

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 37.

November, 1935.

No. 442.

A NEW VARIETY OF CYSTOPTERIS FRAGILIS AND SOME OLD ONES

C. A. WEATHERBY

(Plate 383)

CYSTOPTERIS FRAGILIS (L.) Bernh., var. **protrusa**, n. var., rhizomate longe repents, basibus frondium decisarum sparse tantum onusto, apice vix paleaceo ultra frondes viventes 2-4 cm. producto; lamina adulta 11-22 cm. longa, 5-11.5 cm. lata, fere bipinnato-pinnatifida, pinnis ovatis vel ovato-lanceolatis acutis, pinnulis basin versus pinnae deltoideo-ovatis vel ovato-lanceolatis subacutis plerumque breviter sed evidenter marginato-petiolulatis, profunde pinnatifidis, lobis oblongis obtusis, in lamina juvenili vel depauperata levius incisus obtusioribusque; indusio brevi, c. 0.5 mm. longo, apice leviter lobato vel fere integro. TAB 383, FIGS. 1 et 5.

Rootstock creeping, only sparsely beset with bases of old fronds, the growing point hardly paleaceous, produced 2-4 cm. beyond the fronds of the season; well-developed blades nearly bipinnate-pinnatifid, 11-22 cm. long, 5-11.5 cm. wide, pinnae ovate to ovate-lanceolate, acute, pinnules toward the base of the pinnae deltoid-ovate to ovate-lanceolate, subacute, usually shortly but distinctly petiolulate, deeply pinnatifid into oblong, obtuse lobes; in juvenile or depauperate blades less lobed and more obtuse; indusium about 0.5 mm. long, shallowly lobed or nearly entire at apex. Southern New York, south in the piedmont and the mountains to Alabama, west to Minnesota and Missouri. Apparently in alluvial or loamy soil in woods. NEW YORK: Bloodroot Valley, Staten Island, July 14, 1905, *Dowell* 3884. MARYLAND: near Cabin John, Montgomery Co., Aug. 1, 1920, *Maxon* 6495. DISTRICT OF COLUMBIA: High Island, June 23, 1897, *Holm*. NORTH CAROLINA: Old Fort, *W. Faxon*; near Swannanoa Tunnel, Buncombe Co., July 8, 1898, *Biltmore Herb.* 144°. OHIO: without definite locality, *J. G. Lea*; Cambridge, July, 1896, *Caro M. Taylor*; near Cincinnati, June 8, 1888, *J. G. Lloyd*. INDIANA: Harrison tp., Wells Co., July 21, 1907, *Deam* 2323. KENTUCKY: prope North Bend, *Short*; Hawesville, Hancock Co., June 9, 1920, *E. J. Palmer* 17800; near

Vertrees, Hardin Co., Sept. 6, 1927, *Wherry & Pennell* 13632. TENNESSEE: Knoxville, June 5, 1898, *Ruth* 564 (TYPE, in Gray Herb.). ALABAMA: ravine along Black Warrior River, Tuscaloosa Co., April 14, 1929, *E. J. Palmer*, no. 35,373. ILLINOIS: Grand Tower, May 9, 1902, *Gleason*. MINNESOTA: Spring Grove, June 8, 1902, *Rosendahl* 404. MISSOURI: Worth, Worth Co., May 19, 1929, *E. J. Palmer* 36776; Joplin, Jasper Co., May 1, 1922, *Palmer* 21036; Carthage, July 12, 1910, *Palmer* 3018; Creve Coeur Lake, June 12, 1904, *W. W. Lyon*. Specimens from near Knoxville, Tennessee, June 5, 1929, *Wherry & Benedict* and from Muscle Shoals, Alabama, May 8, 1929, *Wherry*, show transitions to var. *Mackayii*.

Var. *protrusa* was detected some years ago by the keen eye of Prof. Fernald and by him was brought to my attention. It is the best marked of the four geographic variants of *C. fragilis* which can be recognized in eastern North America, being generally rather well distinguished by its combination of creeping rootstock, short-petiolulate basal pinnules and short indusium. Except for the transitions by which it is connected with var. *Mackayii* (to be discussed below) and through it with typical *C. fragilis*, it might almost pass for a species. It probably formed at least part of the concept of *C. tenuis*, generally kept up as a species by the English fern-specialists of the mid-nineteenth century—at least, that was usually described as having a creeping rootstock (cf. Moore, *Nature-Printed Brit. Ferns*, 8° ed., ii. 261 (1859)). The Short and Lea specimens cited above were originally determined as *C. tenuis*. Judging from his description, Milde (Fil. Eur. 153 (1867)) had a specimen of it from Pennsylvania; but it must have lacked a rootstock, for he could find no distinguishing character in it except the short indusium, which he duly noted. Var. *protrusa* is not, however, *Nephrodium tenue* Michx., the nomenclatural base of *C. tenuis*; that, as shown by a photograph of the type before me, is var. *Mackayii*.

