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Additions to the Pteridophyte Flora of Iowa—IV

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This report updates field collection records and summarizes nomenclatural changes of genera and binomials of species of Iowa pteridophytes based on the Flora of North America project. Barychrysum simplex var. compositum, Gymnocarpium jessoense (Koidz.) Koidz. spp. porphyrulum Sarvela, Gymnocarpium Xbrittonianum (Sarvela) Pryer & Haufler, and Gymnocarpium Xintermedium Sarvela were recently added to the state flora. The flora now consists of 66 species, plus 7 hybrids, and 1 distinct form, for a total of 74 taxa. With the addition of 81 new county occurrence records, the Iowa pteridophyte flora now consists of 1754 county occurrence records. A data matrix of species county occurrence records is provided.

INDEX DESCRIPTORS: Iowa vascular flora, pteridophytes, ferns and fern allies, state flora additions, county occurrence records.

Although the pteridophyte flora of Iowa has been the focus of numerous a.d.e extensive floristic investigations (Peck, 1976a, 1984), the last identification manual was that of Cooperrrider (1959) which reported 54 species with 846 county occurrence records (COR). Peck (1976b) provided an annotated checklist with distribution maps of 57 species plus 3 hybrids, with 1254 county occurrence records. Subsequent publications by Peck (1980, 1983, 1989) added taxa and reported COR new to Iowa, resulting in a flora of 62 species plus 7 hybrids with 1672 county occurrence records. During the last seven years, additional field and herbarium work by the authors and several associates, the publication of a pteridophyte volume of the multi-volume Flora of North America North of Mexico (FNA, 1993), and the publication of a modern checklist of the Iowa vascular plant flora (Eilers and Roosa, 1994), make another update necessary to summarize changes in nomenclature, report new taxa to the Iowa pteridophyte flora, add 80 additional county occurrence records, and provide a condensed method of summarizing Iowa pteridophyte floristic information. The Iowa pteridophyte flora now consists of 74 taxa, including 65 species plus 7 hybrids and 1 distinct form, supported by 1754 county occurrence records (Fig. 1).

NOMENCLATURAL CHANGES

With the publication of Flora North America Volume 2, Pteridophytes and Gymnosperms (FNA, 1993), a series of nomenclatural changes were recognized that affect the names used in the Iowa pteridophyte flora. Some corrective comments are also needed with regard to the representation of Iowa pteridophytes in that manual. The checklist of the vascular flora of Iowa (Eilers and Roosa, 1994) includes most names changed in FNA (1993) as synonyms. The extensive genetic level changes in nomenclature in the Clubmoss Family, Lycopodiaceae, used in FNA (1993) were not available to Eilers and Roosa (1994) nor to Kartesz (1994) which also provide many synonyms or alternative classifications.

Traditionally, clubmosses have been treated as a single genus, Lycopodium. Evidence that this does not properly express phylogenetic relationships has accumulated from biosystematic studies over the past 40 years (Ølgaard, 1987, 1989; Wagner and Beitel, 1992). Wagner and Beitel (1993) placed the North American representatives into seven genera. Iowa taxa are classified into four genera: Huperzia, Lycopodium, Diphasiastrum, and Lyopodiella. In Iowa, the Gymnosomegenus Huperzia contains two species and one hybrid. The Shining Firmoss Lycopodium lucidulum Michaux is now Huperzia lucidata (Michaux) Trevisian. The Rock Firmoss Lycopodium porphobilum Lloyd & Underwood is now Huperzia porphilia (Lloyd & Underwood) Holub. The hybrid Lycopodium Xhartleyii Cusick is now Huperzia Xhartleyii (Cusick) Kartesz & Gandhi. Two species in Iowa are retained in the Genus Lycopodium (L. clavatum L. and L. dendroides Michx.) and have no name changes. FNA (1993) is in error by not listing Lycopodium clavatum in Iowa. The genus of Flatbranch Clubmosses, Diphasiastrum contains one species in Iowa, Southern Runningpine, D. digitatum (Dillenius ex Braun) Holub which was previously known as Lycopodium digitatum Dillenius. Diphasiastrum complanatum (L.) Holub was excluded from the Iowa flora (Peck, 1976b); it remains excluded. The Bog Clubmoss Genus Lyopodiella is represented in Iowa by one species, recently discovered in Iowa by J. C. Nekola (Peck et al., 1989). This species, the Northern Bog Clubmoss, Lycopodium inundatum L. is now recognized as Lyopodiella inundata (L.) Holub. The Iowa population of this species seems to have been adventive, being extant only three growing seasons, from 1987 through 1989. Hopefully, it will reappear at the original site in Buchanan Co. or appear at other locations in Iowa. FNA (1993) is in error by not listing this clubmoss in the Iowa flora.

