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Plants from the estuary of the Hudson River

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Early in the fall of 1933 Mr. Max Elwert brought me specimens of *Plantago cordata* Lam. collected in the Hudson River at Red Hook, Dutchess County, with some photographs of the habitat of this remarkable species.

Plantago cordata is primarily a plant of the Mississippi valley and the Great Lakes region, its only record from the New York area, according to Taylor (Fl. Vic. N. Y. 568, 1915), being "an old collection made at Mattewan, New York, many years ago." Torrey (Fl. N. Y. 2: 15. 1843) however, cites it from "Manhattanville on the Island of New York, and near Fishkill in Dutchess County." Mr. Elwert first took me to the south bay of Crueger Island on September 21, 1933, where a number of plants grew on a protected gravel beach. This colony was said to be small in comparison with the hundreds of plants to be seen at Stony Creek, about a mile to the northward, and a later visit to this interesting locality showed large plants and innumerable seedlings covering the rocky shores where they were submerged at high tide level. *Plantago cordata* has the outward appearance of a robust *P. major*, but is easily differentiated by the thick fleshy roots and the attractive appearance of the purplish flowering spikes which appear in the spring. Mr. Elwert and I again visited Rocky Creek on October 11, 1934, fortified this time by a pair of rubber boots, and despite the damage of early frosts we found the *Plantago* and many other interesting plants of the tidal shores in good condition. *Plantago cordata* was also collected by me at Catskill, Greene County, in 1934 (Svenson no. 6275). Like *Samolus floribundus* and several other species of wide distribution in the interior, *Plantago cordata* is evidently a strictly estuarine plant at the northeastern limit

of its range, but it appears to occupy a zone much higher than the other estuarine plants.

ISOETES RIPARIA Engelm. Plants of *Isoetes* (nos. 6108, 6437), which clearly belong to the *I. saccharata*-*I. riparia* complex, were found sparingly in the tidal mud on both visits. A rather poor specimen of the earlier collection (no. 6108) was submitted



Plantago cordata

to the late T. Chalkley Palmer who said that its identity could not be certain, but that it was almost certainly not *I. Eatoni* which it resembled in spore characters, and that he could not call it *I. saccharata*, and that similar semiabortive spores (measuring $376-423\mu$) were found in young or spindly *I. riparia*. The plants (no. 6437) were of moderate size (leaves 10-15 cm. long) with strongly bilobed dark corms, and megasporangia in which the spores averaged 400μ in diameter. The markings consisted of close-set high jagged crests, which appeared identical with

those in a collection of *I. riparia* by Commons at Newcastle, Delaware (specimen in herb. Brooklyn Botanic Garden), with traces here and there of a fine reticulum. The megaspores were also a good match for the illustration of *I. riparia* by Clute.¹ Through the kindness of Dr. Pennell, I examined several sheets (from the herbarium of the Philadelphia Academy of Sciences) of *I. saccharata* from the Delaware region, named by Palmer. These have megaspores with low crests conforming to the accepted characterization of *I. saccharata*. The question of specific differentiation between *I. saccharata* and *I. riparia* remains as indefinite as it was when Shull² discussed the problem, but the Red Hook material apparently belongs with the deep-crested phase known as *I. riparia*. The only species of *Isoetes* previously recorded from the Hudson River appears to be *I. Engelmanni* (Pfeiffer, Ann. Missouri Bot. Garden, 9: 204. 1922). Dr. Gleason has kindly lent me the material at the New York Botanical Garden representing the collection by LeRoy in 1868 from tidal shores at Peekskill, but this collection has megaspores in too young a stage to arrive at any definite conclusion as to the species. The occurrence of *Isoetes riparia* was to be expected in New York, since it has been recorded from New England and from the Delaware and Passaic Rivers (Pfeiffer, l.c. p. 182).

ERIOCAULON PARKERI Robinson. This species, easily recognized by the small blackish heads, occurred sparingly on the tidal shores (no. 6463). It is confined to river estuaries from Maine to Virginia (cf. Fassett, Proc. Boston Soc. Nat. Hist. 39: 99. 1928) and its occurrence at Stony Creek makes the plant a new record for New York.