The following key attempts to place var. *protrusa* in relation to the other geographic variants of *C. fragilis* in eastern North America. It is presented with the caveat that too much is not to be expected of it. Clear definition in this group is not easy. Leaf-form varies widely both within and between varieties. The characters of the indusium are none too constant and, in any case are hard to make out because of the fragility of that organ and the consequent difficulty of getting good dissections.¹ The key, then, in all probability will not

¹ So much is this the case, that of all the illustrations of *C. fragilis* which I have seen, only those of the always accurate and painstaking Christian Schkuhr truly represent the indusium. The almost scale-like character which he ascribes to *Aspidium tenue*, as he called it, can be perfectly matched in young specimens in the Gray Herbarium. Cf. Schkuhr, *Krypt. Gewächse*, pls. 53b, 54.

furnish the means of naming *every* specimen in this variable complex; nor does the treatment which it sets forth settle all questions which may arise.¹ But I believe it does indicate real foci of geographic segregation.

- a. Rootstock oblique or horizontal, short, or, if elongate, thickly beset with bases of old fronds, the growing point usually conspicuously paleaceous, not produced horizontally beyond the fronds of the season; basal secondary segments usually sessile (subpetiolulate in large fronds of var. *Mackayii*) b.
- b. Indusium relatively large, up to 1 mm. long, more or less deeply cleft at apex; at least the basal secondary segments of the blade not evenly cuneate at base, from nearly orbicular to deltoid-lanceolate c.
- c. Indusium glabrous; plant usually not more than 2.5 dm. in height *C. fragilis* (typical)
- c. Indusium sparsely and minutely glandular on the back; plants usually larger, up to 5 dm. high var. *laurentiana*.
- b. Indusium about 0.5 mm. long, shallowly lobed or nearly entire: blade often only pinnate-pinnatifid, the basal secondary segments cuneate at base, oblong to obovate, only shallowly toothed or lobed and with broad, rounded apex, if more deeply lobed often lanceolate or oblong-lanceolate var. *Mackayii*.
- a. Rootstock long-repent, the growing point scarcely paleaceous, produced horizontally 2–4 cm. beyond the fronds of the season; basal secondary segments (pinnules) with a definite margined petiolule; indusium as in var. *Mackayii* var. *protrusa*.

CYSTOPTERIS FRAGILIS (L.) Bernh. Schrader's Journal i, pt. 2, 26, t. 2, fig. 9 (1806). *Polypodium fragile* L. Sp. Pl. ii. 1091 (1753).²—Eurasia; in America across the North from Greenland to Alaska, south commonly to northern New England, the region of the Great Lakes (and perhaps sporadically farther in the East), Missouri, western Texas and southern California. The widely distributed collection, *Fernald, Wiegand, Bartram & Darlington* 4314, from Grand Falls, Newfoundland, July 10, 1911, may stand as representative of the American plant.

Linnaeus had no specimen of *Polypodium fragile* in his herbarium in 1753. The species rests on several unillustrated references to literature, including Linnaeus's own *Flora Suecica* and *Flora Lapponica*, and one to Plukenet's *Almagestum*, pl. 180, fig. 4. This represents, accurately enough, the commonest leaf-form in the species, with lance-ovate, acute pinnae and deltoid-ovate to deltoid-lanceolate sessile basal secondary segments, which are narrowed rather evenly

¹ For instance, the American specimens here referred to typical *C. fragilis* show a greater tendency to develop elongate, horizontal rootstocks than does Old World material at hand or than is indicated by European descriptions. But the American tendency is by no means uniform and appears to be associated with no other character; at present, I cannot see that it offers any clear basis for further segregation.

² For full European synonymy, see Luerssen in Rabenhorst, *Krypt.-Fl. Deutschl.* iii. 451 (1889).

from near the base to a blunt point. In the absence of a specimen, this figure should stand as the type of the species.

