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In this issue:

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EDITORIAL
THE FUTURE OF *MISSOURIENSIS*

Has *Missouriensis* outlived its usefulness? It is a tough question and one that the Board of the Missouri Native Plant Society will be wrestling with in the coming weeks. When the Native Plant Society first officially started in June, 1979, the informal newsletter published until that time was renamed *Missouriensis* by the first board, under the editorship of the late Erna Eisendrath. It was the hope of the board that the newsletter eventually would grow into a "full-fledged, but not 'uppity' journal," which was cited by Robert Mohlenbrock as badly needed, and from the beginning, *Missouriensis* was the "Journal of the Missouri Native Plant Society."

Over time, the format and content of the journal evolved. The first three volumes were in 8½ × 11 inch, newsletter format. This changed with the start of volume 4, in 1982, to a "half-sheet" format, which in turn was made slightly narrower in 1990. Both changes were made to reduce printing costs. Initially, the journal included four issues per year. This changed to two issues with volume 6, in 1985, about the same time that the Society's newsletter, *Petal Pusher*, began publication. Initial volumes included about 80 printed pages, and this increased to about 150 pages by volume 4. Since the reduction to two issues per year, page numbers per volume have varied from a high of 88 pages for volume 9 (1988) to a low of 44 pages for volume 12 (1991), with most volumes containing about 76 pages.

The first six volumes included the beginnings of several repeated features, such as summaries of board meeting minutes, a "What you Missed" summary of field trip and other board meeting events, a "Show-Me Places" series on areas to visit in the state, and the "Missouri Botanical Record" lists of county records. None of these survived past 1992. Instead, during the first ten years of its production there was a gradual shift of emphasis in the journal content from timely notices and informal articles with observations on Missouri flora to scholarly papers on the flora in scientific format. These changes were instituted following a survey of members in 1985 in which many members

expressed a preference for papers on Missouri plants for the journal.

The years 1995 and 1996 were not particularly good ones for *Missouriensis*. In fact, the reason for this editorial is the apparent ill health of the journal. Although we managed to print 76 pages in 1995, both issues of volume 16 were late in production, because submissions to fill an issue lagged behind the production schedule of the journal. In short, the editors had to spend a lot of time begging for contributions to fill pages. This situation became much worse in 1996, with most of the relatively few submissions for volume 17 coming in toward the end of the year.

The issue you are holding, which was printed in April, 1997, represents the entire backlog of submissions made during the year 1996. We have combined these into a single issue for the year, because splitting them into the usual two issues would be expensive and wasteful of mailing labels and time. Volume 17 is the shortest issue of the journal published to date. Perhaps more disturbing is the fact that during the first three months of 1997, there were no submissions to *Missouriensis* at all. In other words, the problems with the journal are continuing to get worse. A related question is whether the journal has much of a readership. If we ceased publication today, how many members would care?

A major portion of membership dues in the Society is allocated to production of the journal. In addition to regular members, several libraries subscribe and we exchange the journal with several other native plant societies. Paying subscribers and those who send us their journals and newsletters on exchange have a right to expect something for their money. The Society needs to decide whether it will continue to support publication of a journal and, if so, what kind of material and how much will fill its pages. Otherwise, a reduction in membership dues may become necessary. This is a complex issue. There may not be another home for the kind of papers and reports that have been published in *Missouriensis* during the past several years. There may be a need to move the journal in a different direction. The journal may need to change to once-a-year production. Or, it may have outlived its usefulness.

If you, who are reading this, have opinions on this issue, you need to make these known to the Society's board. Please contact President Larry Morrison by electronic or postal mail at his address (on the inside of the front cover) and make your wishes known. If you feel that the Society needs to continue producing a journal, you need to decide what goes into it and whether you can help fill its pages. The board will decide at its annual meeting in June how to deal with this problem, and your input is desperately needed. Otherwise, the board will probably decide that none of the members cares about the journal, and *Missouriensis* will end its evolution with extinction.

DALEA GATTINGERI, A CEDAR GLADE ENDEMIC NEW TO MISSOURI

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Recent botanical inventories in Howell County have resulted in the discovery of several populations of an unusual prairie clover, *Dalea gattingeri* (A. Heller) Barneby (Fabaceae) (Fig. 1). This species was previously thought to be endemic to cedar glades from central and eastern Tennessee to northern Georgia and Alabama, more than 700 km to the east of the Missouri populations. The species presently is known from ten counties in Tennessee (Milo Pyne, pers. comm.), two counties in Georgia (James Allison, pers. comm.), and four counties in Alabama (Baskin et al., 1995). All of these populations are found on Cretaceous or Ordovician limestone substrates. In Alabama, the species is state-listed by the Natural Heritage Program, but it is not tracked in Georgia or Tennessee.

Missouri stations occur on Ordovician age, Jefferson City dolomite glades in southeasternmost Howell County, within 10 km of the Arkansas Border. Plants grow from cracks and crevices in areas of gently sloping, relatively open bedrock with very sparse grass cover and are associated with scattered individuals of *Calamintha arkansana, Evolvulus nuttallianus, Hedyotis nigricans*, *Rudbeckia missouriensis*, *Ruellia humilis*, and rarely *Dalea purpurea*. The glades vary from relatively

undisturbed to relatively heavily impacted by activities of heavy equipment and vehicles. Population sizes range from a few plants to more than 200 individuals. Voucher data include:

> HOWELL COUNTY: cherty dolomite glade on east side of Stace-Shannon Lake near dam, ca. 5 mi N of Lanton off Highway 17 on County Road SE 932, T22N R8W S10, 25 June 1993, *Summers et al. 5926* (MO); same locality, 9 July 1993, *Summers 6000* (MO); White Ranch State Forest [Conservation Area], scattered perennials on dolomite glade, stems prostrate, T22N R7W S31 NE¼, 29 June 1993, *Skinner 5970* (MO); 2½ mi E of Lanton in dolomite glade on N side of Highway 142 near junction with County Road 933, T22N R7W S32 S½, 8 Aug 1993, *Summers 6236* (MO); 4½ mi E of Lanton in dolomite glade on N side of Highway 142, T21N R7W S3 S½, 8 August 1993, *Summers 6237* (MO).

The following morphological description was compiled from Missouri specimens and the monographs of Wemple (1970) and Barneby (1977): Plants perennial with thick black rootstocks. Stems several, radiating from rootstock, 10–40 cm long, procumbent to prostrate, glabrous or rarely with scattered, small, spreading hairs near the tip. Leaves alternate, appearing fascicled (by germination of axillary buds, 15–35 mm long, short-petiolate, pinnately compound with 5–9 leaflets, the petioles and rachises punctate with scattered, sessile, yellow to light brown glands. Stipules linear and hairlike, persistent. Leaflets 8–18 mm long, linear to narrowly oblanceolate, the margins inrolled, punctate with scattered, sessile, yellow to light brown glands. Inflorescences terminal and sometimes at the tips of short axillary branches, dense, cylindrical spikes (Fig. 1) 15–75 mm long, 8–10 mm in diameter, short-pedunculate, the peduncle and axis densely pubescent with short, spreading, curved hairs, the axis at least in part visible between the flowers and elongating somewhat after anthesis. Flowers numerous, each subtended by a small, lanceolate bract, this usually shed by

Fig. 1. Habit of *Dalea gattingeri*, showing prostrate branches with leaves and inflorescences. Photo by Bill Summers.

flowering, but often held in place between flowers. Calyces 4–5 mm long, indistinctly 10-ribbed, densely pubescent with short, spreading, curved hairs, the teeth unequal, 1.3–2.6 mm long, lanceolate to narrowly ovate, the 3 upper teeth shorter than the 2 lower ones. Petals 5, pinkish purple, the banner petal 5–6 mm long, long-clawed, the expanded portion ovate, the other petals 3.5–4.5 mm long, clawed, oblong to narrowly oblanceolate, adnate to the tip of the staminal tube. Stamens 5, 6–8 mm long, connate basally into a tube 2.5–3.0 mm long, the anthers 0.9–1.0 mm long, orange. Fruits 2.7–3.5 mm long, triangular to broadly half-moon-shaped in outline, hairy and glandular punctate in the apical half, indehiscent, 1-seeded, enclosed in the persistent calyces. $2n=14$ (Wemple, 1970).

