it by the specimens on the lower part of the type sheet, and particularly by the fruiting lamina at the left.

The specimens from Santo Domingo are rather small and show some almost orbicular ultimate pinnules reminiscent of *N. nivea*, to which Christensen¹ referred them; but they have the dark stipes, elongated sori, and only minutely roughened spores characteristic of *N. incana*, and may safely be referred to that species.

Hispaniola has long been noted for the occurrence of species otherwise Andean and mostly of wide range along the Cordilleras. Instances of species turning up in Hispaniola that have been known previously only from the Mexican highlands are indeed few and far between.

NOTHOLAENA delicatula, sp. nov. Plerumque gracilis. Rhizoma breve erectum vel obliquum, frondes plures dense caespitosas emittens, paleis tenuibus brunneis concoloribus lineari-subulatis longe acuminatis circa 4 mm. longis 0.8 mm. latis integris, cellulis elongatis parietibus tenuibus, onustum. Stipes castaneus gracilis teres glaber subnitidus laminam subaequans. Lamina plerumque deltoidea fere aequilateralis tripinnata vel inferne subquadripinnata. Rachis costaeque stipiti similes. Pinnae majores circa 5-jugae remotae oblongae vel deltoideae petiolatae. Pinnulae structura pinnis similes remotae. Pinnulae ultimae in pedicellis brevibus castaneis articulatae tenuiter herbaceae 4 mm. vel minus

¹ Svensk. Vet. Akad. Handl. ser. 3, xvi. 59 (1937).

longae, pagina superiore minute glanduliferae, inferiore granis ceraceis albidis minutissimis discretis copiose praeditae, sub-integrae vel minute irregulariterque crenatae, margine non revoluti; laterales oblongae vel ovatae vel inaequilateraliter rhomboideae, apice obtusae, basi subtruncatae vel late cuneatae; terminales vel eorum lobi centrales rhomboideae vel fere flabelliformes, saepe in basin angustam ex comparatione longam sicut petiolum abrupte contractae. Nervillae evidentes tenues liberae pinnatae 1-3-furcatae e costula angulo acuto egredientes, fere per totam longitudinem sporangiferae. Sporangia brevissime stipitata, annulo e cellulis circa 20 composito. Sporae brunneae sphaericae jugis tenuibus flexuosis fuscis rugosae, diametro ca. 50μ .

MEXICO.—COAHUILA: Lerios, 45 miles east of Saltillo, July 1880, *E. Palmer* 1387 (TYPE in U. S. Nat. Herb., sheet no. 60365; isotypes, G, K, P, Y); Sierra Madre, 40 miles east of Saltillo, March 1880, *Palmer* 1385 (G, US, Y). NUEVO LEÓN: Monterrey, 1880, *Palmer* 1386 (G, P, US; a juvenile state with dilated segments; see discussion below). JALISCO: limestone ledges, mountains near Monterrey, June 1889, *Pringle* 2581 (B, BM, G, K, P, US, Y).

Notholaena delicatula differs from *N. incana* in its paler stipes, delicate texture and rugose spores; from *N. nivea* in texture and usually more elongate sori; and from both in its broader lamina, its stronger tendency toward cuneate-based ultimate pinnules, and its generally glandular upper surface. *Palmer* 1385, though otherwise in agreement with the type, is of thicker texture and has the upper surface nearly glabrous.

We are in doubt regarding two collections from the Sierra Madre Oriental of Nuevo León (*C. H. & M. T. Mueller* 628 and 1115). In their castaneous stipes and somewhat rugose spores they suggest *N. delicatula*, from which they differ notably, however, in their greater size, glabrous upper surface, and more copious waxy covering beneath. In general appearance they agree with *N. incana* and may be placed there temporarily, in spite of their castaneous stipes.

NOTHOLAENA NIVEA (Poir.) Desv. Journ. Bot. Appl. i. 93 (1813).