Traditionally, Lady Ferns have been treated as a single genus, Athyrium. Evidence that this is inadequate to properly express phylogenetic relationships has accumulated from biosystematic studies over the past 40 years, primarily from tropical and Asiatic studies (Kato, 1977; 1984; Kato and Darnaedi, 1988). The three species in Iowa are now segregated into three genera: Athyrium, Diplazium, and Deparia. The Narrowleaved Glade Fern Athyrium pycnocarpon (Sprengel) Tidestrom is now Diplazium pycnocarpon (Sprengel) Broun (Kato, 1993b). The Silvery Glade Fern Athyrium tylotopoda (Michx.) Desw. is now Deparia acrostichoides (Swartz) Kato (Kato, 1993c). Although the Northern Lady Fern remains in Athyrium, the biological relationships among the infraspecific taxa of Athyrium filix-femina (L.)
Fig. 1. A summary matrix displays 1754 county occurrence records for the Iowa pteridophyte flora. A dot indicates a voucher specimen was collected in that county and was deposited in an herbarium.
Nekola from 1984-1991 documented a third spread tetraploid species and one regionalized diploid species (Wagener, genetically, and that the plants growing in the prairie swale in Black noircarpium two taxa that were new to Iowa. Those reports indicated that additional

While documenting the pteridophyte floras of Iowa (Peck, 1976b), the Driftless Area of the Upper Midwest (Peck, 1982), and Wisconsin (Peck and Taylor, 1980), numerous problematic specimens of Cystopteris were encountered in herbaria or collected from the field. Since then, other workers have conducted biosystematic studies that resolved some of the taxonomic confusion and constructed an appropriate nomenclature that reflects relationships in this genus. Peck (1989) reported clarifications of problematic Iowa specimens of Cystopteris based on biosystematic studies of R. Moran and C. Hauffer, summarized in FNA(1993) by Hauffer, Moran, and Windham (1993). All Iowa Cystopteris taxa previously reported as hybrids are now considered to be species of hybrid origin with fertility restored through polyploidy. Thus, they do not warrant the hybrid sign (multiplication sign) in front of the specific epithet.

The family Thelypteridaceae contains approximately 900 species that have been variously sorted into as many as thirty genera. Smith (1993) placed North American members in the three genera: Thelypteris, Phloegopteris, and Macrothelypteris. The three Iowa species are placed in the first two genera. Eilers and Roosa (1994) placed all three in the genus Thelypteris, providing as synonyms the binomials used in FNA (1993) and in previous reports on Iowa pteridophytes (Peck, 1976b, 1980, 1983, and 1989).

TAXA NEW TO IOWA

Botrychium simplex E. Hitch. in the eastern United States has been recognized as including three varieties by some authors: var. simplex, var. tenebrosum (A. A. Ear.) Clausen, and var. compositum (Lasch) Milde (see Mickel, 1979). The morphological differences between these varieties are clear only in large plants, and some have questioned whether these differences are environmentally induced (Wagner and Wagner, 1983). Farrar and Wendel (1996) have shown by starch gel enzyme electrophoresis that the B. simplex varieties are highly distinct genetically, and that the plants growing in the prairie swale in Black Hawk County are variety tenebrosum. Because of similar morphology and habitat, plants in Marshall and Linn counties are probably also this variety. A plant collected by Tom Rosburg from a woodland slope in Pine Peak State Park, Clayton Co., on June 1996 is much larger and distinctly not var. tenebrosum. Its morphology is that of var. compositum and represents a new taxon for Iowa.