Dalea gattingeri flowers in Missouri mainly during a relatively short period from early to late June. However, secondary, axillary spikes are sometimes produced, extending flowering into early August. Fruits mature mostly from late July to mid-August, and are dispersed intact within the calyces as the inflorescence shatters, leaving the naked axis at the stem tip. Baskin and Baskin (1989) reviewed the autecology of this species in Tennessee and found the following: the species forms root nodules, flowers are apparently pollinated by honeybees,

plants are several years old before they flower (but can flower during the first year in the greenhouse), and seed germination rates in nature are apparently relatively low.

As noted above, *D. gattingeri* occasionally occurs with the other purple-flowered species of prairie clover in the state, the widespread *D. purpurea* Vent. Both were previously classified in Section *Purpurei* of *Petalostemon* (Wemple, 1970) and are currently treated as members of Series *Purpureae* of Section *Kuhnistera* of *Dalea* (Barneby, 1977). However, within the series they are more closely related to other species than to each other. Although superficially similar, the two species are easily separated by a number of characters summarized in the following key:

1. Stems 10–40 cm long, prostrate to procumbent; leaflets 5–9; inflorescences 8–10 mm in diameter, dense, but with the axis at least in part visible between the flowers; calyces with the lobes and tip of tube hairy; fruits 2.7–3.5 mm long . . . . . *D. gattingeri*
1. Stems 20–100 cm long, erect to ascending; leaflets 3–5(–7); inflorescences 9.5–12.0 mm in diameter, so dense that the axis is hidden by the flowers; calyces uniformly hairy throughout; fruits 2.1–2.6 mm long . . . . . *D. purpurea*

In addition to the morphological characters the two species also have somewhat different flowering times in Missouri. Flowering in *D. gattingeri* occurs primarily during a relatively short period of only a few weeks from early to late June, with occasional, secondary spikes produced sporadically from the leaf axils and potentially extending the flowering period into early August. Individual spikes remain in flower for a short time, and most spikes begin flowering more-or-less synchronously. At the stations where *D. gattingeri* occurs, *D. purpurea* routinely begins flowering two or three weeks later than does *D. gattingeri* and the period of flowering can last into early September. Individual flowers of a spike mature in a somewhat

slower sequence. Production of secondary inflorescences also appears to be more common. In an average year, there is limited overlap in the flowering times of the two species, except for the occasional late inflorescence in *D. gattingeri*. No apparent hybrids were noted in any of the populations found. Wemple (1970) performed artificial crosses between the two taxa and noted reduced fertility in the hybrids, and the taxa are thus both phenotypically and genetically isolated.

Dalea gattingeri has been cited as one of about 44 angiosperm species endemic or nearly endemic to calcareous glades in the southeastern and midwestern states (Baskin and Baskin, 1989). Thus far, relatively few of these endemics have been documented as shared between the glades of the Ozarks/midwestern states and those of the southeastern states (Baskin and Baskin, 1989; Baskin et al., 1995). This evidence, plus apparent differences in population densities among the dominant grasses, has caused some researchers to suggest a vegetational dichotomy between calcareous glade communities of the two regions (Baskin et al., 1995). According to this theory, calcareous glades of the Ozarks and midwestern states are viewed as successional grasslands destined to evolve into deciduous, hardwood forests in the absence of periodic disturbance (Steyermark, 1940; Heikens and Robertson, 1995; and references cited therein), whereas similar glades in the southeastern states are relatively stable, climax communities requiring little perturbation to maintain themselves (Baskin et al., 1995).

Opponents of this theory note the overall strong floristic similarities between glades in the two regions, both among vascular plants and bryophytes (Redfearn, 1983). By this view, the apparent differences between glades of the two regions are due to differences in substrates, climates, and post-Pleistocene vegetational history, rather than to differences in successional status. The discovery that *D. gattingeri* grows on dolomite glades in the Ozarks as well as on limestone glades in the southeastern states provides evidence of floristic similarities between the two regions. However, a more detailed exploration of data concerning the distinctness or relatedness of these plant communities is beyond the scope of the present paper.

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TWO INTRODUCED SPECIES NEW TO MISSOURI

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This account presents information on two naturalized species of monocots that have not previously been documented as part of Missouri's Flora. They are a grass, *Paspalum distichum*, and a member of the arum family, *Arum italicum*. In the first case, the original observations were made more than 45 years ago, but not confirmed until recently, and in the other case the initial discovery was made in 1996. Voucher specimens of these species are accessioned at the Missouri Botanical garden Herbarium (MO), with duplicates to be distributed.

PASPALUM DISTICHUM L. (POACEAE)

In 1949, while working for Ozark Fisheries, Inc., I noticed an unusual grass forming mats around the margins of an artificial hatchery pond in southeastern Camden County. These ponds were constructed on former farm land by building dams and levees along small drainages, and are managed intensively for commercial fish production. There are now more than 400 ponds in the company's holdings, many of them along two adjacent drainages, Wet Glaize (= Mill) Creek and Sellars Creek. The ponds are reached via State Highway 7, ca. 10 km southeast of Montreal.

At that time, I keyed this grass to *Paspalum distichum* L., knotgrass, using the seventh edition of Gray's Manual (Robinson and Fernald, 1908), but did not collect any vouchers. By the time I retired and moved from the area in 1975, I noticed that the grass appeared to be spreading to other ponds in both drainage systems. It was not until 1996 that I had the opportunity to return to the area and to collect a voucher (Pond #3, along Wet Glaize Creek, just off Hwy. 7, 28 Sep 1996, *Hudson 959*). Although I was unable to survey very many ponds during this most recent trip, it was clear that this introduced species

was still naturalized around a number of hatchery ponds on the property.

Paspalum distichum is a wetland species of pantropical occurrence. In the United States it grows nearly throughout the southeastern and western states, and is naturalized outside of its presumed native range as far north as New York (Gleason and Cronquist, 1991). The closest reports for Arkansas are from Randolph and Washington Counties (Smith, 1988), about 250 km to the southeast and southwest, respectively.

Knotgrass is a strongly stoloniferous perennial that in Missouri forms mats around pond margins and grows out along the water surface, rooting freely at the nodes. Pond #3, where the voucher specimen was collected, had been grazed intensively by sheep in 1996, and the fertile plants there were all rooted in shallow water. Other ponds on the property with this species have been managed by mowing, grazing by cattle and sheep, or treatment of the edges with herbicides during various years. The species appears to have become naturalized mostly on "feathered out" ponds, that is, those with levees and therefore relatively steep banks on three sides and a lengthy, more natural, flatter margin on the "upstream" side of the drainage in which the pond was created. Many ponds on the site have levees on all four sides, and these rarely support populations of *P. distichum*.