Pteris nivea Poir. Encycl. v. 718 (1804). TYPE from Peru, Jos. Jussieu, sheet no. 1047 in herb. Jussieu at Paris; seen.

Acrostichum albidulum Cav. ex Sw. Syn. Fil. 16, 205, t. 1, fig. 2 (1806). Type not seen, but apparently belonging here.

Cincinnatia nivea (Poir.) Desv. Berl. Mag. v. 313 (1811).

Notholaena albidula (Cav.) Sturm, Pl. Vasc. Crypt. Chile, 16 (1858).

Gymnogramma nivea (Poir.) Mett. Cheil. 7 (1859).

Pellaea nivea (Poir.) Prantl, in Engler, Bot. Jahrb. iii. 417 (1882).

Representative specimens. ECUADOR: in rupium apricarum fissuris secus oppidum Huano, Dec. 1858, *Spruce* 5632 (B, BM, G, K, NY, P); Berg am Rio Ambato, erloschenen Volkan trockener kalkhaltiger Sandboden, selten, Nov. 2, 1932, *Erica Heinrichs* 36 (B, NY); in altiplanitie ad rupes prope Pifi, 2600 m., 1897, *Mille* (US); same locality, Sept. 1902, *Mille* 171 (P).

PERU.—ANCACHS: zwischen Samanca und Caraz, 3700 m., May 24, 1903, *Weberbauer* 3061 (B); Caraz, May 19, 1903, *Weberbauer* 3009 (B). HUANUCO: in Andium montibus, *Ruiz* 45 (B). LIMA: Matucana, April 19, 1878, *Savatier* 1215 (K); same locality, *Macbride & Featherstone* 425 (US); Puruchuca, *Mathews* 755 (K, P); Oroya Railroad, *Steere* (G, P), *Safford* 990 (G, P, NY, US), *Weberbauer* 135 (B); open hillside, Rio Blanco, 3000–3500 m., April 15–17, 1929, *Killip & Smith* 21561 (G, NY, US). JUNÍN: open hillside, Tarma, 3000–3200 m., April 20–22, 1929, *Killip & Smith* 21812 (US, NY); open, rocky hillside, Mantaro Canyon, 3150 m., April 29, 1929, *Killip & Smith* 22161 (US). Cuzco: offen aber stellenweise dichte Formation, gemischt aus Kräutern (Gräser zahlreich), kleiner Sträuchern und stachelblatttrigen stammbildenden Bromeliaceen, Cacteen sehr sparlich vertreten, felsige Stellen, 3500–3600 m., Cuzco, May 25, 1905, *Weberbauer* 4866 (B); dry, rocky cliff above Ollantaitambo, 3600 m., Nov. 29–Dec. 6, 1923, *Hitchcock* 22528, 22549 (US); Calca, 3000–3200 m., Oct. 1924, *Herrera* 144 (US); walls of temple of Viracocha near Tinta, 3500 m., April 15, 1915, *Cook & Gilbert* 196, 221 (US).

BOLIVIA: canyon of La Paz River, Aug. 6, 1920, *Shepard* 181 (G, NY, P, US); La Paz, 3300 m., *Buchtien* 600 (NY, US), *R. S. Williams* 2631 (NY, US), *Rose* 18917 (NY, US), *Cárdenas* (Mulford Exp.) 47 (G, NY), *Bang* 19 (B, BM, G, K, NY, P, US), 2600 (G, NY, US), *Pflanz* 73 (B), *Rusby* 324 (US); beneath stones or bushes, Chorolque, Dept. Potosí, 3500 m., Dec. 1931, *Cárdenas* 141a (G); Escayache bei Tarija, 3600 m., Jan. 31, 1904, *Fiebrig* 3024 (B, BM, G, K, P, US); Pazna, 4200 m., May 1908, *Buchtien* 1142 (US); La Tetilla bei Oruro, 4000 m., *Stübel* 1221 (B); vicinity of Oruro, Aug. 18, 1914, *Rose* 18935 (NY, US); Cerro de Oruro, 3900 m., Sept. 1911, *Herzog* 2446 (US); Cochabamba, 3000 m., May 26, 1892, *Kuntze* (B, NY); Serro Macho, Dept. Sucre, April 1933, *Cárdenas* 492 (G).