With the realization that hybrid taxa occurred in the genus Gymnocarpium (Root, 1961), preliminary biosystematic examination of North American material resulted in the identification of two widespread tetraploid species and one regionalized diploid species (Wagner and Wagner, 1966). A world-wide synopsis of the Oak Fern genus Gymnocarpium by Sarvela (1978) led to a re-examination of North American taxa (Sarvela, 1980; Sarvela et al., 1981) that uncovered previously unknown and complex relationships. The North American material has been studied biosystematically over the past decade by K. Pryer and associates (Pryer, 1981, 1990, 1992, 1993; Pryer & Britton, 1983; Pryer, Britton, & McNeil, 1984; Pryer and Hauffer, 1993). Specimen from Iowa cited in these reports were identified as two taxa that were new to Iowa. Those reports indicated that additional field study in the Iowa Driftless Area (Paleozoic Plateau) might be rewarding. Examination by Pryer of an extensive series of Gymnocarpium plants collected from Iowa algalic talus slopes collected by Nekola from 1984-1991 documented a third Gymnocarpium taxa new to Iowa. In 1993, Peck sent the holdings of Iowa Gymnocarpium specimens from four Iowa herbaria (ISC, IA, ISTC, and COE) to Pryer for inspection and annotation to provide uniform and expert identifications. As a result, five Oak Ferns are now known from Iowa.

Two tetraploid species, Gymnocarpium dryopteris (L.) Newm. and Gymnocarpium robertianum (Hoffm.) Newm., were previously reported as being present in Iowa (Peck, 1976a). The first species is widely distributed in eastern North America, Europe and Asia. The second species occurs in eastern North America, Europe and Asia Minor. In addition to these taxa, three other taxa (one species and two hybrids) were recently reported as new to the Iowa pteridophyte flora (Nekola, 1997).

Sarvela (1978) split what had previously been called Gymnocarpium robertianum into two species: G. robertianum s. s., occurring in eastern North America westward to the Great Lakes region and G. jessoense ssp. parvulum, occurring from the Great Lakes region westward to Alaska. Gymnocarpium jessoense (Koidz.) Koidz. ssp. parvulum Sarvela, the Nahanni Oak Fern, is a tetraploid that occurs in Asia, Scandinavia, and across western North America, from Alaska to the western Great Lakes region, with outliers in Quebec. Distinguishing features of these two species were elaborated by Sarvela et al. (1981), Pryer et al. (1983), and Pryer (1990). Most Iowa plants are G. robertianum; however, Pryer et al. (1984) reported G. jessoense ssp. parvulum as present in the Iowa flora based on two herbarium specimens; an 1882 collection by E. W. Holway from Decorah, Winneshiek Co. (Holway s. n., G), and a 1958 collection by T. G. Hartley from “Old Stone House”, 7 mi NE of Postville, Allamakee Co. (Hartley 6254, IA). The voucher of the Allamakee Co. record is no longer at IA, (pers. comm. from Dr. Diana Horton). Efforts by Nekola in 1990–1991 to relocate this species were unsuccessful (Nekola, 1997).

Gymnocarpium xbrittonianum (Sarvela) Pryer & Hauffer is a triploid, sterile hybrid originating from a cross between Gymnocarpium dryopteris which occurs in six counties in northeastern Iowa and Gymnocarpium disjunctum (Rupr.) Ching which occurs in the Pacific Northwest, but not in Iowa nor in the eastern United States. This hybrid produces large, “basketball” spores and small, irregular, abortive spores. The large, presumably unreduced (triploid) spores may allow for dispersal and apogamous production of sporophytes (Pryer and Britton, 1983). G. xbrittonianum has two centers of concentration: northwestern North America and northeastern North America surrounding the Great Lakes and New England states. The first Iowa record was collected on algalic talus slopes in Bixby State Preserve, Clayton Co. (sec. 23, Lodomillo Twp., 7 July 1990, Nekola 8499 COE) and was subsequently identified by K. Pryer in 1991. An additional distinct population was located in the same valley on June 1991 (Nekola 9415, COE). Another possible population of this hybrid was located on 22 May 1991 (Nekola 9405, 9409, 9414 COE), but herbarium material lacked spores, precluding a definitive determination. These populations are 300 km disjunct from the nearest populations in northern Wisconsin. It must be considered one of our rarest Iowa pteridophytes. Extensive searches of approximately 100 algalic talus slopes in Iowa have not located additional populations (Nekola, 1997).

