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Additions to the Iowa Pteridophyte Flora — III

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To prior reports on the studies of the Iowa pteridophyte flora, five taxa (*Botrychium campestre* Wagner & Farrar, *Botrychium matricariifolium* A. Braun, *Cystopteris fragilis* (L.) Bernh., *Cystopteris laurentiana* (Weath.) Blasdel, and *Lycopodium inundatum* L.) are added, along with 215 new county occurrence records for 39 taxa. Currently, the Iowa pteridophyte flora consists of 70 taxa, supported with 1656 county occurrence records; only 72 (4%) of these records are based solely on collections made before 1950.

INDEX DESCRIPTORS: *Botrychium campestre*, *Botrychium matricariifolium*, *Cystopteris fragilis*, *Cystopteris laurentiana*. Ferns, Fern allies, Iowa vascular flora, *Lycopodium inundatum*, Pteridophytes.

The last comprehensive manual of the Iowa pteridophytes (ferns and fern allies) by Cooperrider (1959) reported a flora of 54 taxa supported by 846 county occurrence records. Since 1970, the Iowa pteridophyte flora has been studied by D. R. Farrar, C. J. Peck, D. M. Roosa, and J. H. Peck, with the support of many other workers. A series of reports summarized literature that dealt with Iowa pteridophytes (Peck, 1976a, 1984), herbarium collections (Peck, 1976b), and on-going field searches that added taxa to the flora or increased the extent of county occurrence records (Peck, 1980, 1983). Since the last floristic summary (Peck, 1983), additional taxa and county occurrence records of Iowa pteridophytes have been brought to my attention (Peck, Nekola, and Farrar, 1989). Field work conducted in autumn 1987 also contributed additional county occurrence records, allowed verification of identifications of new collections, and allowed me to re-examine problematic specimens in Iowa herbaria.

Many problematic specimens are of the genus *Cystopteris*, which Peck (1976b) noted was a significant problem for future study of Iowa pteridophytes. Almost simultaneously, Lovis (1977) described *Cystopteris* as being "perhaps the most formidable biosystematic problem in the ferns". Subsequent collecting in the Driftless Area of northeastern Iowa (Peck, 1982) led to a realization that the *Cystopteris fragilis* complex in that region was not adequately treated by the generic monograph of Blasdel (1963). Specimens were sent to a variety of experts, including Robin Moran and Chris Haufler, who were in the process of documenting the presence of 17 taxa (many of which are cryptic and remain unnamed) hidden within plants originally called "*Cystopteris fragilis*", including three diploids, five triploids, seven tetraploids, one pentaploid, and one hexaploid taxon (Lellinger, 1985). Of these 17, five are now known from Iowa: *C. fragilis*, *C. protrusa*, *C. tenuis*, *C. temeseensis*, and *C. laurentiana*. Based on the taxa known to occur in Iowa, and the possible backcrossing among them, another seven *Cystopteris* taxa may yet be discovered in Iowa. Additional collection and study of *Cystopteris* in Iowa probably will be rewarding.

This report adds five taxa new to the pteridophyte flora of Iowa, clarifies nomenclatural status of several Iowa taxa, adds 215 new county occurrence records, and lists 72 county occurrence records which remain vouchered only by specimens collected before 1950. With these additions and clarifying remarks, the Iowa pteridophyte flora now consists of 70 taxa, supported by 1656 county occurrence records. This is a surprisingly large flora and county occurrence record total for a state once dominated by tall grass prairie that was subsequently replaced by equally inimical, intensive row-crop agriculture.

STATE RECORDS

Botrychium campestre W. Wagner and Farrar, Prairie Moonwort, is a North American endemic occurring in the northern Great Plains and Great Lakes region of Canada and the United States. It was recently

described (Wagner and Wagner, 1986) from populations that occur in the Loess Hills from four counties in western Iowa. The Iowa plants were discovered in Monona Co. by Ted Van Bruggen in 1982, recognized as plants new to Iowa by Lawrence Eilers, and after study by Farrar (1985), Farrar and Johnson-Groh (1986), and Wagner and Wagner (1986), described as a new species. The Prairie Moonwort is encountered in xeric prairies, but only from late-April to mid-June, when soil conditions are moderated. It is now known from six counties in Iowa: Dickenson, Fremont, Monona, Plymouth, Pottawattamie, and Woodbury.