CHILE.—TARAPACÁ: Sibaya, *Philippi* (B, K); Quebrada de Quipisca, Noasa, 3500 m., March 1926, *Werdermann* 1068 (B, K, NY, US).

ARGENTINA.—SALTA: Nevada del Castillo, March 19–23, 1873, *Lorentz & Hieronymus* 53 (B, US); Cuesta del Acay, Dec. 2, 1923, *Catalano* 25/1512 (G). LOS ANDES: El Fronton, 3850 m., March 1926, *Catalano* 2 (G); Susques, March 5, 1927, *Castellanos* (G); Chorillos, March 1930, *Budin* 7 (G). TUCUMÁN: Cuesta de la Puerta de San Xavier, Feb. 1874, *Lorentz & Hieronymus* 955 (B). CATAMARCA: coteaux arides, Quebrada de el Tala, 550 m., April 12, 1910, *Castillon* (G, P); La Franca, Feb. 4, 1930, *Castellanos* 30/313 (G). LA RIOJA: Sierra Famatina, Jan. 29, 1879, *Hieronymus & Niederlein* 555 (B); LaFrancia, Feb. 4, 1930, *Castellanos* (G). CÓRDOBA: Huerta Grande, Sierra Chica, Feb. 17, 1897, *Stuckert* 1764 (P). SAN JUAN: Quebrada del Paramillo, Medanos, Jan. 1876, *Echegaray* (B).

There is a good deal of variation in the texture of the rhizome-scales in typical *N. nivea*. In the type specimen and in numerous other collections, especially from the northern part of its range, they are delicate and more or less tortuous, with irregular marginal projections, and in drying are so crisped and drawn together over the apex of the rhizome as to appear like a miniature ball of crumpled tissue-paper. In other specimens, especially from the southern part of the range, the scales are of more substantial consistency, less tortuous and only slightly crisped or merely somewhat twisted in drying. Notwithstanding this tendency toward geographic alignment, there is every intermediate stage between the two extremes; there are no essential differences in the structure of the scales, and no correlating characters.

NOTHOLAENA NIVEA (Poir.) Desv. var. OBLONGATA Griseb. Symb. Fl. Argent. 342 (1879). Type not designated, but said to be from Salta; a specimen at Kew labelled "comm. Grisebach, 1878" is taken as authentic.

PERU.—CUZCO: Feb. 1938, *Soukup* 76 (G). APURIMAC: Andahuaylas, 1800 m., March 1928, *Herrera* 1498 in pt. (G). PUNO: Macusanai, in rupibus umbrosis, June 1854, *Lechler* 1830 (B).

ARGENTINA.—TUCUMÁN: saxicola, 2700 m., Sierras Colchaquias, Jan. 20, 1933, *Burkart* 5168 (G); Villa Nougues, Famailla, Jan. 1922, *Venturi* 1649 in pt. (G, US; white indument scant, approaching var. *tenera*). CATAMARCA: coteaux arides, Ambato, April 12,

1910, *Castillon* (G, P); Dept. Andalgala, Jan. 24, 1917, *Jørgensen* (US). CÓRDOBA: *Lossen* 242 (Pa; with very sparse indument, as well referable to var. *tenera*).

BRAZIL.—SANTA CATHARINA: San Joaquim, 1000 m., *Spannagel* 172 (NY, Pa).

Except for the single outlying station in Brazil, var. *oblongata*, though apparently uncommon, shows no marked geographic segregation and possibly should be regarded as a growth-form. From the scanty material seen, however, it appears not to be a developmental stage; and its strong tendency to perfectly imparipinnate leaf-form, together with the absence of the strongly crisped rhizome-scales frequent in typical *N. nivea*, seem to justify Grisebach's treatment. In general habit it is transitional to var. *tenera*, though in the narrowness of its segments it goes beyond that variety.

