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probable that the glaciers advanced and receded with the changes of seasons, and with each recession of the ice the lichens were given a new lease of life. Thus while the higher plants from the east and the west met on the barren prairies of Iowa, those from the west at first predominating, and while their advance was probably respectively from the southeast and southwest, the lichens of the rocky ledges and boulders came to us from the north and represent the oldest flora in the state.

NOTES ON AQUATIC PLANTS FROM NORTHERN IOWA.

BY B. SHIMEK.

The aquatic flora of northern and northwestern Iowa is of great interest, and it deserves especial attention because the occupancy of that part of the state by agricultural man is rapidly transforming the "Thousand Lake Region of Iowa," as the early settlers called it, into thousands of pastures, flax fields and wheat fields.

The lakes and ponds are being drained either artificially or by the changes in surface conditions, and while it is probable that the aquatic flora will persist in the larger lakes for a long time, it will certainly be restricted; it is, in fact, already restricted, and if these large lakes change as rapidly as Clear lake, Spirit lake and Lake Okoboji (to say nothing of smaller ones) have in the past few years, Iowa will soon know no lakes. It is important, therefore, that the history of the aquatic plants of the northern part of the state be as complete as possible, and that specimens of these plants be preserved for future reference.

Various scattered notes on this flora have been published, but thus far only one paper specially devoted to it has appeared. Early in the year Mr. R. I. Cratty published* an admirable paper on the aquatic flowering plants of Iowa, and these notes are practically merely supplementary to that paper. A part of the field work at Spirit lake and Lake Okoboji, the results of which are here given, was made in company with Mr. Cratty, and his experience and enthusiasm added much to the interest and the value of the work.

* Bulletin Lab. of Nat. His., State Univ. of Iowa, vol. III, No. 4.

The collections on which the notes are based are deposited in the herbarium of the State University of Iowa. To avoid repetition the dates of collecting are here given for the several localities:

Mason City—July 6-9, 1896.

Clear Lake—July 10th-13th.

Forest City, Lake Edwards and the northern part of Hancock county*—July 17th-21st.

Spirit and the Okoboji lakes—July 30th-August 3d.

Rock Rapids and Granite—August 3d-7th.

The following is an annotated list of the species which were collected:†

Nymphaea reniformis D. C. Found in Clear Lake and in the Big Sioux river near Granite. These localities have not been noted heretofore.

Nuphar advena Ait. f. Additional localities: Mason City, Forest City, Spirit Lake.

Myriophyllum spicatum L. Additional localities: Lake Okoboji, common. Mostly in bud. Clear Lake, very common. All in bud. Growing in two to four feet of water.

Myriophyllum heterophyllum Mx. Clear Lake. Rather more common than the preceding. Forest City, not common in Lime creek.

Utricularia vulgaris L. Rather rare at Forest City, in Lime creek.

Ceratophyllum demersum L. Very common in West Okoboji lake, forming beautiful branching tufts in water three to six feet deep.

Elodea canadensis Mx. Very common in Lake Edwards and in the Okoboji lakes. New localities: Rock Rapids, in Rock river. Not common. Clear Lake, very common.

Vallisneria spiralis L. This interesting species was very common in Clear Lake, especially at the west end, but none were found in flower.

In Spirit Lake, along the western shore, small specimens of pistillate plants were collected in shallow water. These grew on a gravelly bottom.

A splendid lot of specimens were collected at the lower end of East Okoboji lake, near its juncture with the west lake. The leaves ranged in length from one to at least four feet, and

* Partly made in September, 1895.

† For convenience in making comparisons the nomenclature is largely that of Mr. Cratty's paper.

hundreds of pistillate flowers in all stages of development were found. A fine series of the staminate flowers were collected. These, so far as observed, were restricted to a small area, seemingly not more than a square yard in extent, in which staminate flowers only were found. These were at a depth of about two feet, growing like the others on a mud bottom.

Heteranthera graminea Vahl. This species is distributed throughout the state. It was common at Mason City, Forest City, Lake Edwards, Lake Okoboji, Rock Rapids, in Rock river, and in the Big Sioux river near Granite.

Spirodela polyrrhiza Schleid. Common at Forest City in Lime creek.

Lemna trisulca L. Very common in Lake Edwards, and also found at Forest City.

Lemna minor L. Abundant in the Big Sioux river near Granite, and in Rock river at Rock Rapids.

Potamogeton natans L. Not rare in the west end of Clear lake. Some were in fruit, others in flower. Specimens collected in Spirit lake were finely fruited.

Potamogeton nuttallii Cham. and Schl. This rare species, which has hitherto been reported in Iowa only from Muscatine county, was found in a small pond in northern Hancock county south of Forest City near the intersection of the Minneapolis & St. Louis railroad and the Burlington, Cedar Rapids & Northern railroad. It was mostly in fruit. A month later Mr. Crary collected it in fine fruit at the same place.