Gymnocarpium xintermedium Sarvela, previously known as G. xhet erotroporum Wagner, but misspelled, is the sterile hybrid that results from a cross between Gymnocarpium dryopteris and Gymnocarpium jessoense subsp. parvulum. This hybrid occurs across North America from Alaska to Quebec, Canada; it is common in the Great Lakes region. Like the previous taxon, this hybrid produces large, “basketball” spores and smaller, irregular, abortive spores. The larger spores may allow the hybrid to disperse and apogamously produce additional sporophytes. In 1990, populations of this hybrid were discovered on algalic talus slopes in two counties: Clayton Co.: Sec 26, Boardman Twp. on 14 September 1990 (Nekola 9051 COE), and Dubuque Co.: Secs 4 & 5, Taylor Twp. on 25 June 1990 (Nekola 8385 COE) and...
on 3 July 1991 (Nekola 9884 COE). Subsequently, in 1995, Pryer
annotated as G. Xintermedium the collections by H. Goddard on 21
June 1899 from rock bluffs in Winneshiek Co. (Goddard s. n. IA;
ISC). Thus, it is known from three counties in northeastern Iowa.
Extensive searches for this taxon on approximately 100 algal talus
slopes in Iowa have located no additional populations (Nekola,
1997).

COUNTY OCCURRENCE RECORDS NEW TO IOWA

Thirty-two taxa have additional county occurrence records (COR)
that document their distribution within Iowa. Of particular impor-
tance is a series of COR for Botrychium campastre reported from
cedar glade communities in northeastern Iowa (Nekola and Schlitch,
1996a,b). The 81 COR added with this report, when combined with
those previously reported (Peck, 1976b, 1980, 1983, and 1989),
result in a total of 1754 COR supporting the Iowa pteridophyte
flora. This more than doubles the 846 COR reported by Cooperrider
(1959) and adds 500 COR to the flora of Peck (1976b). A data
matrix was prepared (Fig. 1) to succinctly display the Iowa pteri-
dophyte flora and the COR for each taxon. New records are cited by
species, collector, collection number and herbarium of deposit.
The latter is cited by acronym code: University of Iowa (IA), Iowa State
University (ISC), University of Northern Iowa (ISTC), and Coe
College (COE).

Asplenium platyneuron Britton, Sterns & Poggenburg: Appanoose
Co.: Zehr 5219011 (ISTC), Benton Co.: C. Peck s. n. (ISTC), Bu-
chaman Co.: Peck 91001 (ISTC), Clarke Co.: Peck 91101 (ISTC), Davis
Co.: Peck 91121 (ISTC), Keokuk Co.: Peck 91143 (ISTC), Lucas Co.: Peck
91163 (ISTC), Mahaska Co.: Zehr s. n. (ISTC), Monroe Co.: Zehr
s. n. (ISTC), Story Co.: Norris s. n. (ISC), Wapello Co.: Peck 91186
(ISTC), Wayne Co.: Peck 91188 (ISTC).


Botrychium campastre Wagner & Farrar: Black Hawk Co.: Nelson
10738 (COE), Butler Co.: Nelson 10739 (COE), Cherokee Co.: Farr-
rar s. n. (ISTC), Clinton Co.: Nelson 10875 (COE), Delaware Co.: Nelson
10750 (COE), Floyd Co.: Nelson 10741 (COE), Franklin Co.: Nelson
10740 (COE), Howard Co.: Nelson 10766 (COE), Jackson
Co.: Nelson s. n. (COE), Linn Co.: Nelson 10731 (COE), O'Brien Co.: Farrar
s. n. (ISTC), Winneshiek Co.: Nelson 10767 (COE).

Botrychium dissectum Spreng. f. dissectum: Mitchell Co.: Nelson
10031 (COE).

Botrychium dissectum Spreng. f. obliquum Clute: Mitchell Co.: Nelson
10047 (COE).