Botrychium matricariifolium A. Braun ex Koch., Daisy-leaved Moonwort, is an amphi-atlantic species that occurs in northeastern North America, westward into the Great Lakes Region, and then southward into the Driftless Area of Wisconsin (Peck, 1982). It was collected in 1986 from Yellow River State Forest in Allamakee Co., Iowa. The site was a relatively pure stand of sugar maple (*Acer saccharum*) on a north-facing slope with a sparse understory, thick leaf litter, and deep humus. This locality is only 15 km across the Mississippi River from its nearest known population at Wyalusing State Park, Grant Co., Wisconsin. Additional effort is needed to locate more localities of this fern in Iowa. It should be searched for in May and June.

Cystopteris fragilis (L.) Bernh., Fragile Fern, co-occurs in Iowa with other species and hybrids in the Fragile Fern complex that were previously reported from Iowa. These taxa are particularly abundant on north-facing, moist, algific and sandstone outcrops in the Driftless Area in northeastern Iowa (Peck, 1982). Extensive collection of *Cystopteris* was undertaken during a survey of the pteridophytes of the Driftless Area (Peck, 1982). These specimens and those of major Iowa herbaria were re-examined in autumn 1987, and compared with recent works on the biosystematics of the genus (Moran, 1982a, 1982b, 1983a, 1983b; Haufler, 1985; Haufler, *et al.*, 1985; Lellinger, 1985). Collections of this taxa were located in nine counties: Allamakee, Clayton, Delaware, Fayette, Harding, Howard, Jackson, Lyon, and Winneshiek.

Cystopteris laurentiana (Weath.) Blasdel, the Northern Hybrid Fragile Fern, is a North American endemic that occurs in northeastern North America, westward to the Great Lakes Region and southward in the Driftless Area (Peck, 1982). It is the putative hybrid of *C. fragilis* (L.) Bernh. and *C. bulbifera* (L.) Bernh. that has undergone polyploidy to become a fertile hexaploid (Blasdale, 1963; Lellinger, 1985). In Iowa, it co-occurs with *C. bulbifera*, *C. fragilis*, *C. protrusa*, and *C. tenuis* one north-facing, moist, algific or sandstone outcrops. The small, dark, scaly, and abortive bulblets on *C. laurentiana* do not readily fall off, making this taxon easy to distinguish from its parents. It is distinguished from *C. temeseensis* Shaver by foliar morphology and its larger spore size. Based on reexamination of herbarium specimens and some additional field work in autumn 1987, this hybrid is now known from six counties, all located in extreme

northeastern Iowa: Allamakee, Clayton, Dubuque, Howard, Jackson, and Winneshiek.

Lycopodium inundatum L., Bog Clubmoss, was discovered in Iowa by Jeff Nekola in 1987. He found this circumboreal, bog-loving species

in an over-grazed, native, sand prairie in Buchanan Co. The plants were growing in wet swales. In 1987, the plants released spores in late September. The population is disjunct by 300 km from the nearest populations in Illinois and Wisconsin (Peck, 1982).

NOMENCLATURAL NOTES

The correct binomial for Mackay's Fragile Fern is *Cystopteris tenuis* (Michx.) Desv., recently interpreted as the fertile hybrid between *C. protusa* and an unknown diploid species (Haufler, et al., 1985; Lellinger, 1985). It was formerly known as *C. fragilis* (L.) Bernh. var. *mackayii* Laws. It hybridizes with *C. bulbifera* to form *C. X illinoensis* Moran, a hybrid not yet known from Iowa. It also hybridizes with the fertile hybrid *C. tennesseensis*, forming the the backcross hybrid *C. X wagneri*, which also is not yet known from Iowa.

The correct name for the Spinulose Wood Fern is now *Dryopteris*

carthusiana (Villars) H. P. Fuchs (Lellinger, 1985). It was formerly known as *D. spinulosa* (O. F. Muell.) Watt.

The correct name for the Crowfoot Clubmoss is now *Lycopodium digitatum* A. Br. (Hickey and Beitel, 1979). It was formerly known as *L. complanatum* var. *flabelliforme* Fern. and *L. flabelliforme* (Fern.) Blanch.