POLYGONUM SAGITTATUM f. CHLORANTHUM Fernald, (Rhodora 19: 134. 1917). The green-flowered form was described from the tidal mud-flats at Bowdoinham, Maine, but it is also common, according to Fassett (l.c., p. 107), on the estuaries of the Merrimac and Connecticut Rivers. It is ordinarily submerged at high tide, and in the specimens collected by us at Stony Creek (no. 6444) was characterized by a conspicuous large petal-like calyx which reached a length of 4.5 and even 5 mm. The calyx of the common pink form averages 3.7 mm. and in no speci-

¹ The Fern Allies, New York 1905 (p. 239).

² Bot. Gazette 36: 200. 1903.

mens examined did it approach the estuarine material in size. The ripe fruit (3.0×2.0 mm.) is the same size as in typical *P. sagittatum*. Fassett has noted (l.c.) that the green-flowered form is found elsewhere than on estuaries. I have found it rather common in the late fall on Long Island where it has flowers of normal size.

PENTHORUM SEDOIDES L. f. **leucosperma**, n. var., a forma typica recedit seminibus albis. The seeds of *P. sedoides* are ordinarily deep brown, but in the sprawling plants (no. 6434, TYPE in herb. Brooklyn Botanic Garden), obtained between high and low tide levels at Stony Brook, the seeds are white or cream colored, only the axis to which they are attached showing any orange-brown coloration. These specimens have a greatly reduced green inflorescence which does not show the brownish color of pistils and filaments ordinarily seen in the typical plants.

LUDVIGIA PALUSTRIS (L.) Elliott var. **inundata** n. var.—Caulo plerumque simplice elongato crassoque fructifero, foliis viridibus, seminis 0.7–0.8 mm. longis, albis vel leviter stramineis. Differt a planta typica caulibus elongatis viridibus et seminibus majoribus albidis.

Differs from typical *L. palustris* in the rather thick simple elongated stems, wholly green color, and larger whitish seeds. Submerged on shores of tidal streams, New York to Maryland. NEW YORK: tidal mud of Rocky Creek, Red Hook, Dutchess County, *M. E. Elwert* and *H. K. Svenson* no. 6446 (TYPE in herb. Brooklyn Botanic Garden); tidal shores of Hudson River, Coeymans, Albany County, *Svenson* no. 5496 (seeds 0.7 mm. long). NEW JERSEY: Taylor, Burlington County, *H. B. Meredith* (seeds whitish to straw-colored, 0.76 mm. long); Camden, *C. H. Brice* (seeds straw-colored, 0.8 mm. long); shores of Delaware River, Burlington County, *Bayard Long* (seeds white, 0.75 mm. long). PENNSYLVANIA: shores of Delaware River, Delair County, *Bayard Long* (seeds white, 0.76 mm. long). MARYLAND: tidal shores, Elkton, *Svenson* no. 3479 (seeds 0.77 mm. long).

The *Ludvigia* collected on the tidal shores at Rocky Creek had an appearance strikingly different from the reddish sprawling plant commonly seen in ditches and on pond shores, the plants being entirely green with leaves confined for the most

part to the ends of the long unbranched stem, the numerous fruits remaining conspicuously on the leafless parts. It is assumed that the stems become more or less erect during high water, with the cluster of leaves reaching nearly or quite to the surface. The fruits appear somewhat thicker than usual in *L. palustris* and contain large white to straw-colored seeds (averaging 0.7–0.8 mm. long³); the cinnamon-colored to brown seeds of the plants of northern United States and of Europe run from 0.5–0.65 mm. and very rarely 0.7 mm. in length. Most of the estuarine plants were exceptionally robust, the stems exceeding 3 dm. in length, but even minute plants only a few centimeters high had seeds 0.7 mm. long. The flowers were minute even for this species with extremely small flowers, a reduction undoubtedly paralleling that in other estuarine plants, for example *Ilysanthes dubia* var. *inundata*.

This material was strikingly similar to previous collections made by me at Coeymans on the opposite shore of the Hudson River, 1932, and from Chesapeake Bay, and this fact suggested that the same type of plant ought to occur in the estuary of the Delaware River. Through the kindness of Dr. Pennell, I have examined specimens from the herbarium of the Philadelphia Academy of Natural Sciences and it is from this material that I have cited stations for var. *inundata* from New Jersey and Pennsylvania.