The culms of this species are ascending from the prostrate, stoloniferous mass, and can grow to 0.5 m long. The relatively short leaf blades are 2–6 mm wide, flat, and mostly glabrous. Inflorescences consist of a pair of branches (unique among Missouri members of the genus), each 15–50 mm long, with the spikelets in 2 rows on the underside of a slender rachis, which is typical for the genus *Paspalum*. Spikelets are 2.5–3.0 mm long, with a single, fertile floret.

The nomenclature surrounding this species and the related *P. vaginatum* Sw. is confusing in much of the botanical literature. Because the application of the name *P. distichum* was uncertain, some authors used it in the sense applied here, whereas others used it in place of the name *P. vaginatum* and referred to our taxon as *P. paspalodes* (Michx.) Scribn. Guédès (1976) reviewed the use of these epithets in the earlier literature

and stabilized the nomenclature by selecting a lectotype for *P. distichum* in accordance with the widest usage of the name. Thus the name *P. paspalodes* is a synonym of *P. distichum*, and applies to the taxon in Missouri. The Camden County plants are referrable to the widespread var. *distichum*. Another variety with coarsely hairy lower leaf sheaths, var. *indutum* Shinn., was described as endemic to the Dallas region of Texas.

ARUM ITALICUM MILL. (ARACEAE)

In 1996, normal growth in most native plant species in Butler County was delayed because of late periods of unusually cold weather. The local woods had a wintry aspect until well into April.

In Poplar Bluff, near my former home on Shady Lane, a former 15 acre woodlot was undergoing "progress" through development of a subdivision, with a road, drainage culverts, utilities, and 3 houses already in place by the end of winter. During a walk through this area in mid-March, I noted a patch of vivid green foliage in seeming defiance of the bitter cold (to –4°F) of recent nights. Closer investigation showed the plant to be Italian arum, *Arum italicum* Mill., an unusual find for the midwestern United States.

A return visit to the site a few days later resulted in the discovery of eight clumps (Fig. 1) of varying size containing both large and small plants. A number of small individuals were growing around the clumps, which were scattered over a about 25 m stretch along the margins of a small stream running along the bottom of a shallow ravine through the woodlot. The population begins about 200 m downstream from the head of the drainage and about 100 m downstream from a drainage culvert where Shady Lane crosses the stream. The drainage is subject to periodic flash-floods following heavy rains. The closest house is about m away, along the ridge bordering the side of the ravine. It seems likely that the plants became established as escapes from a nearby garden or as a result of a garden plant that was discarded into the ravine by an unthinking homeowner. The population is well-established, and presumably has been

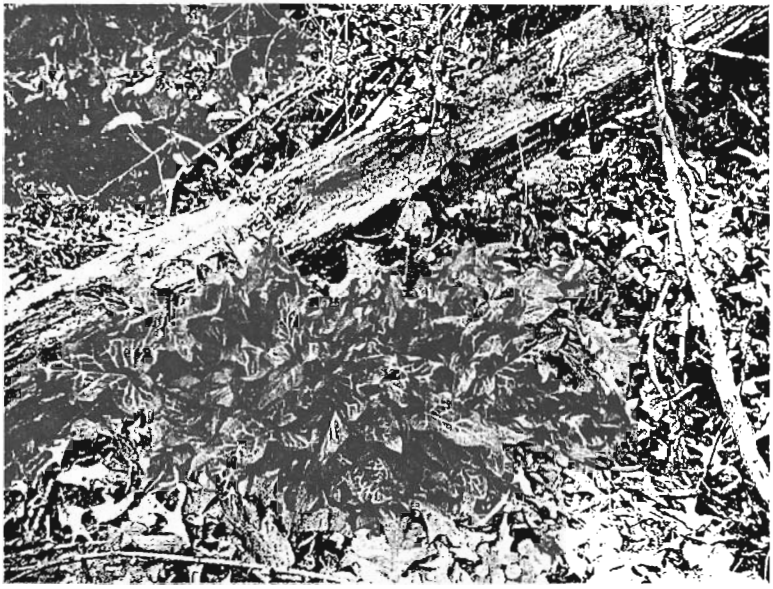

Fig. 1. Clump of *Arum italicum* growing at the base of a fallen log. Photo by Stanton Hudson.

naturalized for several years. Its fate is uncertain as development of the site continues.

The population was monitored for the next few months. At the time of the initial find in mid-March, the leaves were only partially expanded, with nearly vertical leaf blades A vegetative voucher (*Hudson 566*) was collected. By late April, the leaves were fully expanded and the largest had blades about 30 cm long that were held at about a 45° angle to the petiole. On 14 May, several spathes were noted (vouchered by *Hudson 586*), some opened to reveal the yellow inflorescences and others still closed (Fig. 2). The largest clumps had five spathes, of which three had opened. Flash-flooding in the ravine knocked over most of the leaves and inflorescences and only one plant subsequently produced mature fruits. By late July, when the mature fruits were brigh reddish orange, the leaves and spathes had withered.

At its Missouri site, *Arum italicum* is located in a disturbed, mesic upland forest on cherty substrate overlain by rich,

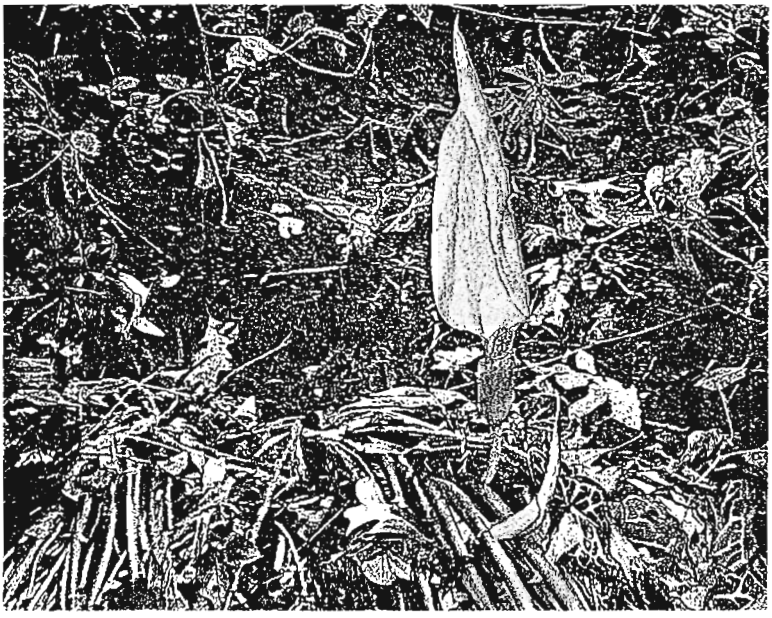

Fig. 2. Inflorescence of *Arum italicum*, showing the large, white spathe. Note that the leaves have been made prostrate by flooding earlier in the season. Photo by Stanton Hudson.

organic, loamy soil. Associates include spice bush (*Lindera benzoin*), wild yam (*Dioscorea quaternata*), poison ivy (*Toxicodendron radicans*), spotted jewelweed (*Impatiens capensis*), and the invasive Japanese honeysuckle (*Lonicera japonica*). An unusual associate is strawberry bush (*Euonymus americanus*), of which only four individuals were found.