The correct name for the Northern Adder's-tongue Fern is now *Ophioglossum pusillum* Raf. (Lellinger, 1985). It was formerly known as *O. vulgare* L. var. *psendopodium* (Blake) Farwell.

COUNTY OCCURRENCE RECORDS

The following 215 county occurrence records augment distributional data for 39 taxa. Based on re-examination of Iowa specimens, some county occurrence records for *Cystopteris tenuis* and *C. tennesseensis* must be deleted as noted.

Adiantum pedatum L.: Adair Co.: Peck 87037 (ISTC), Adams Co.: Peck 87065 (ISTC), Keokuk Co.: Peck 87142 (ISTC), Monroe Co.: Roosa 6537 (ISTC), Montgomery Co.: Peck 87063 (ISTC), Page Co.: Peck 87060 (ISTC), Ringgold Co.: Farrar 84671 (ISC).

Asplenium platyneuron (L.) B. S. P.: Clinton Co.: Pusateri 281 (ISTC), Decatur Co.: Farrar 84661 (ISC), Fayette Co.: Peck 87186 (ISTC), Louisa Co.: Peck 87125 (ISTC), Washington Co.: Peck 87137 (ISTC), Winneshiek Co.: Peck 87200 (ISC).

Athyrium angustum (Willd.) Presl: Buchanan Co.: Peck 87001 (ISTC), Butler Co.: Peck 87226 (ISTC), Keokuk Co.: Peck 87141 (ISTC), Monroe Co.: Peck 87081 (ISTC), Wapello Co.: Peck 87084 (ISTC).

Athyrium pycnocarpon (Spreng.) Tidest.: Fayette Co.: Nekola (specimen lost), Linn Co.: Nekola 6410 (COE), Muscatine Co.: Peck 87134 (ISTC).

Azolla mexicana Presl: Benton Co.: Peck 87160 (ISTC).

Botrychium campestre Wagner and Farrar: Dickinson Co.: Farrar 885291 (ISC); Fremont Co.: Pusateri sn. (ISC), Monona Co.: Farrar 875181 (ISC), Eilers sn. (ISC, MICH), Wagner 85015 (MICH); Plymouth Co.: Farrar 845303 (ISC), Eilers sn. (ISC); Pottawattamie Co.: Farrar 835291 (ISC); Woodbury Co.: Farrar 835261 (ISC).

Botrychium dissectum Spreng. f. *dissectum*: Benton Co.: Peck 87165 (ISTC), Black Hawk Co.: Peck 87190 (ISTC), Bremer Co.: Peck 87188 (ISTC), Buchanan Co.: Eilers 2965 (IA), Cedar Co.: Peck 87167 (ISTC), Chickasaw Co.: Peck 87189 (ISTC), Clinton Co.: Pusateri 386 (ISTC), Davis Co.: Peck 87095 (ISTC), Decatur Co.: Peck 87072 (ISTC), Howard Co.: Peck 87198 (ISTC), Iowa Co.: Pusateri 400 (ISTC), Jefferson Co.: Peck 87110 (ISTC), Johnson Co.: Nekola 6393 (ISC), Jones: Peck 87176 (ISTC), Keokuk Co.: Peck 87149 (ISTC), Louisa Co.: Peck 87128 (ISTC), Muscatine Co.: Peck 87133 (ISTC), Scott Co.: Peck 87175 (ISTC), Wapello Co.: Peck 87074 (ISTC), Washington Co.: Peck 87086 (ISTC), Wayne Co.: Peck 87074 (ISTC).

Botrychium dissectum Spreng. f. *obliquum* (Muhl.) Fern.: Benton Co.: Peck 87162 (ISTC),

Black Hawk Co.: Lammers 3196 (ISTC), Boone Co.: Farrar sn. (ISC), Bremer Co.: Peck 87187 (ISTC), Buchanan Co.: Peck 87179 (ISTC), Cedar Co.: Peck 87167 (ISTC), Chickasaw Co.: Peck 87191 (ISTC), Clarke Co.: Pusateri 419 (ISTC), Clinton Co.: Roosa 6270 (ISTC), Davis Co.: Peck 87096 (ISTC), Hancock Co.: Farrar sn. (ISC), Howard Co.: Peck 87197 (ISTC), Jefferson Co.: Peck 87110 (ISTC), Keokuk Co.: Peck 87143 (ISTC), Louisa Co.: Peck 87129 (ISTC), Muscatine Co.: Pusateri 412 (ISTC), Scott Co.: Peck 87170 (ISTC), Wapello Co.: Tiffany sn. (ISC), Wayne Co.: Peck 87096 (ISTC).

