

Distribution of *Botrychium campestre* in Northeastern Iowa

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ABSTRACT.—A survey of 42 glade sites in northeastern Iowa documented the occurrence of the northern plains *Botrychium campestre* at 12 sites. These populations represent a 200–350 km eastern range extension into a habitat previously unreported for this taxon. The presence of *B. campestre* with other northern plains disjuncts in the flora of these sites suggests that eastern Iowa glades may represent refugia for taxa whose ranges were more extensive during the Hypsithermal.

Botrychium campestre W.H. Wagner & Farrar initially was located in 1982 in the Loess Hills of western Iowa. While at first believed to represent a Loess Hills endemic (Howe et al., 1984), subsequent investigation revealed it to occur in dry gravel or loess prairie sites from extreme southwestern Iowa to central Alberta (Lellinger, 1985; Wagner and Wagner, 1986; Coffin and Pfannmuller, 1988). Disjunct populations of this species also have been found in grasslands on beach dunes or on thin soil over bedrock along the eastern, western, and northern shores of Lake Michigan, Lake Huron, and the southern shore of Lake Superior (Wagner and Wagner, 1993). Although the most recent range map for this species (Wagner and Wagner, 1993) shows this taxon entering eastern Iowa, until now no populations were known east of Dickinson County in extreme northwestern Iowa (Peck et al., 1989).

A single population of *B. campestre* was located in May 1993 on a limestone glade southwest of Rockford in Floyd County, Iowa. This station represented a 200 km range extension eastward into a previously undocumented habitat for this species. During May of 1994 and 1995, 42 additional glade sites, spread across 17 northeastern Iowa counties, were surveyed. Populations of *B. campestre* were located at 12 sites in 10 counties (Fig. 1). All specimens are housed in the R.V. Drexler Herbarium (COE) at Coe College, in Cedar Rapids, Iowa.

SPECIMENS EXAMINED. (numbers cited are COE accession numbers)—Black Hawk Co., Pints Quarry Glade, SE $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 36, T89N R12W, *Nekola & Schlicht* s.n. (COE 10738); Butler Co., Austinville Glade, NW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 19, T90N R18W, *Nekola & Schlicht* s.n. (COE 10739); Clinton Co., Maquoketa South Glade, N $\frac{1}{2}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 5, T83N R3E, *Nekola* s.n. (COE 10875); Delaware Co., Earlville Glade, SW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 4, T88N R4W, *Nekola* s.n. (COE 10750); Floyd Co., Beemis Creek

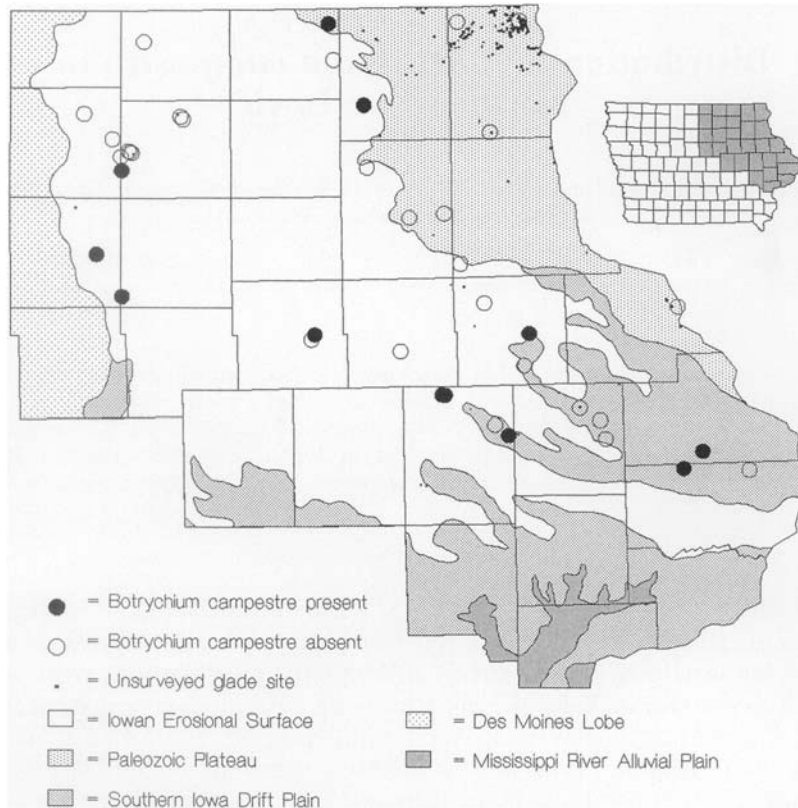


FIG. 1. Map of the northeastern third of Iowa showing county and physiographic region boundaries, with the location of glade sites inventoried for *B. campestre*. Open circles designate sites in which *B. campestre* was absent; filled circles sites in which *B. campestre* was present.

Glade, SW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 6, T94N R18W, *Nekola & Horton* s.n. (COE 10700, 10741); Franklin Co., Hampton East Glade, NE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 6, T91N, *Nekola & Schlicht* s.n. (COE 10740); Howard Co., Florenceville Glade, SW $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 27, T100N R11W, *Nekola* s.n. (COE 10766); Jackson Co., Hamilton Glade, NE $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 23, T84N R3E, photo voucher, *Nekola & Hamilton* s.n.; Linn Co., Baty Glade, NE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ and NE $\frac{1}{4}$ SE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 10, T86N R7W, *J. Nekola & F. Nekola* s.n. (COE 10731, 10732); Matsell Bridge Glade, SW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 26, T85N R5W, *Schlicht* s.n. (COE 10775); Troy Mills Quarry Glade, SW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 9, T86N R7W, *Nekola* s.n. (COE 10776); Winneshiek Co., Ludwig Glade, NE $\frac{1}{4}$ NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 25, T97N R10W, *Nekola* (COE 10767).