In the Missouri flora, *A. italicum* is most similar to arrow arum, *Peltandra virginica*, but differs in the venation pattern of its leaf blades, with a complex network of anastomosing veins present throughout the leaf (as opposed to mostly parallel side-veins, with anastomoses restricted to the marginal areas). Also, *Peltandra* has green fruits that remain enclosed in the base of the spathe at maturity, whereas *Arum* has brightly colored fruits that are exposed at maturity. The following description was compiled from Missouri plants and the monographs of Boyce (1993) and Thompson (1995): Plants with horizontal, rhizome-like, often deep-set tubers, sometimes forming clumps; leaves

25–75 cm long, continuing to enlarge during growing season, glossy, the blade sagittate or hastate, with 3 distinct main veins (the 2 lateral ones running into the basal lobes), green with usually white or lighter green variegation along the larger veins; lateral veins forming a complex network over the entire leaf surface; spathes 10–30 cm long, pale green to nearly white, sometimes faintly purplish tinged near the base, the open part above the pistillate flowers withering as the fruits develop; spadices yellow, with a thickened, sterile tip, the staminate flowers in upper 25–35 percent of the flowering portion; berries 5–11 mm in diameter, orangish red at maturity, with 2–5 seeds, in a globose cluster, not enclosed in the spathe.

The native range of Italian arum includes portions of southern Europe, western Asia, and northern Africa. It is cultivated widely as an ornamental in gardens, and has become naturalized sporadically in California, Oregon, and Washington (Thompson, 1995), as well as in Argentina (Boyce, 1993). Given its surprising tolerance of winter cold, it is surprising that this species has not been reported as an escape elsewhere in the United States.

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REDISCOVERY OF *ORYZOPSIS RACEMOSA* (POACEAE) IN MISSOURI

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The range of black-seeded rice grass or black-seeded mountain rice (*Oryzopsis racemosa* (Smith) A. Hitchc.) extends from Quebec and New England, south to Tennessee and Virginia, and west to Missouri, Minnesota, Iowa, and North and South Dakota (Chase, 1951; Steyermark, 1963; Great Plains Flora Association, 1986). The only Missouri records are an 1886 Tracy collection from Shannon County and an 1892 Bush collection from Clark County (Steyermark, 1963).

On 15 September 1995, the senior author discovered a small colony (17 separate clumps) of this species along the base of a small rocky slope adjacent to the junction of a small, intermittent stream and an unnamed tributary of Cedar Creek in Callaway County, central Missouri. We and members of the Missouri Native Plant Society returned to the locality 2 August, 11 August, and 2 September 1996 to search for additional populations within a small radius of the rediscovery site and other areas within the National Forest. These searches resulted in the discovery of 83 additional clumps scattered on the northeast and west banks of the small intermittent stream and along the north-facing limestone bluffs above the unnamed tributary. The following collections voucher the new discoveries:

Callaway Co.; Mark Twain National Forest, Cedar Creek District, ca. 0.8 mi WNW of Paris Fork

Church and ca. 0.8 mi S of the confluence of Smith and Cedar creeks, ca. 0.75 mi WSW of the highest point on Devil's Backbone; T46N, R11W S35 SW¼ of SW¼, 15 Sep 1995, *Wakeman* s.n. (MO, UMO); 11 Aug 1996, *McKenzie 1742 with Wakeman & Smith* (MO, MICH, UMO).

HABITAT AND ASSOCIATED SPECIES

Clumps of *Oryzopsis racemosa* occur on the lower 80–100 meters of the slopes adjacent to the small intermittent stream, and extend from the steep cliffs above the unnamed tributary to about mid-slope west of the intermittent stream. Habitat at the rediscovery site is a rich, mesic, mature, semi-open to shaded deciduous forest with steep limestone bluffs above the larger stream. A soil survey for Callaway County (Horn, 1992) categorized the soil profile of the area as a "Goss-Gasconade-Rock outcrop complex" with 5–35 percent slopes. Features of this complex include: 1) moderately sloping to steep slopes; 2) a combination of Goss and Gasconade soils that range on the surface from "very dark grayish brown and very dark gray cherty silt loam" to "very dark brown flaggy silty clay loam"; 3) rapid surface runoff; 4) well drained to excessively drained soils formed in cherty and clayey limestone residuum; and 5) soil that has moderate to moderately slow permeability (Horn, 1992).

A review of the literature suggests that *Oryzopsis racemosa* can be found in a wide range of habitats. Some authors (e.g., Schaffner, 1917; Chase, 1951; Rhoads and Klein, 1993) have listed the habitat for this species as open, rocky woods, whereas others have reported "steep, north- or east-facing wooded slopes" (Eilers and Roosa, 1994); "wooded slopes" (Steyermark, 1963); "rich upland woods" (Van Bruggen, 1985); "deciduous woods" (Great Plains Flora Association, 1986); "dune slopes, wooded bluffs, and ravines" (Swink and Wilhelm, 1994); "rich, rocky woods" (Mohlenbrock, 1972); or "rocky woods in the mountains" (Strausbaugh and Core, 1952). Herkert (1991) and Schwegman (1991) reported the habitat for this

species in northern Illinois as "calcareous mesic forest slopes, often above dolomite cliffs and ledges". Voss (1972) stated that this species occurred "usually in rich deciduous woods and wooded dunes, sometimes in disturbed places; less often associated with jack pine and oak". These references suggest that this species can occur in soil that ranges from sandy to rocky to rich loam. Habitat at the Callaway County site is apparently similar to sites described for the species in Illinois by Mohlenbrock (1972), Herkert (1991), and Schwegmann (1991).

Overstory at the rediscovery sites consists of: *Acer saccharum* ssp. *saccharum*, *Carya ovata*, *Juglans cinerea*, *Quercus alba*, *Q. muehlenbergii*, *Q. rubra*, *Tilia americana* var. *americana*, and *Ulmus rubra* (nomenclature of associates follows Yatskievych and Turner, 1990). Understory shrubs include: *Amelanchier arborea*, *Carpinus caroliniana*, *Cercis canadensis* L., *Lonicera flava*, *Ostrya virginiana*, *Rhus aromatica* var. *aromatica*, *Ribes missouriense*, *Ptelea trifoliata*, *Viburnum rafinesquianum* var. *affine*, and *V. rufidulum*.

The following understory herbaceous plants also were recorded at the Callaway County sites: *Actaea pachypoda*, *Adiantum pedatum*, *Agrimonia pubescens*, *Amphicarpaea bracteata*, *Anemone cylindrica*, *Aquilegia canadensis*, *Arisaema triphyllum*, *Asplenium platyneuron*, *Botrychium virginianum*, *Brachyelytrum erectum*, *Bromus pubescens*, *Cacalia atriplicifolia*, *Campanula americana*, *Desmodium glutinosum*, *D. nudiflorum*, *Echinacea purpurea*, *Elymus hystrix*, *Elymus villosus*, *Erigeron pulchellus* var. *pulchellus*, *Festuca subverticillata*, *Galium circaezans* var. *hypomalacum*, *Hieracium scabrum* var. *scabrum*, *Muhlenbergia sobolifera*, *M. tenuiflora*, *Panicum latifolium*, *Parthenocissus quinquefolia*, *Pedicularis canadensis*, *Solidago flexicaulis*, *Uvularia grandiflora*, and *Veratrum woodii*. *Asplenium rhizophyllum*, *Eupatorium rugosum* var. *rugosum*, *Fragaria vesca*, *Liparis liliifolia*, *Solidago drummondii*, and *Woodsia obtusa* are established on different portions of the limestone bluffs above scattered populations of *Oryzopsis racemosa*.