Botrychium multifidum (Gmel.) Rupr.: Black Hawk Co.: Nelson
9375 (COE), Linn Co.: Nelson 8074 (COE).

Botrychium simplex E. Hitch. var. compositum (Lasch) Milde: Clayton
Co.: Rosburg 1493 (ISC).

Botrychium simplex E. Hitch. var. tenebrosum (A. A. Ear.) Clausen:
Marshall Co.: Peck 90001 (ISTC).

Botrychium virginianum (L.) Sw.: Osceola Co.: Peck 87073 (ISTC),
Worth Co.: Peck 87007 (ISTC).

Cystopteris fruticosa (L.) Bernh.: Dubuque Co.: Nelson 8395 (COE),
Mitchell Co.: Nelson 6844 (COE).

Cystopteris praestans (Weath.) Blasdel: Calhoun Co.: Zehr s. n.
(ISTC), Keokuk Co.: Peck 91144 (ISTC), Poweshiek Co.: Peck 90307
(ISTC), Wapello Co.: Peck 91187 (ISTC).

Cystopteris tennesseensis Shaver: Lee Co.: Zehr s. n. (ISTC).

Diphasiastrum digitatum (Dill. ex Broun) Holub: Fayette Co.: Ne-
kola 7307 (COE); Linn Co.: Nelson 8030 (COE).

Dryopteris carthusiana (Vill.) Fuchs: Benton Co.: C. Peck s. n.
(ISTC); Story Co.: Friedrich s. n. (ISC).

Dryopteris cristata (L.) Gray: Butler Co.: Leochke 516 (ISC), Floyd
Co.: Leochke 888 (ISC), Van Buren Co.: Peck 81376 (ISTC).

Dryopteris goldiana (Hook.) Gray: Fayette Co.: Nelson 8519 (COE).

Equisetum fluviatile L.: Franklin Co.: Leochke 881 (ISC), Muscatine
Co.: Leochke 491 (ISC).

Equisetum pratense Ehrh.: Benton Co.: Leochke 1067 (ISC), Buchan-
an Co.: Klag 90186-3 (IA).

Equisetum sibiricum L.: Bremer Co.: Freeman 78114 (ISC), Cedar
Co.: Nelson 9152 (COE), Fayette Co.: Nelson 7726 (ISTC).

Equisetum Xferrissii Clute: Osceola Co.: Peck 7665 (ISC).

Gymnocarpium jessoensee (Koidz.) Koidz. ssp. parvulum Sarvela: Al-
lamakee Co.: Hartley 6254 (IA), Winneshiek Co.: Holloway s. n. (GH).

Gymnocarpium robertianum (Hoffm.) Newm.: Delaware Co.: Nelson
9662 (COE).

Gymnocarpium Xbrittianum (Sarvela) Pryer & Haufier: Clayton
Co.: Nelson 8499 (COE).

Gymnocarpium Xintermedium Sarvela: Clayton Co.: Nelson 9051
(COE), Dubuque Co.: Nelson 8383 (COE), Winneshiek Co.: Goddard
s. n. (IA).

Huperzia lucidula (Michx.) Trevs.: Webster Co.: Farrar s. n. (ISC)
[voucher from population at Woodman Hollow State Preserve re-
places photovoucher of extirpated population at Dolliver State Park].

Ophioglossum pusillum Raf.: Butler Co.: Leochke 1481 (ISC), Clinton
Co.: Peck 90018 (ISTC), Clayton Co.: Nelson 10093 (COE), Des
Moines Co.: Peck 91204 (ISTC); Jones Co.: Peck 90022 (ISTC).


Ornunda regalis L.: Jones Co.: Nelson 10018 (COE).

Pellaea glabella Mett. ex Kuhn: Butler Co.: Nelson 8438 (COE).

Pulystichum acrostichoides (Michx.) Schott: Appanoose Co.: Wright s.
COE; Jones Co.: Peck 87207 (ISTC), Monroe Co.: Peck 91006
(ISTC).


Woodsia obtusa (Spreng.) Torr. subsp. obtusa: Des Moines Co.: Peck
87286 (ISTC), Fayette Co.: Peck 90007 (ISTC), Monroe Co.: Peck
91006 (ISTC).

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