Botrychium matricariifolium A Braun: Allamakee Co.: Rogers 004 (ISTC).

Botrychium multifidum (S.G. Gmel.) Rupr.: Buchanan Co.: Peck 87246 (ISTC).

Botrychium simplex E. Hitchc.: Black Hawk Co.: Farrar 876771 (ISC).

Botrychium virginianum (L.) Sw.: Adair Co.: Peck 87038 (ISTC), Adams Co.: Peck 87064 (ISTC), Audubon Co.: Peck 87040 (ISTC), Buena Vista Co.: Peck 87011 (ISTC), Butler Co.: Peck 87225 (ISTC), Calhoun Co.: Peck 87005 (ISTC), Carroll Co.: Peck 87013 (ISTC), Cass Co.: Peck 87039 (ISTC), Dallas Co.: Peck 87031 (ISTC), Davis Co.: Peck 87097 (ISTC), Greene Co.: Peck 87014 (ISTC), Grundy Co.: Peck 87015 (ISTC), Ida Co.: Peck 87012 (ISTC), Keokuk Co.: Peck 87144 (ISTC), Lyon Co.: Peck 87233 (ISTC), Mills Co.: Peck 87059 (ISTC), Monroe Co.: Roosa 6536 (ISTC), Montgomery Co.: Peck 87063 (ISTC), Page Co.: Peck 87061 (ISTC), Ringgold Co.: Farrar 84676 (ISC), Taylor Co.: Peck 87066 (ISTC), Wapello Co.: Peck 87087 (ISTC), Woodbury Co.: Bates 90 (ISTC).

Cystopteris bulbifera (L.) Bernh.: Iowa Co.: Peck 87141 (ISTC), Louisa Co.: Peck 87126 (ISTC).

Cystopteris fragilis (L.) Bernh.: Allamakee Co.: Peck 7845 (ISTC), Clayton Co.: Peck 76619 (ISC), Delaware Co.: Eilers 1814 (IA), Fayette Co.: Peck 76620 (ISTC), Hardin Co.: Farrar 1102 (ISC), Howard Co.: Peck 76620 (ISTC), Jackson Co.: Peck 76626 (ISTC), Lyon Co.: Farrar 1248 (ISC), Winneshiek Co.: Peck 76619 (ISC).

Cystopteris protrusa (Weath.) Blasdell: Mills Co.: Roosa 6332 (ISTC), Monroe Co.: Roosa 6534 (ISTC), Page Co.: Peck 87062 (ISTC), Plymouth Co.: Bates 995 (ISTC).

Cystopteris tenuis Raf.: Deletions: Buchanan, Cherokee, Clay, Dallas, Dickinson, Emmet, Fayette, Hamilton, Henry, Jackson, Lee, Monona, Monroe, Story, Tama, and Woodbury counties.

Cystopteris laurentiana (Weath.) Blasdell: Allamakee Co.: Peck 80624 (ISTC); Benedict sn. (VPI), Clayton Co.: Roosa 1814 (ISTC), Dubuque Co.: Peck 80617 (ISTC), Howard Co.: Farrar sn. (ISC), Pammel and Zimmerman 323 (MO), Jackson Co.: Peck 80607 (ISTC), Winneshiek Co.: Peck 87242 (ISTC); Rosendahl 3668 (MIN).

Cystopteris tennesseensis Shaver: Boone Co.: Farrar 855204 (ISC), Fayette Co.: Pusateri 404 (ISTC), Pammel sn. (MO), Jones Co.: Farrar 6187 (ISC). Deletions: Allamakee, Clayton, Dubuque, Jackson, Winneshiek cos.

Dryopteris carthusiana (Vill.) H.P. Fuchs: Buchanan Co.: Peck 87247 (ISTC), Chickasaw Co.: Peck 87192 (ISTC), Fayette Co.: Klug 524861 (IA), Guthrie Co.: Farrar 874123 (ISC), Keokuk Co.: Klug 726875 (IA), Louisa Co.: Peck 87131 (ISTC), Mitchell Co.: Roosa 6539 (ISTC), Monroe Co.: Roosa 6535 (ISTC), Scott Co.: Peck 87174 (ISTC).