PHENOLOGY

Most references list the flowering period of this grass from late spring to early fall (e.g., Strausbaugh and Core, 1952; Steyermark, 1963; Kucera, 1961; Mohlenbrock, 1972; Swink and Wilhelm, 1994). At the Callaway County site, anthesis had ceased and fertile lemmas were well formed on 2 August, and disarticulation of lemmas was well underway on 2 September.

RARITY

Most authors consider black-seeded rice grass as a conservative species. For example, Swink and Wilhelm (1994) gave *Oryzopsis racemosa* the highest possible "coefficient of conservatism" at 10. This concept (Swink and Wilhelm, 1979, 1994) ranks plants based on how confidently we would predict that a particular specimen originated from a particular, intact, natural community. Voss (1972) is the only reference we could find indicating that this species can occur occasionally in disturbed habitats. *Oryzopsis racemosa* is state-listed as endangered in Missouri (Missouri Department of Conservation, 1995) and threatened in Illinois (Herkert, 1991).

FIELD IDENTIFICATION

We concur with Swink and Wilhelm (1994) that *Oryzopsis racemosa* is very similar vegetatively to *Brachyelytrum erectum*, a species with which it is associated at the Callaway County site. *Oryzopsis racemosa* can be distinguished from *Brachyelytrum erectum* by: its cespitose vs. rhizomatous habit; its much longer panicle branches; its brighter green leaves that are usually longer and velvety on the abaxial side and have smooth margins; its shorter ligule; its shiny black, oval vs. green to brown, lanceolate lemmas; and by the midvein of the leaves which is conspicuously off-center (Fig. 1). Although we can find no mention of the latter field mark in the published literature, it is a characteristic that provides for immediate recognition, even for sterile specimens. Also, the leaves of *O. racemosa* are unusual,

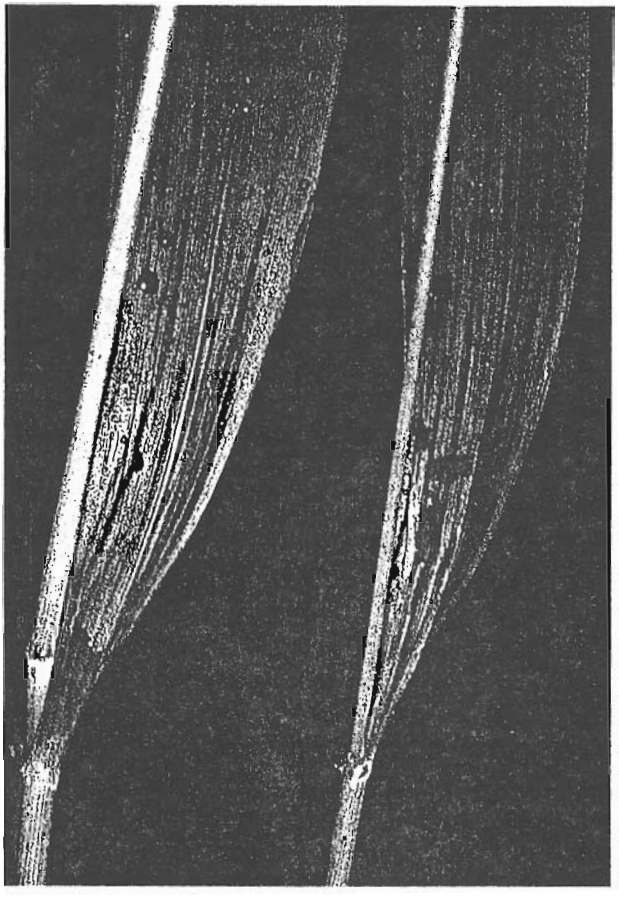

Fig. 1. Two culms of *Oryzopsis racemosa*, showing the off-center midveins of the leaf blades and the twisting of the leaf blades at their bases, so that the abaxial and adaxial surfaces are reversed in position. Photo by George Yatskievych.

in that the base of the leaf blade is twisted just above the sheath, so that the abaxial and adaxial surface are reversed in position (Fig. 1).

NEED FOR ADDITIONAL SURVEY WORK

Our observations and the widely distributed records in Missouri suggest that more populations may be discovered with additional field work during late summer through early fall, in appropriate habitats. Because there is an abundance of habitat similar to the rediscovery site throughout the Missouri Ozarks, it is not known whether the lack of records in the state is due to the rarity of the species or the lack of extensive botanical explorations during the late summer/early fall when many researchers are usually not looking for grasses. We agree with Steyermark (1963), that Missouri is on the extreme southwestern edge of this species' range. Recent searches in Illinois by John Schwegman (Schwegman, 1991) increased the number of county records for Illinois from 4 to 13 counties.

In August and September, 1996, we and various members of the Missouri Native Plant Society searched similar habitat with the same soil type in areas within 4 kilometers of the rediscovery site without finding additional populations except in areas directly adjacent to the 15 September 1995 locality. Despite these results, we believe that further survey work for this species in rich, rocky woods throughout the state is warranted, and we predict that with sufficient effort additional populations will be found.

ACKNOWLEDGMENTS

We thank George Yatskievych (Missouri Department of Conservation, Flora of Missouri Project), Tim Smith (Missouri Department of Conservation), Stephanie Smith (Missouri Department of Natural Resources), Barbara Moran (U.S. Forest Service, Mark Twain National Forest, Cedar Creek District), and members of the Missouri Native Plant Society for their assistance with this report.

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ANNOUNCEMENT

Copies of plant lists and other information relating to the flora are requested for inclusion in the Society's flora file. Please send items to the archivist, Jim Bogler (see address on inside front cover).

CYPERUS SETIGERUS AND *KYLLINGA GRACILLIMA* (CYPERACEAE) IN MISSOURI

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Recent field and herbarium studies have resulted in new data on two species of Cyperaceae in Missouri. These include the rediscovery of the uncommon *Cyperus setigerus* 80 years after its initial collection in the state and the first specimens of the introduced *Kyllinga brevifolioides* for Missouri.

CYPERUS SETIGERUS

Cyperus setigerus Torr. & Hook. is recorded from Kansas, Oklahoma, Texas, Missouri, and New Mexico (Steyermark, 1963; Barkley, 1968; Correll and Correll, 1972; Correll and Johnston, 1970; Great Plains Flora Association, 1986; Jones and Reznicek, 1993). Habitats listed for this species include "moist, clay meadows and ditches" (Correll and Correll, 1972), "scattered moist prairies, ditches, shoreline of ponds and lakes" (Great Plains Flora Association, 1986), and "open mesic disturbed roadside in red sandy clay soil with igneous rock outcrops" (Jones and Reznicek, 1993). The senior author noted that "prairie swales" and "ditches at the base of road cuts that had been excavated through limestone" were habitats commonly reported on specimens taken from Kansas. The only previous report of this sedge in Missouri was based on a specimen taken along the Missouri River near Sheffield in Jackson County by Bush on 17 June 1915 (Steyermark, 1963).

On September 9, 1995, we discovered a large colony of this species in a ditch adjacent to Interstate I-70 in Columbia (Fig. 1).

> **Voucher specimen**: U.S.A. MISSOURI. Boone County, along the west bound entrance ramp to Interstate I-70 at Exit 125 (West Blvd.), one large colony containing approximately 600 culms in a ditch, ca. 175 meters east of the junction of the west bound ramp onto I-70 and the interstate; NE¼, NE¼, NW¼, Sec. 11, T48N, R13W; 9 Sep 1995, *McKenzie 1650* with Brad Jacobs and Jerry Brabander (KANU, MO, NYS, UMO, VSC).