Individuals of *B. campestre* from eastern Iowa (Fig. 2) appear on average to be slightly smaller than typical material from western Iowa (see Wagner and Wagner, 1986, fig. 5). It is not clear if this difference is related to genetic or ecotypic factors, or a combination of both. By far the largest population observed was that at Beemis Creek, where at least 52 individuals were noted.

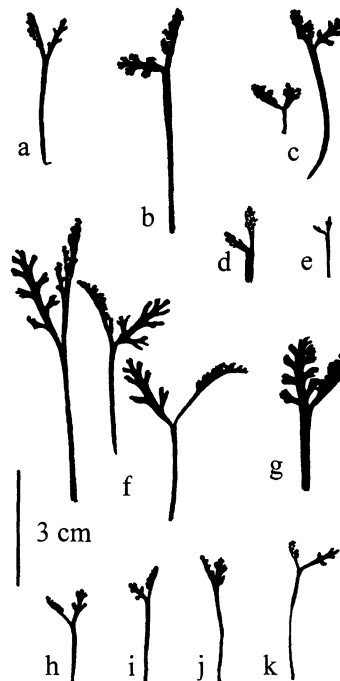


FIG. 2. Silhouettes of specimens from ten northeastern Iowa *B. campestre* populations. a) Linn Co. (COE 10776); b) Butler Co. (COE 10739); c) Linn Co. (COE 10731, 10732); d) Delaware Co. (COE 10751); e) Winneshiek Co. (COE 10767); f) Floyd Co. (COE 10741); g) Floyd Co. (COE 10700); h) Black Hawk Co. (COE 10738); i) Howard Co. (COE 10766); j) Linn Co. (COE 10776); k) Franklin Co. (COE 10740).

Other significant populations were observed at Baty (17 individuals), Maquoketa South (10 individuals), and Austinville (7 individuals). At the remaining sites, populations consisted of fewer than five individuals. The very small numbers of individuals seen on most sites suggest that populations should be monitored to determine long-term demographic trends.

Andropogon scoparius, *Anemone patens*, *Aster sericeus*, *Carex abdita*, *Carex meadii*, *Carex richardsonii*, *Castilleja sessilifolia*, *Commandra umbellata*, *Dodecatheon media*, *Echinacea pallida*, *Oxalis violacea*, *Rosa carolina*, *Sisyrinchium campestre*, *Sporobolus asper*, *Sporobolus heterolepis*, *Viola pedata*, *Viola pedatifida*, *Zizia aurea*, and *Zygadenus glaucus* were common associates of *B. campestre* on these sites. Of these, *Andropogon scoparius* and *Carex richardsonii* were the most consistent: All *B. campestre* individuals were found within 10 cm of *A. scoparius* clumps, whereas *C. richardsonii* was found within a few meters of *B. campestre* at all but one site, although they never co-occurred at very small (<0.25 meter) spatial scales.

Other plants typical of northeastern Iowa glades that were seen at *B. campestre* sites, but which did not consistently associate with it at scales less than 1 m² included: *Agoseris cuspidata*, *Arenaria stricta*, *Aster oblongifolius*,

Astragalus crassicaarpus, *Bouteloua hirsuta*, *Cacalia tuberosa*, *Draba reptans*, *Gentiana puberula*, *Geum triflorum*, *Heuchera richardsonii*, *Isanthus brachiatus*, *Lespedeza leptostachya*, *Liatris aspera*, *Liatris cylindracea*, *Lithospermum canescens*, *Lithospermum incisum*, *Muhlenbergia cuspidata*, *Oenothera serrulata*, *Panicum virgatum*, *Petalostemum purpureum*, *Phlox pilosa*, *Psoralea esculenta*, *Ranunculus rhomboideus*, *Solidago nemoralis*, *Solidago ptarmicoides*, and *Valeriana edulis*.

Eastern Iowa *Botrychium campestre* populations are separated from the main part of their range in western Iowa by the Des Moines Lobe physiographic region (Prior, 1991), a 200 km wide barrier across which no appropriate habitats (xeric gravel prairie or carbonate glades) occur. These populations are also isolated by 400 km. from those found along the Great Lakes. Although *B. campestre* appears to occur sporadically across the extent of glade habitats in northeastern Iowa, we were unable to locate populations within two geographic areas: 1) the northwest corner of the Iowan Erosional Surface (6 sites surveyed); 2) the Paleozoic Plateau region of northeastern Iowa (8 sites surveyed).

Botrychium campestre is but one of a series of northern plains species (including *Amelanchier alnifolia*, *Carex richardsonii*, *Juniperus horizontalis*, *Ranunculus rhomboideus*, *Solidago ptarmicoides*, and *Zygadenus elegans*) that are disjunct on northeastern Iowa glades. As Hypsithermal warming progressed south out of the northern plains into northern Iowa (Baker et al., 1992), by 6000–5000 B.P. a corridor between northeastern Iowa glades and the northern plains may have developed. The northern plains taxa of northeastern Iowa glades (including *B. campestre*) thus may represent relicts of once more extensive ranges that have persisted as isolated fragments in the region due to the microclimate and/or microedaphic conditions maintained on glade sites.

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