NOTHOLAENA NIVEA (Poir.) Desv. var. TENERA (Gill.) Griseb. Symb. Fl. Argent. 342 (1879).

N. tenera Gill. ex Hook. in Curtis, Bot. Mag. sub. t. 3055 (1831). Type at Kew, a cultivated specimen grown from spores sent by Gillies from Argentina.

Pellaea nivea f. *tenera* (Gill.) Hieron. in Engler, Bot. Jahrb. xxii. 390 (1896).

PERU.—LIMA: in convalle fluminis Rimac ad 8000 ped., May 1882, *R. Ward* (K); rochers, Matucana, April 21–22, 1877, *Savatier* 589 (K), April 12–May 3, 1922, *Macbride & Featherstone* 82 (G); Oroya Railroad, Oct. 26, 1901, *Steere* (G, P, Y), *Safford* 992 (US); Rio Blanco, 3000–3500 m., April 15–17, 1929, *Killip & Smith* 21578 (NY). JUNIN: crevices of bare rock, Mantaro Canyon, April 29, 1929, *Killip & Smith* 22162 (NY, US). Cuzco: Sept. 1, 1914, *Rose* 19471 (US); pueblo de Gucay, Urubamba, Aug. 1925, *Herrera* 717 (US).

BOLIVIA: in scopulosis, vic. Sorata, 2700–3000 m., Feb.–April 1859, *Mandon* 1550 (BM, G, K, NY, P), *Mandon* 1863 (B), *Rusby* 326 (G, NY, US); La Paz, April 1885, *Rusby* 327 (NY, US); Cochabamba, 2600 m., 1932, *Bro. Julio* II 234 (US); Pazna, 4200 m., May 1908, *Buchtien* 1141 (US); Cotaña am Illimani 2450 m., Nov. 1911, *Buchtien* 3112 (G, US); Miraflores, Potosí, among calcareous rocks, 3800 m., March 1932, *Cárdenas* 141a, 141b (G).

ARGENTINA.—JUJUY: sobre las peñas, Volcán, 2400 m., Feb. 17, 1927, *Venturi* 4931 (G, US); entre los cerros, entre cactus, 2500 m.,

Tilcara, Feb. 1936, *A. G. Schulz* 974 (G). TUCUMÁN: Cienaga, *Lorentz* 888 (B); Famailla, Quebrada de Lulas, Nov. 21, 1920, *Venturi* 1064 (G, US); Cerro del Campo, Burroyaco, 2000 m., en las peñas, April 12, 1930, *Venturi* 10369 (NY). CATAMARCA: Yacutula, Dec. 1879, *Schickendantz* 44 (P), 364 (B); El Candado, Feb. 20, 1916, *Jørgensen* 1237 (G). LA RIOJA: en las cercanías de la mina del Oro, Sierra Famatina, Jan. 23-25, 1879, *Hieronymus & Niederlein* 439 (B), 732 (B), Jan. 25, 1928, *Castellanos* 28/19 (G). CÓRDOBA: 1879, *Stuckert* 5971 (P), Dec. 1891, *Kuntze* (NY). MENDOZA: hauteurs audessous de Rio Tigre près San Rafael, 1200 m., Feb. 4, 1897, *Wilchek* 2 (P). BUENOS AIRES: Sierra de Ventana, Jan. 1896, *Bettfreund* 1006 (B).

Var. *tenera* shows a strong tendency to a narrow lamina, bipinnate only, except toward the base. In color of stipe it is somewhat variable; most specimens have the comparatively light castaneous stipes of typical *N. nivea*, but in some they are quite as dark as in var. *flava*. This, together with Hieronymus's specimens, in which the habit of var. *tenera* is combined with sparse yellow or sometimes with sparse white indument, suggests that var. *tenera*, as here defined, may include glabrate derivatives from both the typical variety and var. *flava* or crosses with them.