Although the site in Columbia is unlike the historical location in Jackson County recorded by Steyermark (1963), it is similar to literature descriptions of habitats described elsewhere for the species. How this species became established along the interstate is unknown. The location suggests that the sedge may have appeared some time following the construction of the interstate (around 1960). It is possible that the species occurred in appropriate habitat within the corridor outlined for construction. If so, earth moving activities may have moved the species to its current location. Another possibility is that achenes or rhizomes that had become embedded in the tires or blades of earth moving equipment may have become dislodged during transport on the interstate. Due to the species' apparently limited distribution in the Midwest, however, we believe it is unlikely that the sedge became established at the current locality based on the latter scenario. Nonetheless, there is no evidence that this sedge was deliberately planted at the current location.

Associated species at the site include plants typical of wet, disturbed habitats: *Carex annectens* var. *xanthocarpa*, *Cyperus esculentus*, *C. strigosus*, *Juncus spp.*, and *Typha latifolia*.

Based on Bush's historical collection of 17 June 1915 in Missouri and examination of collection dates on herbarium sheets for specimens of *Cyperus setigerus* taken in Kansas, the flowering date of 9 September 1995 in Columbia is apparently

Fig. 1. Large clump of *Cyperus setigerus* at the rediscovery site. Photo by Paul McKenzie.

late for this species. This is further supported by our observations of this sedge in flower at Boone County site on 19 June 1996. Differences in observed flowering dates between the two years is apparently due to scheduled maintenance of the interstate right of way by the Missouri Highway and Transportation Department. Flowering culms observed 9 September 1995 probably resprouted following mowing operations at the site in June or July of the same year. When we visited the site 19 June 1996, maintenance crews had recently mowed all right of way vegetation except the large flowering stand of *Cyperus setigerus*, which could not be mowed due to wet conditions at the site and an adjacent concrete culvert.

Recent negotiations with the Missouri Highway and Transportation Department have been successful in protecting the site for now. Nonetheless, some rhizomes will be translocated to the Center for Plant Conservation at the Missouri Botanical Garden and Rock Post Wildflowers, a private nursery in Fulton, Missouri, to initiate artifical propagation. To further maintain and protect the presence of the species in the state, additional rhizomes will be transplanted to selected natural sites later in 1996 when conditions are more favorable for transplanting.

The current status of *Cyperus setigerus* within portions of its limited range in the United States is unknown and warrants further investigation. Bill Carr of the Texas Parks and Wildlife Department, however, recently examined records of specimens collected in Texas and concluded that this species is well distributed throughout that state (pers. comm., 31 January 1996).

KYLLINGA GRACILLIMA

Kyllinga gracillima Miq. is a sedge native to Asia (Ohwi, 1965) that recently has become a naturalized weed in the United States (Bryson and Carter, 1994; Delahouusaye and Thieret, 1967; Kral, 1981; Webb et al., 1981). Previously, it has been treated primarily as *K. brevifolioides* (Thieret & Delahouusaye) G.C. Tucker, *K. brevifolia* (Rottb.) Hassk. var. *leiolepis* (Franch. & Sav.) Hara, *K. monocephala* Rottb. var. *leiolepis* Franch. et Sav., *K. brevifolia* Rottb. var. *gracillima* (Miq.) Kük., *Cyperus brevifolioides* Thieret & Delahouusaye, or *C. brevifolius* (Rottb.) Hassk. var. *leiolepis* (Franch. et Sav.) T. Koyama, (Delahouusaye and Thieret, 1967; Kral, 1981; Ohwi, 1965; Tucker, 1987). Recent investigations by Gordon Tucker of Eastern Illinois State University confirm that *Kyllinga gracillima* is the correct combination for this sedge (pers. comm., 13 March 1996).

Since this species was first reported in this country by Delahouusaye and Thieret (1967), *K. gracillima* has been documented in Connecticut, Delaware, Pennsylvania, New Jersey, Maryland, Virginia, North Carolina, Alabama, Georgia, Arkansas, Tennessee, and Mississippi (Kral, 1981; Webb et al., 1981; Naczi, 1984; Naczi et al., 1986; Sundell and Thomas, 1988; Snyder, 1983; Bryson and Carter, 1994).

Kyllinga gracillima is a rhizomatous perennial (Fig. 2) that forms thick mats. This habit readily distinguishes it from the tufted annual, *K. pumila* Michx. [*Cyperus tenuifolius* (Steud.) Dandy], which is the only other species in the genus recorded from Missouri. *Kyllinga gracillima* is most similar to *K. brevifolia* Rottb., a pantropical species (Tucker, 1984, 1987) that is native to the southeastern Gulf Coastal Plain (Dela-

Fig. 2. Xerograph of a plant of *Kyllinga gracillima*, showing the creeping rhizome, ×½.

houusaye and Thieret, 1967; Sundell and Thomas, 1988), but one which might be discovered in Missouri. Various authors have reported that *K. gracillima* can be distinguished from *K. brevifolia* by its round vs. oval or rectangularly shaped inflorescence, by its smooth vs. denticulate scale keels, by its longer spikelets and achenes, by its usually multiple vs. single stamens, and by its more slender stipe, (Delahouusaye and Thieret, 1967; Kral, 1981; Sundell and Thomas, 1988; Bryson and Carter, 1994). Tucker (pers. comm., 13 March 1996), however, believes that *K. gracillima* can be distinguished more readily from *K. brevifolia* by its thicker rhizomes (2–3 mm vs. 1 mm) and by the horizontal vs. erect orientation of the longest involucral bracts.

Habitats for *Kyllinga gracillima* include "dredged sand over tidal marsh; moist open fields, sand bars, tidal marshes, creek bottoms, and pastures" (Delahouusaye and Thieret, 1967); "wet or frequently irrigated areas of lawns, roadsides, ditches, cemeteries, golf courses, and flower beds" (Bryson and Carter, 1994); and "cleared areas along streams" (Kral, 1981).

On 23 September 1995, the senior author collected the first record of *Kyllinga gracillima* for Missouri:

> **Voucher specimen**: U.S.A. Missouri. St. Charles County, Busch Conservation Area, ca. 400 m WNW of the intersection of the main entrance road and Route D, or ca. 4.5 km WSW of the intersection of Route 40/61 and Route 94 in Weldon Spring, several hundred strongly rhizomatous plants forming mats along S edge of small pond directly adjacent to and S of a boardwalk to the Ahden Knight Hampton Waterfowl Refuge and Memorial Lake, and just W of the main headquarter buildings, Sec. 25, T46N, R2E, 23 Sep 1995, *McKenzie 1666* (MO, NYS, UMO, VSC). Fertile achenes collected 7 Dec 1995 from the same location.

The source of introduction of *K. gracillima* into Missouri is unknown. Because the collection site is directly adjacent to a waterfowl refuge, it is possible that *K. gracillima* was introduced into the state by migrating waterfowl. Dunn and Knauer (1975) postulated that waterfowl were responsible for the introduction of certain plant species, including *Cyperus flavicomus* Michx. (*C. albomarginatus* Mart. & Schrader), at Mingo National Wildlife Refuge in southeastern Missouri. The recent discovery of *K. gracillima* in Missouri and published literature of the last 15 years suggest that this species is continuing to expand its range in North America.