Dryopteris cristata (L.) Gray: Benton Co.: Peck 87161 (ISTC), Buchanan Co.: Peck 87247 (ISTC), Fayette Co.: Klug 524861 (IA), Hardin Co.: Farrar 855202 (ISC), Howard Co.: Roosa 6590 (ISTC), Iowa Co.: Klug 913861 (IA), Jones Co.: Peck 87161 (ISTC), Marshall Co.: Pusateri 286 (ISTC), Mitchell Co.: Roosa 6269 (ISTC), Worth Co.: Roosa 6486 (ISTC).

Dryopteris goldiana (Hook.) Gray: Delaware Co.: Pusateri 356 (ISTC), Iowa Co.: Klug 83861 (IA), Mitchell Co.: Roosa 6216 (ISTC).

Equisetum fluviatile L.: Bremer Co.: Nekola 6891 (ISTC), Buchanan Co.: Nekola 6594 (ISC).

Equisetum pratense Ehrh.: Butler Co.: Klug sn. (IA), Mitchell Co.: Leoschke 181 (ISC).

Equisetum scirpoides Michx.: Jackson Co.: Pusateri sn. (ISTC), Delaware Co.: Roosa 6187 (ISTC).

Equisetum sylvaticum L.: Buchanan Co.: Roosa 6309 (ISTC), Butler Co.: Klug sn. (IA), Howard Co.: Nekola 6920 (ISTC).

Equisetum X litorale Kuhlw.: Clinton Co.: Leoschke 225 (ISC), Mitchell Co.: Farrar sn. (ISTC).

Lycopodium digitatum A. Braun: Clinton Co.: Bryant & Selby sn. (ISTC), Dubuque Co.: Lehmann 820611126 (ISTC), Jones Co.: Nekola 6565 (ISC).

Lycopodium inundatum L.: Buchanan Co.: Nekola sn. (COE), Roosa 6576 (ISTC); Peck 87003 (ISTC).

Lycopodium lucidulum Michx.: Benton Co.: Nekola sn. (COE), Guthrie Co.: Roosa 6542

(*ISTC*), Fayette Co.: Nekola 6614 (ISC), Linn Co.: Nekola 6800 (ISC).

Mattencia struthiopteris (L.) Tod. var. *sylvanica* (Willd.) Morton: Bremer Co.: Peck 87188 (ISC), Buchanan Co.: Peck 87181 (ISC), Davis Co.: Peck 87098 (ISC), Des Moines Co.: Peck 87123 (ISC), Guthrie Co.: Farrar 874121 (ISC), Jefferson Co.: Peck 87113 (ISC), Keokuk Co.: Peck 87145 (ISC), Monroe Co.: Peck 87082 (ISC), Poweshiek Co.: Peck 87155 (ISC), Wapello Co.: Peck 87090 (ISC), Wayne Co.: Peck 87075 (ISC).

Onoclea sensibilis L.: Floyd Co.: Peck 87224 (ISC), Franklin Co.: Peck 87226 (ISC), Hamilton Co.: Peck 87020 (ISC), Keokuk Co.: Peck 87146 (ISC), Monroe Co.: Peck 87083 (ISC).

Ophioglossum pusillum Raf.: Benton Co.: Peck 87163 (ISC), Black Hawk Co.: Farrar 865121 (ISC), Buchanan Co.: Roosa 6414 (ISC), Cedar Co.: Klug 528861 (IA), Fayette Co.: Nekola 6900 (ISC), Howard Co.: Tolstead 9277 (ISC), Johnson Co.: Roosa 6178 (ISC), Marshall Co.: Roosa 6413 (ISC), Muscatine Co.: Pusateri 86 (ISC), Scott Co.: Peck 87172 (ISC).

Osmunda claytoniana L.: Guthrie Co.: Zager 1307 (ISC), Keokuk Co.: Peck 87147 (ISC), Tama Co.: Roosa 6529 (ISC).

Polypodium virginianum L.: Delaware Co.: Roosa 6325 (ISC), Fayette Co.: Klug 83872 (IA).