Occasional specimens show a tendency toward the oblong pinnules characteristic of var. *oblongata*. Such are:

PERU: Oroya Railroad, Oct. 26, 1901, *Steere* (P, Y). ARGENTINA: Sierra de Catamarca, Jan. 1888, *Schenck* 14 (B); Sierra Famatina, La Rioja, Jan. 1879, *Hieronymus & Niederlein* 439 (B), *Castellanos*, Jan. 1928 (G).

This tendency, however, is much less clearly marked than in var. *oblongata* and, though it somewhat weakens the standing of that variety, seems itself to require no taxonomic recognition.

NOTHOLAENA NIVEA (Poir.) Desv. var. FLAVA Hook. Sp. Fil. v. 112 (1864). No type designated, nor specimens cited, but identity clear.

Acrostichum flavens Sw. Syn. Fil. 16, 204 (1806). Type from South America, *Née*, presumably at Stockholm. Not seen, but identity scarcely to be doubted.

A. tereticaulon Desv. Berl. Mag. v. 310 (1811). Type at Paris, "Amer. aequinoct.," probably from Peru; seen.

Cincinalis (?) *flavens* (Sw.) Desv. Berl. Mag. 329 (1811).

Gymnogramma flavens (Sw.) Kaulf. Enum. 77 (1824).

Notholaena chrysophylla Kl. in Allg. Gartenzeit. xxiii. 265 (1855).

Type at Berlin, a garden specimen, said to have come originally from Peru (*Warszewicz*); seen.

Notholaena flavens (Sw.) Moore, Ind. Fil. LXX (1857).

Pellaea nivea forma *flavens* (Sw.) Hieron. in Engl. Bot. Jahrb. xxii. 390 (1896).

Pellaea flavens (Sw.) C. Chr. Ind. Fil. 480 (1906).

COLOMBIA: *Mutis* 2102, 2104 (US).

ECUADOR: Loja, *Seemann* (K); Quito, 1896, *Sodirol* (P) (a form in habit approaching var. *oblongata*).

PERU.—HUANUCO: clefts of rocks, etc., on dry hills, April 1863, *Pearce* (K). LIMA: loose, rocky embankment, Piedra Grande, near Santo Domingo, May 14–19, 1923, *Macbride* 3706 (US). Without definite locality: 1835, *Mathews* 755 (K); *Dombey* (P).

BOLIVIA: Espia, head of Bopi River, 3500 ft., July 23, 1921, *White* (Mulford Exped.) 619 (K, NY, US), *Rusby* 143 (NY); Cinti, Dept. Chuquisaca, Jan. 1846, *Weddell* 3918 (P); descent from Taca to Chuncamayo, Yungas, 2000 m., Dec. 11, 1876, *Stübel* 1228 (B); Musu Mts., 3500 ft., Jan. 11, 1902, *R. S. Williams* 1366 (US); Tarija, Jan. 2, 1928, *R. E. Fries* 1225 (G), 2000 m., July 1932, *Cárdenas* 141 (G).

ARGENTINA.—JUJUY: on old wall, Feb. 1864, *Pearce* (BM, K). SALTA: zwischen Salta und Campo Santo, April 1873, *Lorentz & Hieronymus* 209 (B, US). TUCUMÁN: Vipos, 850 m., Oct. 1921, *Venturi* 1386 (G, US); en las barrancas, 1100 m., Molle de Castilla, Feb. 7, 1927, *Venturi* 5138 (US). CATAMARCA: Capital, Choya, 550 m., May 17, 1910, *Castillon* (G, P). LA RIOJA: Vilgo, April 3, 1906, *Uniche* (B). CÓRDOBA: Dec. 12, 1896, *Stuckert* 11714 (P); Jan. 26–27, 1876, *Hieronymus* 270 (B).

BRAZIL.—MINAS GERAES: an Felsen des Campos São Julião, *Schwacke* 12764 (P); Miguel Burnier, Preto, *Damazio* 1728 (NY, US).