It is obvious that this variety is not the same as *L. palustris* (L.) Ell. f. *submersa* (Gluck) E. H. Eames (*Rhodora* 35: 229. 1933) which was a renaming of the sterile branched deepwater form of Europe. I do not believe that it can be associated with the poorly defined *Isnardia palustris* β *americana* DC. (*Prod.* 3: 61. 1828) differentiated only by "foliis untrinque magis acuminatis" and based primarily upon plants from southern United States.

Although small purplish rudimentary petals were reported in *Ludvigia palustris* by Torrey (*Fl. N. Y.* 1: 238. 1843) and have been mentioned by subsequent writers, no sign of such structures, with a single exception, has been observed by me in examination of a large amount of material. In a collection of *L. palustris* by E. J. Palmer (no. 12235) from Kerr County, Texas, four

³ Average measurements were obtained from ten seeds.

whitish petals up to 2 mm. in length with much narrowed base, were inserted alternately with the four glandular structures which Meehan (Proc. Phila. Acad. Nat. Sci. 51: 95. 1899) considered, probably incorrectly, as representing modified petals. Palmer's collection has plump rounded seeds and should perhaps be identified with *L. natans* Ell.

The name *Isnardia ascendens* Hall in Eaton, Man. N. Amer. Bot. ed. 7: 353. 1836, is of importance, especially since the species came from Albany. It was described as having a "stem obliquely ascending, rigid, (never creeping or prostrate) somewhat angular, reddish, grows with the *palustris*, but is generally smaller and quite different in appearance." This description seems to have had its origin from Wright and Hall (Plants Vic. Troy, 22. 1836) where *Isnardia palustris* has the notation, "A variety of this or another species, with an ascending, rigid stem, flowering in August, grows 3 miles west of Albany." This last citation might well place *Isnardia ascendens* at the site of the station for *Ammannia humilis* Michx. [*Rotala ramosior* (L.) Koehne] given by Paine (Cat. Pl. Oneida Co. 134. 1865): "Around sandy pools and banks of rivulets in the Pine barrens between Albany and Schenectady, near the Central railroad and Centre station. Rare. July, August." *Ludvigia palustris* and *Rotala ramosior* often have a strong superficial resemblance and the description of *Rotala* in Britton & Brown (Illus. Fl. ed. 2, 2: 579. 1913), "4-angled stems . . . ascending or erect" corresponds in some respects to the stated characteristics of *Isnardia ascendens*. Until Hall's specimen can be located, no definite judgment can be passed. Dr. H. D. House, in response to my inquiry, has written that the type of *I. ascendens* has not been located, and that the fate of Hall's herbarium is unknown. In whatever way the name *Isnardia ascendens* may be disposed of, it is apparent that it does not apply to the estuarine variety of *Ludvigia palustris*.

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A collection issued by me as *Rotala ramosior* from Hollow Rock, Tennessee (Svenson no. 4386) differs from all other specimens I have seen, in possessing a remarkable woody rootstock 3 mm. thick. In this specimen the white seeds average 0.65 mm., but the small leaves and arcuate branches place it closer to the slender southern phase of *L. palustris* (*L. nitida* Michx.

Fl. Bor. Am. 1: 87. 1803), which has seeds 0.4–0.65 mm. long, varying from brown to whitish.

LIMOSELLA SUBULATA Ives (cf. Fassett, l.c., p. 105). This diminutive species of the Scrophulariaceae is more tolerant of saline conditions than the other estuarine species found at Rocky Creek, where it was associated sparingly (no. 6442) with *Isoetes riparia* and *Eriocaulon Parkeri*. It is known from several stations on Long Island and has been previously recorded from as far north as Peekskill on the Hudson River (House, N. Y. State Mus. Bull. 254: 623. 1924).

HEMIANTHUS MICRANTHUS (Pursh) Pennell (*Micranthemum micranthemoides* (Nutt.) Wettst. Known previously only from the tidal flats of the lower Delaware River and southward, occupying with *Heteranthera reniformis* the tiny pools left by the receding tide (no. 6109). On our second visit only fragmentary material was observed, and it was obvious that the plants had suffered severely from frost.