Polystichum acrostichoides (Michx.) Schott: Clinton Co.: Peck 87175 (ISC), Davis Co.: Peck 87100 (ISC), Delaware Co.: Pusateri sn. (ISC), Winneshiek Co.: Peck 87198 (ISC).

Pteridium aquilinum (L.) Kuhn. var. *latiusculum* (Desv.) Underw. ex Heller: Bremer Co.: Peck 87189 (ISC), Davis Co.: Peck 87101 (ISC), Keokuk Co.: Peck 87148 (ISC), Tama Co.:

Roosa 6530 (ISC), Wapello Co.: Peck 87094 (ISC), Washington Co.: Peck 87138 (ISC).

Selaginella rupestris (L.) Spring.: Benton Co.: Peck 87161 (ISC), Buchanan Co.: Nekola 6597 (COE), Cedar Co.: Peck 87168 (ISC).

Thelypteris palustris (L.) Schott: Benton Co.: Peck 87164 (ISC), Davis Co.: Peck 87102 (ISC), Des Moines Co.: Peck 87124 (ISC), Floyd Co.: Peck 87223 (ISC), Franklin Co.: Peck 87227 (ISC), Jefferson Co.: Peck 87115 (ISC), Keokuk Co.: Peck 87142 (ISC), Kossuth Co.: Peck 87229 (ISC), Mahaska Co.: Peck 87152 (ISC), Mitchell Co.: Peck 87152 (ISC), Poweshiek Co.: Peck 87157 (ISC), Tama Co.: Peck 87159 (ISC), Van Buren Co.: Peck 87108 (ISC), Washington Co.: Peck 87139 (ISC).

Woodsia obtusa (Spreng.) Torr.: Clinton Co.: Pusateri sn. (ISC).

COLLECTIONS REQUIRING UPDATES

Although 96% of the county occurrence records of Iowa pteridophytes are documented with collections made after 1950, the following records are documented only by collections made before 1950 and need to be updated or verified. Many of these old records may now document populations that are no longer extant. The records are listed as binomial: county (date of last collection):

Athyrium thelypteroides: Delaware (1897).

Azolla mexicana: Fremont (1905).

Botrychium multifidum: Fayette (1893).

Camptosorus rhizophyllus: Fremont (1918), Harrison (1892).

Cryptogramma stelleri: Cerro Gordo (1917), Johnson (1880).

Cystopteris protrusa: Black Hawk (1938), Dickinson (1910), Sac (1931), Taylor (1926), Winneshiek (1933).

Cystopteris tenuis: Boone (1927), Chickasaw (1925), Decatur (1902), Johnson (1911), Linn (no date), Muscatine (1948), Pottawatomie (1897), Van Buren (1921), Wayne (1924).

Cystopteris tennesseensis: Cerro Gordo (1899), Decatur (1898), Hardin (1949), Jefferson (1933), Webster (1920).

Dryopteris carthusiana: Emmet (1922).

Dryopteris intermedia: Webster (1903).

Dryopteris marginalis: Dubuque (1922).

Equisetum fluviatile: Dubuque (1901), Emmer (1922), Hamilton (1882), Hancock (1896), Palo Alto (1939), Story (1889), Tama (1933), Webster (1906).

Equisetum pratense: Webster (1897).

Equisetum sylvaticum: Boone (1930s), Chickasaw (1926), Jasper (1886), Winneshiek (1880).

Gymnocarpium dryopteris: Johnson (1892).

Lycopodium digitatum: Buchanan (1917), Chickasaw (1925), Clayton (1923), Delaware (1940), Muscatine (1894).

Lycopodium lucidulum: Boone (1933), Cedar (1941), Chickasaw (1926).

Lycopodium porophyllum: Delaware (1930).

Lycopodium lucidulum X *porophyllum*: Clayton (1921).

Ophioglossum pusillum: Howard (1942).

Osmunda cinnamomea: Clayton (1945), Henry (1938), Jackson (1905).

Pellaea glabella: Buchanan (1919), Cerro Gordo (no date), Henry (1938), Mitchell (1919), Scott (1949), Van Buren (1940), Webster (1872).

Phegopteris connectilis: Delaware (1872), Muscatine (1892).

Phegopteris hexagonoptera: Hardin (1901), Johnson (1913), Louisa (1897), Van Buren (1933).

Pteridium aquilinum: Webster (1907).

Selaginella rupestris: Dubuque (1885).

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