Like var. *tenera*, var. *flava* shows an occasional individual approaching var. *oblongata* in habit—for instance, Quito, Ecuador, 1896, *Sodirol* (P). But, as in var. *tenera*, the tendency is slight and not clearly marked. Except that var. *flava* has outlying stations in Colombia and in the highlands of eastern Brazil, none of the varieties have a distinctive range.

Hieronymus, when in Argentina, became interested in this group and, with his colleagues, collected it intensively. He brought together a considerable series of specimens, now at Berlin, which he considered intermediate among *N. nivea*, *N. flavens*, and

N. tenera (as they were then generally called), and which he duly cited and discussed in his *Beiträge zur Kenntniss der Pteridophyten-flora der Argentina* (in Engler, Bot. Jahrb. xxii. 390-391). Some of them appeared to the junior author, who saw them at Berlin in 1937, reasonably referable to one or another of the groups here recognized and they are so cited by us. The residue is, however, sufficient to prove the existence of stages transitional in habit and in quantity and color of indument and is supported by similar collections from other sources. The following may serve as examples: Peru, *Wilkes Exped.* (Y), habit of typical *N. nivea*, but glabrous; Choya, Catamarca, Argentina, May 17, 1910, *Castillon* (G, P), good var. *tenera*, except that some fronds have more or less white indument; Quebrada del Salado, San Luis, Argentina, *Galandier* (B), with both white and yellow indument on the same fronds. From such evidence Hieronymus concluded that *N. flavens* and *N. tenera* were without adequate taxonomic basis, and reduced both to formal rank under *N. nivea*. This was rather extreme. His opinion that neither the absence of indument nor its color constitutes a character of specific importance in this subgroup of variable forms is sound; but he took too little account of the rather vague but actual correlative tendencies in habit, color of stipe, and texture of scales. Grisebach was more nearly correct, as we see it, in treating *N. tenera* as a variety of *N. nivea*; but he gave too much importance to color, and maintained *N. flavens* as a species. The treatment here adopted, the recognition as varieties of four rather slightly characterized and variable trends, not yet fully disentangled in the course of evolution, seems most accurately to express the facts of nature.

One other type of variation remains to be discussed. In three of the varieties of *N. nivea* and in the Mexican *N. delicatula* there occur occasional individuals of very different aspect from the normal. Mostly these are small plants, with narrow blades; the terminal segments of the pinnae are much dilated laterally (up to 8 mm. wide by 6 mm. long) and more or less lobed, and the lateral segments are somewhat developed in the same manner. Such specimens are: near Salta, Argentina, April 1873, *Lorentz & Hieronymus* 209 (B, K, P—cited by Hieronymus as an intermediate between var. *tenera* and var. *flava*); Quebrada de la Tala, Catamarca, Argentina, Nov. 1872, *Hieronymus & Lorentz* (B); Prov. Cinti, Dept. Chuquisaca, Jan. 1846, *Weddell* 3918 (P—showing fronds with dilated and normal segments on the same indi-

vidual); Monterrey, Nuevo León, Mexico, *Palmer* 1368 in 1880 (G, P, US—the Paris specimen with both types of fronds from the same rhizome).

The condition just described seems to be a juvenile phase, sometimes partially fertile, analogous to the very large and strangely shaped leaves often to be found in saplings and on new shoots of deciduous-leaved trees. Indeed, the occurrence of both types of lamina on the same rhizome hardly allows any other interpretation.