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providing us with information on the status of *Cyperus setigerus* in Texas. We thank Stacy Armstrong (Missouri Highway and Transportation Department), Tim Smith, and Ann Wakeman (Rock Post Wildflowers, Fulton, Missouri) for their assistance with the population of *Cyperus setigerus* along Interstate I-70 in Columbia.

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ECHINOCHLOA WALTERI, A NEW GRASS FOR MISSOURI

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A Missouri population of a barnyard grass, *Echinochloa walteri* (Pursh) Heller was discovered on September 25, 1995, on Dresser Island, St. Charles County. The island is located about 2.5 miles north of West Alton, Missouri. I was conducting an airboat survey of the shorelines of Dresser Island for decurrent false aster (*Boltonia decurrens*) with Dan Matlock, Conservation Department Wildlife Resource Technician. At the margin of a shallow backwater area that opened into the Mississippi River on the east end of the island, we saw several scattered plants of a large grass with conspicuous purplish infrutescences. Dan had noticed the species during previous work on the island, but neither of us had seen it elsewhere. I collected two voucher specimens from one plant and later identified it as *Echinochloa walteri* (*Smith 3273* [MO, UMO]).

As far as I have been able to determine, my collection is the first vouchered report of *Echinochloa walteri* from Missouri. It was not reported as part of our flora in Kucera's (1961) *The Grasses of Missouri*, Steyermark's (1963) *Flora of Missouri*, or Yatskievych and Turner's (1990) *Catalogue of the Flora of Missouri*. Missouri was included, however, in the distribution map for the species in Hitchcock's (1950) *Manual of the Grasses of the United States*. A review of material at the U.S. National Herbarium (US), from which Hitchcock's manual was mostly compiled, yielded no Missouri specimens of *Echinochloa walteri* (Ihsan Al-Shehbaz, pers. comm.). A subsequent review of specimens at the Dunn-Palmer Herbarium (UMO) of the University of Missouri resulted in the discovery of an earlier, unreported collection of the species, also from St.Charles County. This specimen (*Hansen, Iltis, & Nee 2986*) was gathered on October 20, 1974, further west along the Mississippi River on mudflats 1.5 miles west of Kampville.

Other known localities for *E. walteri* near to the Dresser Island site are in St. Clair County, Illinois (Mohlenbrock, 1973), about 25 miles to the south-southeast. According to John Schwegman (pers. comm., 1996), however, the species is most plentiful in Illinois counties along the Illinois River, which are north of Dresser Island. Hitchcock's manual shows an overall distribution from Wisconsin to Massachusetts, south to Florida and Texas. Both Iowa and Arkansas are included, but the species is absent from the Great Plains (Hitchcock, 1950; Great Plains Flora Association, 1986). The area of Missouri holding the greatest potential for additional populations of *Echinochloa walteri* are probably the counties bordering the Mississippi River.

Echinochloa walteri is a robust annual with stout, erect culms up to two m tall (Fig. 1). The scabrous leaf blades are 5–30 mm broad; sheaths are papillose-hispid, or papillose only, or rarely glabrous. Panicles are dense, nodding and 10–30 cm long. The second glume and the sterile lemma are both awned, with awn lengths of 2–10 mm and 10–25 mm, respectively.

If one attempts to use Steyermark's (1963) key in the *Flora of Missouri*, *E. walteri* specimens will lead to the couplets for *E. muricata* var. *muricata* or *E. crusgalli* var. *crusgalli* f. *longiseta*. *Echinochloa walteri* can be distinguished most easily from these and other Missouri *Echinochloa* species by its papillose-hispid sheaths, by its second glume with an awn over 2 mm long, and by its sterile lemma with the awn at least 10 mm long.

The Missouri Department of Conservation will track Missouri locations for *E. walteri* in the Natural Heritage Database. I would appreciate notification of any additional sites for the species, so that location and population data can be entered into the Database.

ACKNOWLEDGMENTS

I am indebted to Paul McKenzie (U.S. Fish and Wildlife Service) and Ihsan Al-Shehbaz (Missouri Botanical Garden) for searching the *Echinochloa* collections at the University of

Missouri and the Smithsonian Institution; to Dan Matlock (Missouri Department of Conservation) for assistance in the field; to John Schwegman (Illinois Department of Natural Resources) for information on the Illinois distribution of *E. walteri*.

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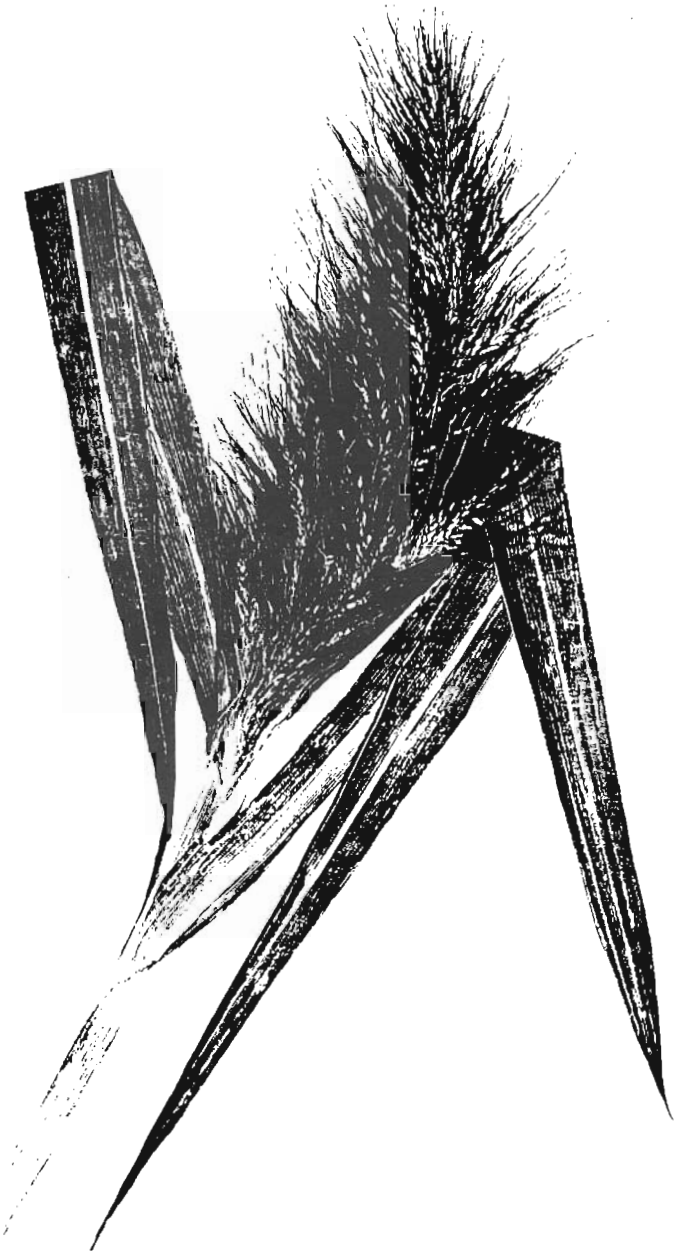

Fig. 1. Xerograph of specimen of *Echinochloa walteri*, showing inflorescence and long awns of spikelets, ×½.

NEW PLANT GROWTH AS A FACTOR IN INSECT ABUNDANCE

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Many of us enjoy asparagus tips, but we know better than to try to eat the developed stems. Asparagus tips (*Asparagus officinalis* L.) are new growth shoots. These rapidly growing tips are tender and juicy. Mature asparagus stems are unchewably fibrous. McKey (1989) explaied that many plants toughen their new growth with lignin deposits as soon as possible, but cannot begin to do so until the cells in the newest tissue have stabilized in size and shape. The survival plan of the asparagus plant involves the rapid development of the lignin content of the stems. So, we settle for the newest asparagus shoots, and if we wait too long to snip them, we are out of luck.