In eastern North America, the species shows two opposite extremes in leaf-form, to which Lawson, D. C. Eaton, Macoun & Burgess, Gilbert, Farwell and Clute have applied, probably correctly, names originally based on European material. These forms are:

Forma **DENTATA** (Dickson) Clute, Fern Bulletin xiv. 120 (1906). *Polypodium dentatum* Dicks. Fasc. Plant. Crypt. Brit. iii. no. 1, t. 7, fig. 1 (1793). Lamina scarcely more than pinnate-pinnatifid, secondary divisions only shallowly lobed and very obtuse, their lobes also obtuse. Distinguished from var. *Mackayii* only by its broad-based secondary segments and long indusia.

Forma **ANGUSTATA** (Hoffmann) Clute, l. c. *Polypodium fragile angustatum* Hoffm. in Roemer & Usteri, Mag. Bot. ix. 11, fig. 14d (1790). Lamina pinnate-bipinnatifid, secondary divisions lanceolate, both they and their lobes acute.

In Missouri and Oklahoma, *C. fragilis* passes into an ill-defined but, in its extreme, striking form, with rather broadly deltoid obtuse pinnae, often more than half as wide as long, obtuse secondary segments, the outer often linear-oblong with nearly parallel sides, and, curiously, rather uniformly large and conspicuous sori. This resembles small fronds of *C. bulbifera* and has been taken for that species. It was long ago observed and described, but not given a name, by Milde¹ who had a specimen from Missouri collected by Engelmann and, though he could see little in his material of var. *protrusa*, considered this "Formam memorabilem, fortasse speciem distinctam." It may be worth designating as:

Forma **simulans**, f. nov., pinnis deltoideis, obtusis, segmentis secundi ordinis obtusis saepe anguste oblongis, soris magnis. A specimen in the Gray Herbarium collected in woods, La Grange, Missouri, Sept. 14, 1911, *John Davis*, may serve as type.

Rarely, and rather evidently as a response to unusual conditions of growth (such as, perhaps, the burying of the plant under leaf-mold or earth), typical *C. fragilis* produces repent rootstocks as long and as sparsely beset with old leaf-bases as in var. *protrusa*. Macoun & Burgess (Trans. Roy. Soc. Can. 1884. 214) record one case, at London, Ontario (presumably, but not quite necessarily, referable to the typical form) in which the rootstock was a foot long and branched. Even so, the rootstock is not produced beyond the fronds of the season. D. C. Eaton's figure (Ferns N. Am. ii. pl. 53, fig. 1 (1879)) was evidently drawn from an aberrant plant of this sort. The ap-

¹ Fil Eur. 154 (1867).

parent clavate projection beyond the frond-base is, as close inspection of the drawing and similar material (Selkirk Mts., British Columbia, Shaw 1095) in the Gray Herbarium show, not really part of the root-stock, but a cluster of young fronds.

Var. LAURENTIANA Weatherby, RHODORA xxviii. 130 (1926). Originally known only from the region about the Gulf of St. Lawrence, but recently discovered at three localities in the Bruce Peninsula, Ontario—Driftwood Cove, Tobermory, Aug. 21, 1933, *T. M. C. Taylor* 6109; Stokes Bay, July 3, 1934, *Taylor* 9586; Barrow Bay, Aug. 25, 1934, *Krotkov* 9590.