II. NEW SPECIES.

NOTHOLAENA peninsularis, sp. nov. Rhizoma breve horizontale vel adscendens, frondes plures laxae caespitosae ad 4 dm. altas emittens, paleis concoloribus castaneis vel pallide brunneis tenuibus siccitate tortis lineari-subulatis longe acuminatis integris ad 5 mm. longis 0.6 mm. latis e cellulis elongatis parietibus tenuibus compositis onustum. Stipes teres nigrescens vel saturate castaneus nitidus inferne plus minusve paleaceus, paleis eis rhizomatis similibus nisi minoribus. Lamina ovata vel ovato-lanceolata usque ad 25 cm. longa et 8 cm. lata bipinnato-pinnatifida, basi paullo angustata (pinnarum jugo infimo leviter reducto), ad apicem obtusum gradatim vel subabrupte angustata, pagina superiore sparse et minutissime ceraceo-glandulosa, inferiore dense albo-ceracea. Rachis stipiti similis, plus minusve ceraceo-glandulosa, paleis parvis tenuibus lineari-acuminatis sparse obsita. Pinae remotae ad decem-jugae imparipinnatae lineari-lanceolatae vel oblongae pleraeque 3–6 cm. longae obtusae petiolatae, costa rachi simili. Pinnulae ad 7-jugae remotae, apicales subsessiles, ceterae in petiolulis brevibus nigrescentibus articulatae, oblongo-ovatae vel majores deltoideae, basi truncatae vel subcordatae, apice obtusae, plus minusve profunde lobatae vel pinnatifidae seu basi pinnatae, lobis 2–4-jugis plerumque oblongis obtusis integris vel minute crenulatis, infimis tantum subinde liberis et leviter lobatis vel latere inferiore basi auriculatis. Costa e basi viridis. Venulae liberae pinnatae obliquae 1–2-furcatae, in frondibus fertilibus sporangia in linea unica per $\frac{3}{4}$ longitudinem gerentes, marginem crassum vix attingentes. Sporangia brevissime stipitata, annulo angusto rubro-brunneo a cellulis ca. 20 composito. Sporae triplanatae pallide brunneae diametro circa 45μ levissime asperatae vel fere laeves.

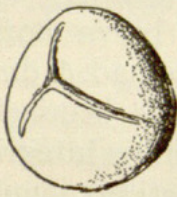
MEXICO.—BAJA CALIFORNIA: Sierra de la Laguna, from San Bernardo to El Sanz, alt. 3500 ft., Jan. 21, 1906, *Nelson & Gold-*

man 7430, TYPE, U. S. Nat. Herb. 565505. Sierra de la Laguna, Jan. 21, 1890, *Brandeggee* (G), *Brandeggee* 656 (US), Jan. 23, 1890, *Brandeggee* 650 (G, NY); Jan. 24, 1890, *Brandeggee* (US); Cota Ranch, Laguna Mts., 14 miles east of Todos Santos, Feb. 21, 1928, *M. E. Jones* 24154 (NY).

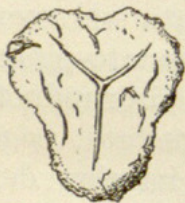
N. peninsularis is most nearly related to *N. incana*, from which it differs as follows:



1



2



3

EXPLANATION OF FIGURE

1. Spore of *Notholaena delicatula*, from *Pringle* 2581, $\times 300$. 2. Spore of *Notholaena incana* from *Pringle* 11267, $\times 330$. 3. Spore of *Notholaena Lumholtzii*, from *Hartman* 298, $\times 250$.

Lamina essentially bipinnate-pinnatifid, only the lowest lobes of the pinnules sometimes free, the lobed portion then occupying half the length of the pinnule or more; rachis more or less glandular and bearing a few small scales *N. peninsularis*.
Lamina bi- to tripinnate; pinnules simple and entire to fully imparipinnate, the terminal segment, if lobed, occupying less than half the length of the pinnule; rachis glabrous and without scales *N. incana*.

From all other members of the group of *N. nivea*, *N. peninsularis* is distinguished by its less divided lamina, its somewhat glandular rachis bearing a few small persistent scales, and its nearly smooth spores. From species in other groups of *Notholaena* it is separated by characters of habit, sori, and indument.