We are not the only ones who choose to eat the fresh, new growth of plants. For various reasons, a great number of our plant-feeding insects do the same. Where there is a greater abundance of new plant growth, the local insect abundance is usually higher also.

The hog peanut (*Amphicarpaea bracteata* (L.) Fernald) is a trifoliate-leaved legume vine. It is common in Missouri in rich, shady woodlands along streams. Several beetle species feed on its leaflets. When I notice a plant has been fed upon, I look immediately for the paler leaflets at the growth tip. If the beetle is still on the plant, that is where it is likely to be.

The newest leaves of the hog peanut are both milder in taste and more tender to chew. There also may be a nutritional factor at work here. The active growth zones are likely to be juicier and more laden with nitrogen than the other tissues of the plant (Coley and Aise, 1991). Because nitrogen is basic to protein production, insects that feed in these zones tend to be selected for rapid reproductive success.

When a tree is felled, new shoots may grow from its stump. These shoots can grow very rapidly, and frequently produce leaves that are monstrous for their kind. Such shoots

are themselves new growth zones. They are supported by a vast water- and mineral-gathering system of roots already in place.

It is not surprising that stump regrowth is especially attractive to plant-feeding insects. Stump shoots of bitternut hickory (*Carya cordiformis* (Wangenh.) K. Koch) have been used for mating swarms by *Babia quadriguttata* (Olivier), a shiny, black, beetle with red markings. Three separate aggregations of feeding nymphs of the usually solitary bug, *Largus succinctus* (L.), were discovered on stump shoots of hickory (*Carya* sp.), sycamore (*Platanus occidentalis* L.), and black oak (*Quercus velutina* Lam.), respectively. Many other plant-feeding insects are frequent on such shoots. Whether the insects are chewing or sucking types, they find the new leaves and stems juicy, mild, and relatively tender. The rapidly rising shoots are rich in nutrients, but still short on the tannins that interfere with the nutrition of feeding insects (Feeny, 1976).

In the early spring, millions of microlepidoptera (small moths) produce their tiny larvae on the very newest leaves of the oaks and other forest species (Feeny, 1976; Forsyth and Miyata, 1984). These tiny worms would have no chance of attacking the more developed leaves, which would be drier, tougher to chew, and laced with tannins that interfere with digestion of plant materials (Feeny, 1976). But, the "micros" have on occasion stripped whole forests of their newly emergent leaves. The spring warbler migration is fueled by the hordes of these hungry herbivores (Forsyth and Miyata, 1984).

Some insects do specialize in feeding on mature oak leaves. Within the Lepidoptera, these include certain species within the genera *Anisota, Catocala, Datana*, and *Parasa*. But, these insects require a much longer period of development, and are far less numerous, both as species and as individuals, than their cousins, which complete their life histories on the newest growth leaves.

Anyone who studies insects in Missouri needs to spend some quality time in the field from April through June. This is the time of new growth, the flush of new life, and the insects are right on top of it. Many of our insect species are observable at no other time of the year.

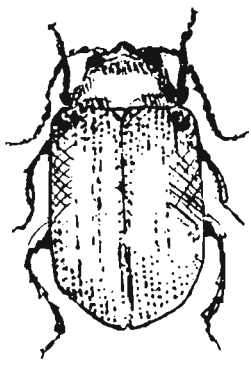

Fig. 1. *Trichaltica scabricula*. Drawing by Jim Ziebol.

Even as the winter buds of blue ash (*Fraxinus quadrangulata* Michx.) open, their emergent leaves are commonly attacked by tiny blue and gold flea beetles, *Trichaltica scabricula* Crotch (Fig. 1). More than 100 of these beetles were recorded on new leaves of *F. quadrangulata* on April 18, 1976, at a single site in Jefferson County, Missouri. Each of these beetles is adapted for feeding on its particular tree species, but only on the new growth. If they wait too long to get started, the chemical buildup in the leaves may severely impair their digestion and make reproduction impossible (Feeny, 1976).

The buckeye trees seem to produce their new leaves earlier than they should, and frequently get nipped by late freezes. But, they still may come out ahead by developing their leaves when the weather is cold enough to slow down the voracious beetles. A similar "phenological escape" is suspected in the tropical, deciduous forests of Panama, where certain trees produce new leaves even before rainfall resumes at the end of the dry season. The local leaf-eating beetles do not appear until the leaves are beyond their initial, vulnerable stage (Coley and Aide, 1991).

Some plants do have a full charge of chemicals in their newest growth tissues. These usually are plants with brief life cycles and which spring up in different sites in successive years (Feeny, 1976). Examples are *Crotalaria sagittalis* L. and various Brassicaceae. But, these plants frequently have their own insect foes, which not only can handle their toxins, but are even attracted to them, and even these hardy herbivores tend to choose the tenderest new leaves produced.

In the tropical rainforest, where new growth is present throughout the year, heliconian and other butterflies seek out the tender, new leaves for laying their eggs. The tiny hatchling larvae must be able to break through the epidermis of the leaf if they are to beggin to feed at all.

McKey (1989) has associated functioning extrafloral nectaries with the new-growth areas of plants. The structures may be found on all portions of a plant, but the only ones that produce nectar are the ones near the new-growth tips. In my own observations, *Chamaecrista fasciculata* (Michx.) Greene, *Fraxinus americana* L., *Polygonum scandens* L., and many others fit this pattern. McKey (1989) sees the nectaries as stop-gap defense mechanisms in view of the fact that they often bring ants to the temporarily defenseless, new-growth tips.

It has bee well-documented that some tropical ants actively defend their nectary plants from herbivory (Strong et al., 1984; Beattie, 1985; Oliveira and Oliveira-Filho, 1991), but even our less feisty, temperate zone ants may defend the plants they occur on by their ordinary scavenging behavior. Egg-laying females of plant-feeding insect species have been shown to seek the right blend of odors in order to determine the right ovipositioning sites (Miller and Strickler, 1984). If the odor of formic acid enters the mix, betraying the recent presence of ants, the insect may be deterred.

In savanna or prairie areas, the periodic passage of fire is followed by a major flush of new growth. Herbaceous perennials and some woodies grow back quickly from well-developed root systems. Seeds that have long lain dormant now come to life. Flowers abound, and they attract insects not only to their pollen and nectar, but also to the tender new-growth tissues of their rapidly forming corollas. In many ways, the affected area is like an enhanced springtime. It has been my experience that the common insects frequently are abundant and readily observed in such areas, and that even the less common species are more likely to turn up there.

But, fire destroys. How can fire lead to insect abundance? In nature, fire is often patchy. Older growth vegetation is more susceptible. But, the insects that key in on new growth are good dispersers. In their reproductive stage, they "get their wings" and they use them to find the best new growth (this is arguably the most imporant function of wings in insects). Thus, the new-growth specialists no longer are present when the old stuff is ready to burn. But, they will be back when the new growth follows the fire.

We have seen that many of our plant-feeding insects choose the newest growth of plants, and so benefit from tenderness, nutrition, mildness, and escape from debilitating chemicals. Ants may be attracted to new growth to help the plants to defend themselves in their vulnerable stage of development. Natural patterns of fire tent to stimulate abundant and varied new growth phenomena, and to revitalize native insect populations.

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