Var. MACKAYII Lawson, Fern Flora of Canada, 233 (1889). *Nephrodium tenue* Michx. Fl. Bor.-Am. ii. 269 (1803). *Aspidium tenue* Sw. Syn. Fil. 58 (1806); Schkuhr, Krypt. Gewächse 196, t. 53b (at least as to left-hand figure and indusium) (1815). *Athyrium tenue* Presl Rel. Haenk. i. 39, in obs. (1825). *Cystopteris tenuis* Desv. Mém. Soc. Linn. Paris vi. 263 (1827). *C. Filix-fragilis*, var. *tenuis* Farwell, Rep. Mich. Acad. Sci. vi. 200 (1904), at least as to name-bringing synonym. Not *C. fragilis*, var. *tenuis* Milde, Fil Eur. 149 (1867).—Nova Scotia and southern Quebec to Virginia and occasionally westward to Wisconsin, Illinois, Missouri and the Black Hills of South Dakota. The prevailing form in southern New England; apparently not common elsewhere—Representative specimens are as follows. QUEBEC: Cleveland, July 20, 1923, *Chamberlain & Knowlton*. NEW BRUNSWICK: Grand Manan, Aug. 11, 1926, *Weatherby* 5600. NOVA SCOTIA: near West River, Lime Rock, Pictou Co., July 21, 1875 and northeast of Mt. Dalhousie, Pictou, Sept. 16, 1876, *Mackay*; George River, Aug. 29, 1920, *Bissell & Linder* 19471. MAINE: Cascade Brook, T. XVIII, Range 10, July 21, 1893, *Fernald* 208. NEW HAMPSHIRE: Gap Mt., Troy, May 30, 1898, *Rand & Robinson* 1028. VERMONT: Hartford, July 23, 1890, *Kennedy*. MASSACHUSETTS: Granville, June 26, 1914, *Seymour* 204. CONNECTICUT: Gaylordsville, July 14, 1887, *Holden*. NEW YORK: Thousand Island Park, Jefferson Co., July 2, 1902, *Robinson & Maxon* 76; Ithaca, June 18, 1916, *Wiegand* 5392. DELAWARE: Mt. Cuba, July 13, 1873, *Commons*. VIRGINIA: Stony Man Mt., Aug. 19, 1901, *Steele* 141. ILLINOIS: Starved Rock, La Salle Co., June 1–7, 1909, *Greenman, Lansing & Dixon* 168. SOUTH DAKOTA: Williams, Black Hills Region, Aug., 1891, *Thornber*.

A weaker variety than var. *protrusa*, depending on the association of short indusia and cuneate-based basal secondary segments and on its concentration in a geographic area lying between the regions inhabited by the typical form and that variety. In other respects also, such as the indusium and a tendency, in its larger forms to develop somewhat petiolulate segments, it forms somewhat of a transition between the typical form and var. *protrusa*.

I have not seen Lawson's type, but material furnished Davenport

by Mackay and now in the Davenport Fern Herbarium is presumably authentic. As previously noted, there is no doubt that Michaux's *Nephrodium tenue*, from southern Quebec, belongs here, though his name cannot be used in the varietal category.

Where *C. fragilis*, forma *magnasora* Clute, Fern Bulletin ix. 65 (1901) belongs, I do not know.

EXPLANATION OF PLATE 383

Fig. 1, Frond of *Cystopteris fragilis*, var. *protrusa* $\times \frac{1}{2}$; 1a, pinna of the same $\times 1$, both from *Biltmore Herb.* no. 144c; 2, pinna of var. *Mackayii* $\times 1$, from a specimen collected at Hartford, Vermont, by *Kennedy*; 3, pinna of *f. simulans* $\times 1$, from the type specimen; 4, pinna of typical *C. fragilis*, $\times 1$, from a specimen collected by Collins & Fernald at Rivière du Loup, Quebec; 5, indusium of vars. *Mackayii* and *protrusa*, approximately $\times 20$; 6, indusium of typical *C. fragilis*, approximately $\times 15$. Both indusia after Schkuhr.

GRAY HERBARIUM.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. CIX.

MIDSUMMER VASCULAR PLANTS OF SOUTHEASTERN VIRGINIA

M. L. FERNALD

(Plates 384-405)

STIMULATED by the success of the brief botanical trip to Princess Anne and Norfolk Counties, Virginia, made by Mr. Griscom and me in September, 1933, and reported upon in the paper, *Three Days of Botanizing in Southeastern Virginia*,¹ I induced Mr. Bayard Long to join me for a midsummer trip to the same area in 1934. Mr. Griscom being then in Europe it was necessary to forego his always cheerful and stimulating companionship. Accompanied by my son, Mr. Henry G. Fernald, as chauffeur and photographer, Mr. Long and I reached Virginia Beach on July 27. We had expected to stay four or five days but the pressure of interesting plants and those new to the area forced us to prolong the stay until August 9; and even then, on our last half-day in the field we brought in more than a score of species not previously reported from Princess Anne County. When we left, therefore, we were fully aware of the vast amount of exploration still needed and the desirability of further studies in the region.

¹ Fernald & Griscom, RHODORA, xxxvii. 129-157, 167-189, plates 332-351. Contrib. Gray Herb. no. cvii (1935).



Weatherby, Charles Alfred. 1935. "A NEW VARIETY OF CYSTOPTERIS FRAGILIS AND SOME OLD ONES." *Rhodora* 37, 373–378.

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