NOTHOLAENA Lumholtzii, sp. nov. Rhizoma breve erectum, frondes plures ad 12 cm. longas dense caespitosas emittens, paleis lineari-ligulatis longe acuminatis circa 4 mm. longis 0.4–0.5 mm. latis integris tenuibus siccatis plus minusve crispatis rufo-brunneis concoloribus e cellulis elongatis parietibus tenuibus compositis dense onustum. Stipes quam lamina brevior gracilis teres nigra plus minusve glauca glabra. Lamina deltoideo-lanceolata vel deltoideo-ovata 7–8 cm. longa 5–7 cm. lata ut videtur bipinnata tantum, apicem versus pinnata, nulla parte pinnatifida. Rachis costaeque stipiti similes. Pinnae suboppositae vel alternae remotae circa 7-jugae oblongae, basales 2.5–3.5 cm. longae, perfecte imparipinnatae. Pinnulae herbaceae vel subcoriaceae remotae omnino simplices nec lobatae glabrae glauco-virides integrae, terminales deltoideae 5–7 mm. longae et latae e basi truncato vel late cuneato in apicem obtusum aequaliter angustatae, laterales 1–4-jugae

plerumque oblongae vel deltoideo-ovatae obtusae breviter petiolatae obscure articulatae, marginibus herbaceis nec hyalinis leviter vel nullo modo revolutis. Nervatio pinnata, venulis liberis e costula basin versus nigrescente superne viridi angulo acuto egredientibus 1-3-furcatis, ramulis ultimis apicem versus (venulae longitudinis ad quartam partem) leviter incrassatis sporangiferis, soros angustos sublineares formantibus. Sporangia brevissime stipitata, annulo brevi ex comparatione lato e cellulis 10-13 composito. Sporae circumscriptione circulares vel obtuse subtrilobatae ad 72μ diametro, jugis tenuibus humilibus brevibus fuscis flexuosis vel fere rectis sparsis leviter asperatae.

MEXICO.—SONORA: Huehuerachi, 4000 ft. alt., Dec. 7, 1900, *Hartman* (Lumholtz Exped.) 298 (G, US, TYPE); same locality, Dec. 20, 1890, *F. E. Lloyd* (Lumholtz Exped.) 489 (G).

N. Lumholtzii is probably most nearly related to *N. Jonesii* Maxon, from which it differs in its relatively slender, black, somewhat glaucous stipe and rachis, its strictly bipinnate habit, without pinnatifid tip or lobed terminal segment at the apex either of the lamina or the pinnae, and the shape, size, and texture of the pinnules. From *Pellaea microphylla*, which it suggests in its strictly imparipinnate habit, it differs in the color of stipe and rachis, the simpler architecture of the lamina, the non-cordate bases of the pinnules, and the only lightly rugose spores.

2. STUDIES IN THE BROMELIACEAE,—X.

BY LYMAN B. SMITH.

Pitcairnia biflora, spec. nov., e fragmentis solum cognita, florifera 4 dm. alta; folio unico cognito 4 dm. longo, integro, longe petiolato, petiolo gracillimo, sparse pallido-lepidoto; lamina lineari-lanceolata, 22 mm. lata, filiformi-acuminata, glabra, subtus pallida; scapo gracillimo, sparse lepidoto, rubro; scapi bracteis valde remotis, late ovatis, acuminatis; inflorescentia laxe biflora; bracteis florigeris late ovatis, acuminatis, membranaceis, rubris, quam pedicellos bene brevioribus; pedicellis gracilibus, 1-2 cm. longis; floribus erectis, glabris; sepalis anguste ellipticis, obtusis, 25 mm. longis, ecarinatis; petalis angustis, obtusis, 6 cm. longis, basi ligulatis, rubris vel albis; ovario $2/3$ supero; ovulis caudatis. Tab. I, fig. 1-3.



Maxon, William R. and Weatherby, Charles Alfred. 1939. "Some species of Notholaena, new and old." *Contributions from the Gray Herbarium of Harvard University* (127), 3–17. <https://doi.org/10.5962/p.336228>.

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