ILYSANTHES DUBIA (L.) Barnhart var. *INUNDATA* Pennell, *Torreyia* 19: 149. 1919. No specimens of *Ilysanthes* were collected at Stony Creek, but the plants of the submerged shores are undoubtedly the same as material obtained at Coeymans (*Svenson* no. 5495) on the opposite shore of the Hudson River. The variety has previously been known from the Passaic River to the Potomac River, and is cleistogamous (Pennell, *Bartonia* 8: 10. 1924). In no. 5495 the corollas are rudimentary, not exceeding 2 mm., whereas in typical *I. dubia* they are 5–10 mm. long.

BIDENS HYPERBOREA Greene. This estuarine species, composed of several geographic variants, extends southward from Hudson Bay to northeastern Massachusetts, and according to Fassett (l.c. p. 104) is known from a single collection (1827) from the Hackensack marshes of New Jersey. This is the first occurrence in New York State. At Rocky Creek, *B. hyperborea* was accompanied by *B. laevis*, *B. frondosa* var. *anomala*, *B. bidentoides* and *B. Eatoni* var. *major*, all of which are common on tidal shores of the Hudson River from Albany to Peekskill. Both *E. connata* and *E. Eatoni* var. *major* are represented in the numerous collections which I have made over a period of years from the Hudson estuary, by forms with downward, upward, and intermediately barbed achenes.

The foregoing treatment of unusual items gives no conception of the almost tropical richness of vegetation along the upper tidal reaches of the Hudson River. The broad expanse of quiet water supports great stands of *Typha latifolia*, and *Scirpus validus*. With these are mingled wild rice (*Zizania aquatica*) and enormous masses of the cow lily (*Nymphoanthus advena*), here reaching its northeastern limit except for an isolated station at the mouth of the Kennebec River. The golden club (*Orontium aquaticum*) is abundant and achieves a surprising development. The small tidal tributaries, such as Stony Creek, are choked by masses of *Vallisneria americana*, *Anacharis occidentalis*, *Heteranthera graminea*, *Myriophyllum humile* (no. 6430) and *Potamogeton Spirillus*, and I have collected the rarer *P. Vaseyi* (no. 6274) and *P. zosterifolius* (no. 6271) at the mouth of the Catskill on the opposite shore of the Hudson River. The margins of these small streams are frequently lined with *Sagittaria heterophylla*, and submerged in quiet places is usually an abundance of *Lemna trisulca*.

Turf often occupies the shores at the high-tide limit where the submergence is not so prolonged and here among other plants at Stony Creek grew *Juncus brachycephalus* (no. 6439, determined by F. J. Hermann), *J. Dudleyi* (no. 6027), and *Mentha arvensis* var. *glabrata* (no. 6429). The asters which occupy the submerged zone are *A. lateriflorus* var. *hirsuticaulis* (no. 6027), *A. pilosus* Willd. var. *demotus* Blake (*A. ericoides* of Gray Man. ed. 7) (no. 6112) which is greatly dwarfed, and *A. puniceus* L. var. *firmus* T. & G. (no. 6431). The last, represented by narrow unbranched plants, flowers when only 4-5 dm. high.

Above the influence of the tide and occupying the clayey banks were a number of species of interest, among them the indigenous *Physostegia virginiana* (nos. 6113, 6432) which according to House, (l.c. p. 597) is "infrequent or rare from Lake Champlain and Oneida County southward and westward." Occasional on these banks but becoming abundant in nearby alder thickets, was the true *Gentiana Andrewsii* (cf. Fernald, *Rhodora* 19: 147. 1917) which has the appearance of *G. Saponaria* but is easily recognized by the corolla fringes which project from the narrowed apex of the flower. *G. Andrewsii* is chiefly a western species, which has been confused with *G. clausa*, the common species of the New England uplands. *Pedicularis lanceolata* ap-

peared just above the high tide level and on the rocky slopes Mr. Elwert had found clumps of the fragrant sumach, *Rhus canadensis*, a species of sufficient rarity in eastern New York to receive attention. Although Taylor (l.c. p. 429) cites it only from a single station (Guilford, Conn.) in the New York area, it is noted by House (l.c. p. 476) as "locally common from Lake Champlain south to the Hudson highlands." I had previously seen *Rhus canadensis* growing abundantly on a rocky headland projecting into the Hudson River at Malden, Ulster County.

It is evident from these foregoing records of interesting plants, a number of them new to New York State, that this rich area has been insufficiently explored by botanists.

BROOKLYN BOTANIC GARDEN