Potamogeton spirillus Fock. Found with the preceding. The species had been reported from Muscatine and Poweshiek counties. It is rare.

Potamogeton lonchites Fock. This was common, in flower, in the Big Sioux near Granite, and in Rock river at Rock Rapids. The submersed leaves were abundant.

Potamogeton amplifolius Fock. Common in the west end of Clear lake, mostly in flower. A form with narrower, nearly green leaves was not rare. Common and well fruited in Lake Okoboji and Spirit lake. Rare in Rock river at Rock Rapids.

Potamogeton prelongus Wnef. Rather common in Clear lake. Fine specimens, 8 or 10 feet long, were abundant in deep water. Rare in East Okoboji lake. No flowers or fruit were collected.

Potamogeton perfoliatus L., var. *richardsonii* A. Benner. Common in flower in the west end of Clear lake. Very abundant in Okoboji lakes in flower and fruit. A form found in Spirit

lake, growing on gravelly bottom along the west shore, approaches the type in the character of the leaves.

Potamogeton zostercefolius Schum. Common in Clear lake, in flower. Also common in Lake Edwards. Common in the Okoboji lakes, some finely fruited, but most of them in flower. Not common in Rock river at Rock Rapids.

Potamogeton foliosus Raf. Abundant in Lime creek near Forest City, mostly in flower. Mr. Cratty found it a month later in fine fruit.

Potamogeton major (Fries) Morong. Common in Clear lake, some in fruit, but most of it in flower. Very common in the Okoboji lakes at their juncture. In good fruit, but flowering specimens were common.

Potamogeton pussillus L. Rare in Clear lake at west end. Some in fruit, others flowering. Not common in East Okoboji lake near its northern extremity. The glands at the base of the leaf are well shown in most of the specimens.

Potamogeton pectinatus L. Common, mostly in flower, in Clear lake. The specimens growing on sandy bottom at the east end of the lake were slender and few-leaved. Also common in Lake Edwards. Very fine and in excellent fruit in East Lake Okoboji. Rare in Rock river near Rock Rapids.

Nais flexilis (Willd) R. & S. Very common in rather shallow water in Lake Edwards, Clear lake and Spirit. Growing on sandy or mud bottoms.

Zannichellia palustris L. Quite common and in fruit in shallow water on gravelly bottom along the west shore of Spirit lake. Much finer specimens were found in East Okoboji lake in somewhat deeper water. The leaves were in excellent condition for collecting, and many species of aquatic plants which seldom fruit were found in splendid condition. The following algæ, identified by Miss Lucy M. Cavanagh were also collected:

Chaetophora pisiformis (Roth) Ag. Common in West Lake Okoboji.

Chaetophora monolifera Kg. Common on *Cladophora* in Clear lake. New to the state.

Cladophora obigoelona Kg. Common in Clear lake.

Cladophora glomerata Kg. var. Common in West Lake Okoboji.

Cladophora fracta Kg. Common in West Lake Okoboji.

Cladophora fracta var. *gossypina* Kg.(?) Common in West Lake Okoboji.

Cladophora fracta Kg. var. In West Lake Okoboji.

Hydrodictyon utriculatum. Very common in Lime creek, at Forest City.

SPERMATOPHYTES OF THE FLORA OF FAYETTE, IOWA.

BRUCE FINK.

INTRODUCTION.

A considerable amount of work has been done on the flora of the vicinity of Fayette since the early settlement, and during the last five years the writer has explored the region thoroughly. Nearly 200 of the plants of this list have been carefully compared by the writer and other persons at the herbaria of the University of Minnesota and Harvard university. I have also had the aid of specialists on five difficult genera, and altogether the list of a few more than 700 species and varieties has been carefully worked out.

The early work was done by Dr. C. C. Parker who, previous to 1876, had collected and preserved nearly 500 specimens of our herbaceous plants. Dr. Parker's herbarium contains twenty-eight plants not found by the writer, which are listed. They may be known, as he is given credit for the collecting. I am also indebted to him for the use of his herbarium in preparing this record, and for valuable aid in finding several rare plants.

As to territory covered, the list is approximately complete for the region within five miles of Fayette. A few plants are included which were collected ten or fifteen miles away, but the work is doubtless quite incomplete for some portions of Fayette county. This region furnishes a good field for the study of the higher plants, as the topographical features are quite varied. Prairies, woods, rivers, springs, marshes, ponds, hills and limestone ledges all abound. The woods, even after so much clearing has been done, are a more inviting field for study than the limited amount of unbroken prairie. Twenty years ago the prairie grasses and sedges were surely much more abundant than now, but unfortunately they were not